DEPARTMENT OF SOFTWARE ENGINEERING

BACHELOR OF SOFTWARE ENGINEERING

2022

Daffodil International University | DIU (daffodilvarsity.edu.bd)

Bachelor of

SOFTWARE ENGINEERING

Academic Session 2021/2022

DIU Vision

To be a global leader in providing tertiary level education that produces graduates with high self-esteem who are able to accept and overcome challenges in a fast-changing environment.

DIU Mission

To positively influence and enhance the lives of people by promoting research that is aligned with national development agenda, Millennium Development Goals (MDGs), Sustainable Development Goals (SDGs), innovation and entrepreneurship.

DIU Values

ETHICS

We value ethics and are committed to being ethical in our practices and services. No way it will ever compromise with ethical values and always nourish ethical values among its staffs, teachers, and students.

QUALITY

We strive to ensure excellence in what we do and the way we serve people. DIU believes in continuously looking for and making use of opportunities to improve further.

LEADERSHIP

We believe in leadership as we through our prompt and agile work process set up examples for others to follow.

INNOVATION

We empower individuals to think innovatively, remain curious, and value new ideas.

DIVERSITY

We value opinions and ideas from different people of different groups no matter what their race, nationality, age, religion, and position is !

CONTINUOUS LEARNING

We influence people to be lifelong learners so that they remain committed to update and upgrade themselves.

Department Missions

Mission 1

To empower aspiring software engineers with a comprehensive education, fostering innovation, critical thinking, and ethical leadership to drive technological advancements.

Mission 2

To cultivate a diverse community of software engineers equipped with technical expertise, problem-solving abilities, and a commitment to creating impactful solutions that positively transform industries and communities.

Mission 3

To prepare skilled graduates embracing lifelong learning and adaptability that are aligned with National Development Agenda (NDA), Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs).

Department Vision

To become a tertiary level academic and research center of excellence in the field of Software Engineering for creating global leader with high self-esteem who are able to accept and overcome challenges in a fast-changing environment.

Department Goal

The program is designed to satisfy the growing demands of software professionals throughout the country and to produce skilled manpower for the global IT Market. It provides the students an opportunity to obtain a broad knowledge of Software Engineering, Programming, Software Development Engineering, Computer System Engineering, Electronics Engineering and Software Management. The goal of this degree is the generation of competent software engineering graduates specialized in Cyber Security, Robotics and Data Science to meet increasing demands for the area both in domestic and international market.

Department Objectives

Program Educational Objective 1

Graduates will establish themselves as practicing global professionals having high esteem in Software Engineering or related fields for accepting and overcoming challenges in a fast-changing environment.

Program Educational Objective 2

Graduates will engage in lifelong learning of knowledge and interdisciplinary learning appropriate for research, industrial and academic careers.

Program Educational Objective 3

Graduates will contribute to the well-being of people and society by producing research, innovation and entrepreneurship that are aligned with national development agenda, Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs).

Dr. Imran Mahmud
Head, Department of Software Engineering

On behalf of the faculty members and students of the Department of Software Engineering, I, Dr. Imran Mahmud, Head of the Department, welcome you to our department.

Software is now everywhere and our society is now totally dependent on software- intensive systems. Software Engineers around the world are now shaping society through digitization and digitalization. And we are going to be a part of that.

We have designed our courses to increase the employability of our students in the public, corporate, entrepreneurial and non-profit sector anywhere in the world. We prepare our students to embrace the highest professional standards in the IT and Software Engineering sector. Our excellent faculty members are committed to supporting you.

The uniqueness of our department and programs is our delivery. We focus more on real life projects and research works where students get learning experience which is more experiential. This is more about problem-based learning and enquiry-based learning. Our teaching is much different than traditional teaching and it includes flipped classroom and blended learning.

Another unique aspect of the department is that students are offered three different major courses: Cyber security, Data Science and Robotics, to keep pace with the rapidly growing job market.

Founded in 2010, the Department of Software Engineering is renowned for teaching, research and qualified alumni who are working as software engineers at top tier companies both home and abroad. The syllabus is always reviewed by experts from industry and academia.

STUDENT'S PERSONAL INFORMATION

Full Name	
Identity Card (IC)/ Passport No.	
Current Address	
Permanent Address	
E-mail Address	
Telephone No. (Residence)	
Mobile Phone No. (if applicable)	
Department	Software Engineering
Program of Study	Bachelor of Software Engineering (Hons.) [B.Comp.Sc. (Hons.)]

Contents

Faculty of Science and Information Technology

DEAN & ASSOCIATE DEAN

 **Professor Dr. Md. Fokhray Hossain** **Dean**	 **Dr. Bimal Chandra Das** **Associate Dean**

Department of Software Engineering

HEAD & ASSOCIATE HEAD

 **Dr. Imran Mahmud** **Associate Professor and Head**	 **Dr. Md. Fazla Elahe** **Assistant Professor & Associate Head**

LIST OF MAIN ADMINISTRATIVE FACULTY

Principal Officers	E-mail Room Number Telephone Extension
DEAN Professor Dr. Md. Fokhray Hossain	E-mail: deanfsit@daffodilvarsity.edu.bd Cell: 01896034264 Ext: 65108
ASSOCIATE DEAN Dr. Bimal Chandra Das	Email: adeanfsit@daffodilvarsity.edu.bd, bcdas@daffodilvarsity.edu.bd Phone: 01847334809 Ext: 53102
HEAD Dr. Imran Mahmud	E-mail: headswe@daffodilvarsity.edu.bd, imranmahmud@daffodilvarsity.edu.bd Cell: 01847140117, 01711370502 Ext: 35100
ASSOCIATE HEAD Dr. Md. Fazla Elahe	Email: aheadswe@daffodilvarsity.edu.bd Cell: 01891866411 Ext: 35101

FACULTY LIST

Associate Professors:

Associate Professors	Specialization	Academic Qualification
Dr. Imran Mahmud	Software Engineering, DBMS, MIS	Ph.D. (Technology Management), Universiti Sains Malaysia (2017)
SAM Matiur Rahman	Application of Software Engineering in Artificial Intelligence, Biological Signal Processing and Analysis, Exercise and Sport Science	M.Sc. in Software Engineering Sherbrooke University, Canada B.Sc, Major in Computer Science Bishop's University, Canada B.Sc. Ag (Hons) Bangladesh Agricultural University, Mymensingh
Kaushik Sarker	Artificial Intelligence, Embedded Systems, Image Processing, Cyber Security and IoT, Robotics and Education	MSc in Computer Systems and Network Engineering, University of Greenwich, London, United Kingdom. BSc in Electronics and Telecommunication Engineering, Electrical Engineering and Computer Science, North South University, Dhaka. H.S.C in Science, English Version, Notre Dame College, Dhaka.

Assistant Professors:

Assistant Professors	Specialization	Academic Qualification
Mr. Md. Khaled Sohel	MIS, Systems Analysis, Software Engineering	M.Sc. (MIS), DIU
Md. Maruf Hassan	Steganography, Authentication, Web Vulnerability, Data Science, Machine Learning, Deep Learning	Doctor of Philosophy University Malaysia Perlis, Perlis, Malaysia MSc. in Computer Science & Engineering East West University, Dhaka, Bangladesh BSc. in Information Systems Australian Catholic University, Sydney, Australia
Dr. Md. Fazla Elahe	Data Mining, AI, Bioinformatics	Ph.D. (CS & Tech), Hunan University, China
Afsana Begum	Computer Fundamentals, Data Structure with Lab, Data Communication with Lab, Telecommunication Engineering with Lab, Desktop and Web Programming, Discrete Mathematics, Introduction to Computer, Mobile communication, Networking etc.	Masters in IT, Institute of Information Technology, Dhaka University. BSc in TEE, Hajee Mohammad Danesh Science and Technology University, Dinajpur.
Ms. Nusrat Jahan	Database Management System, Networking, Software Engineering, Data Communication, Network Security, Software Testing.	M.Sc. in Information Technology, Jahangirnagar University B.Sc. in Information Technology, Jahangirnagar University
Mr. Md. Shohel Arman	Software Engineering, C programming, Data Structure & Algorithm, Web Programming, Software Security, Operating System	B.Sc. in Software Engineering, Daffodil International University
Ms. Tapushe Rabaya Toma	Computer Algorithm, Database Management System, System Analysis & Design, Software Engineering, Documentation	PhD in Communication and Information Technology, Universiti Malaysia Perlis, (Running); M.Sc. in Information Technology (IT) Institute of Information Technology, Jahangirnagar University; B.Sc. in Software Engineering Department of Software Engineering, Daffodil International University (DIU)

Lecturers

Lecturers	Specialization	Academic Qualification
Mr. Khalid Been Badruzzaman Biplob (Senior Scale)	Development of an inductive teaching method based on knowledge of the brain given in the QURAN	PhD (Ongoing), University Sains Islam, Malaysia; M.Sc. (CSE), DIU; B.Sc. (CSE), DIU
Ms. Nadira Islam (Senior Scale)	Artificial Intelligence, Machine Learning, Data Science, IoT, Image Processing	M.Sc. (IT), University of Dhaka; B.Sc. (ICT), Hajee Mohammad Danesh Science and Technology University
Ms. Fatama Binta Rafiq (Senior Scale)	Human Computer Interaction (HCI), Internet of Things (IoT), Management Information System (MIS)	B.Sc. (Software Engineering), AIUB
Mr. Nuruzzaman Faruqui (Senior Scale)	Discrete Mathematics, Digital Electronics, Artificial Intelligence, Machine Learning	M.Sc. in Information Technology, IIT, Jahangirnagar University B.Sc. in Electrical & Electronics Engineering, North South University
Mr. Sk. Fazlee Rabby (Senior Scale)	Object Oriented Programming, Artificial Intelligence, System Analysis & Design, Software Engineering, Database Management System	B.Sc. in Computer Science and Engineering, Daffodil International University, Dhaka
Mr. Md Rajib Mia	Machine Learning, Deep Learning, Software Quality Assurance	M.Sc. (Software Engineering, Data Science), DIU; B.Sc. (Software Engineering), DIU
Md. Julkar Nayeen Mahi	Software Defined Networks, Service Computing, Fog Computing, Cloud Computing, Artificial Intelligence, Machine Learning, Deep Learning, Internet of Things, Edge Computing and Operations Research	Master of Science (M. Sc.), Information Technology, Institute of Information Technology (IIT), Jahangirnagar University, Dhaka, Bangladesh. Bachelor of Science (B.Sc.), Information Technology, Institute of Information Technology (IIT), Jahangirnagar University, Dhaka, Bangladesh.
Ms. Nusrat Tasnim	Artificial Intelligence, Machine Learning, Deep Learning, Computer Vision	M.Sc. ICT, Jahangirnagar University; B.Sc. (IT), Jahangirnagar University
Mr. Md. Rittique Alam	Machine learning, Data Mining, Computational Finance, Computational Economics, Intelligent Systems	B.Sc. In Computer Science and Engineering, American International University-Bangladesh, Dhaka, Bangladesh H.S.C In Science, Adamjee Cantonment College, Dhaka, Bangladesh
Mr. Mohetuzzaman Mobin	Web Development, Artificial Intelligence, Machine Learning, Deep Learning	B.Sc. In Computer Science and Software Engineering, American International University Bangladesh H.S.C In Science, SOS Hermann Gmeiner College Dhaka

Administrative Staff	E-mail
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General Office	Room Number: 607 Phone: +8801847334937 Ext: 35111 Phone: 01847140012 Ext: 35112

Chapter 1 INTRODUCTION

1.1 Department of Software engineering

The Department of Software Engineering offers the program of B.Sc. (Hons.) in Software Engineering. The program is designed to produce skilled manpower for the global IT market in order to satisfy the growing demands of software engineering professionals throughout the world. The central goal is to create knowledgeable, efficient, and skilled software engineering graduates so that they are able to make themselves competent to work not only with the software industries in their home country but also with any giant technological organization of the world.

1.2 Bachelor of Software engineering (Honors) Program

The program is designed to satisfy the growing demands of software professionals throughout the country and to produce skilled manpower for the global IT Market. It provides the students an opportunity to obtain a broad knowledge of Software Engineering, Programming, Software Development Engineering, Computer System Engineering, Electronics Engineering and Software Management. The goal of this degree is the generation of competent software engineering graduates specialized in Cyber Security, Robotics and Data Science to meet increasing demands for the area both in domestic and international market.

1.3 General Educational Goals and Objectives

The general educational goal of the Bachelor of Computer Science (Hons.) degree program is to produce high-quality graduates with the necessary professional skills to practice as successful computing professionals and compete effectively in a world of rapid technological change. Therefore, the educational objectives of the program are to produce graduates in computer science who:

No.	PEO Statement
PEO1	**Professionalism:** Graduates will establish themselves as practicing global **professionals** having highest min Software Engineering or related fields for accepting and overcoming challenges in a fast-changing environment.
PEO2	**Continuous Personal Development:** Graduates will engage in lifelong pursuit of knowledge and interdisciplinary learning appropriate for research, industrial and academic careers.

PEO3	**Social Engagement:** Graduates will contribute to the well-being of people and society by producing research, innovation and entrepreneurship that are aligned with the national development agenda, Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs).

1.3.1 Program Learning Outcomes

At the end of the program, graduates will be able to:

No.	Subject	Program Learning Outcome
PLO1	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PLO2	**Problem Analysis**	Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.
PLO3	**Design/ Development Solutions of**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and or cultural, societal and environmental concerns.
PLO4	**Investigation**	Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.
PLO5	**Modern**	Create, select and apply appropriate techniques, resources and Tool Usage modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations.
PLO6	**The Engineer Society**	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and consequent responsibilities relevant to professional engineering practice.

PLO7	**Environmental sustainability**	Understand the impact of professional engineering solutions in and societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PLO8	**Ethics**	Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.
PLO9	**Individual Work and Teamwo**	Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.
PLO10	**Communication**	Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able To Comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PLO11	**Project Management Finance**	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team **and** member or a leader to manage projects in multidisciplinary environments.
PLO12	**Life-long Learning**	Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

1.4 ACADEMIC RULES AND REGULATION

1.4.1 CODE OF CONDUCT

Preamble:

Daffodil International University (DIU) is committed to the freedom of speech as stated in article 39 of the Constitution of the People's Republic of Bangladesh and constructive debate of alternative views, theory and data. It recognizes and respects all peaceful and non-obstructive forms of dissent, whether individual or collective, that are within the University regulations and which do not interfere with the regular and essential academic/ non-academic operations of the University. This Code of Conduct has been formulated to provide a clear statement of the University's expectations of students in respect of academic matters and personal behavior. Studying at the University presents opportunities for interacting with other members of the University community. The University recognizes and values the diversity of student experiences and expectations, and is committed to treating students, both academically and personally, in a fair and transparent manner. All students, in return, are required to comply with the requirements set down in this Code of Conduct (CoC).

Daffodil International University reaffirms its commitment to:

High academic standards, intellectual rigor and a high-quality education;

Intellectual freedom and social responsibility; Recognition of the importance of ideas and the pursuit of critical and open inquiry; Tolerance, honesty and respect of relationships throughout the university community; and High standards of ethical behavior.

All students are required to be aware of and act consistently with these values.

Accordingly, the DIU authority, through the representation of Disciplinary Committee (DC), who have performed their responsibilities in good and due form; do hereby establish DIU Code of Conduct (CoC) for students.

1.4.1 The Disciplinary Code

Purpose

The purpose of this code is to outline the acceptable standard of conduct and disciplinary actions applicable to students, in case of violations of the standard conduct. It is acknowledged that a disciplinary code and disciplinary actions are necessary for the smooth operation of an educational institution and the safety and fair treatment of all students.

1.4.2 Underlying Principles

This code is based on the following principles:

Any violation of the CoC, as stated in this document, is a cause for initiating necessary disciplinary action(s). The judicial system is subject to the authority of the Vice-Chancellor of the University as he/she deems appropriate, except that the DC shall have the authority to approve disciplinary warning as a sanction. The DC shall consider the cases and make recommendations to the Vice-Chancellor for necessary sanction(s).

Proctor's Office has the authority to the application of discipline at the University and at any event that is organized under the University banner, inside or outside the premises. The Proctor's Office ensures that there is no violation of the CoC.

When enforcement of discipline is needed, emphasis is given on guidance and rehabilitation rather than the imposition of punishment.

The DC is the apex body related to disciplinary matters concerning students.

If a student is alleged of an activity that violates both this conduct and the law of the land, then the disciplinary action at the University will normally proceed, while civil or criminal proceedings will be initiated by informing the law enforcement agency. The application of discipline in all instances must be consistent and fair.

The Proctor's Office may take measures to protect the discipline of the students in the surrounding areas outside the University.

Activities of any group/dealers in the surrounding areas outside of the University which poses a threat to the University and its students; with the permission of the university authorities, the Proctor's office can take action with the help of law enforcement agency.

1.4.3 Disciplinary Sanctions

Based on the severity of the misconduct, the range of official sanctions shall be recommended by the DC for violation of regulations (both academic and social). The disciplinary sanctions are the following:

1.4.3.1 Verbal Warning (VW)

In case of moderate offense, an Assistant Proctor under the guidance of the Proctor should conduct a disciplinary interview with the student involved along with the student affected/witness(es) that may result in an official warning. This is a notice to the student that his/her conduct was questionable and that if the student

is eventually found in violation of a rule while on disciplinary warning; subsequent action may be more severe. The verbal warning shall become a matter of record in the student's file/ or automated system to track the student's behavior for future reference.

1.4.3.2 Calling Guardian and Warning Letter (CG & WL)

More serious offense or repetition of the misconduct can result in calling of guardian along with a final written warning through the Registrar Office where the student and guardian shall execute a bond to take on the liability of any future disciplinary actions. The final written warning shall be recorded to the student's file or in the automated systems to track the student's behavior for future reference.

1.4.3.3 Monetary Fine (MF)

Students will be charged with a monetary fine for violating specific Code of Conduct (CoC). The monetary fine will be imposed based on the violation of code and/or repetition of the occurrence.

1.4.3.4 Disciplinary Probation (DP)

The status of disciplinary probation is assigned for a specific period of time. Though students will be allowed to continue with academic activities in the University, disciplinary probation status may impose some conditions or tasks to comply. During the disciplinary probation period if the student is found "in-violation" for another violation of the CoC, more severe sanctions may be imposed such as suspension or expulsion. The violation of the code requires rectification for future progressive and or corrective measures in conduct, Proctor's Office will keep the student on disciplinary probation by counseling. During the disciplinary probation period, the student's behavior will be closely monitored and he/she will be called to the Proctor's Office for hearing every week. The Proctor's office will communicate with the student's mentor to take his/her class attendance and class behavior report.

1.4.3.5 Temporary Suspension (TS)

The student may, if necessary, be temporarily suspended, before, during, or pending the outcome of the inquiry. Such a sanction requires the student to leave the campus immediately. It may be imposed upon a student by the Department Head, the Chairperson of DC or the Proctor through the Registrar Office. Any instantly suspended student, who returns to the campus during the period of interim suspension, shall be subjected to disciplinary dismissal or disciplinary expulsion. The suspended student must stay off university property until an official hearing is conducted by the Proctor's office. During the Temporary Suspension period if he/she puts pressure on the complainant person, shall be subjected to disciplinary dismissal or disciplinary expulsion.

1.4.3.6 Disciplinary Suspension (DS)

The case where a student is accused of major breach of conduct by committing a severe misconduct will be directed to the Disciplinary Committee (DC). Such as a student may be suspended for up to 2 (two) semesters as per the decision made by the DC. The disciplinary suspension will start from the following semester for the stipulated period of time. If the student has voluntarily refrained from registering for the semester during which the DC holds its hearing, that semester will not be counted within the stipulated period of disciplinary suspension.

1.4.3.7 Disciplinary Expulsion (DEP)

In this case the student will be ineligible to be admitted to this university anytime in future. Disciplinary Expulsion is a sanction that removes the student from the individual's academic program and permanently separates a student from the University without the opportunity to graduate or re-enroll at the University in future. Disciplinary expulsion shall be executed by the approval of the Vice-Chancellor of the University.

1.4.3.8 Compensation to the University (CPS)

Compensation shall be charged to any student who alone, or through group activities, organizes or knowingly participates in the events causing such damages or costs.

1.5 Filing a Complaint

If a student or group of students have concerns about treatment by another student(s), it is appropriate to seek help from the Proctor's Office. The student feeling mistreated may directly come to the Proctor's Office, meet the available assistant proctor, narrate the incident and file a complaint. The complainant is required to file a written complaint in a formal complaint form which is available at the Proctor's Office. Students also welcome to lodge a complaint electronically by email and also using the google form.

1.6 Student Code of Conduct (CoC)

1.6.1 Personal Conduct

All students must:

- Treat all employees, honorary appointees, consultants, contractors, volunteers, any other members of the public and other students with respect, dignity, impartiality, courtesy and sensitivity.
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- Maintain a cooperative and collaborative approach to inter-personal relationships.
- Act honestly and ethically in their dealings with others.
- Respect the privacy of everybody.
- Ensure that they do not act in a manner that unnecessarily or unreasonably impedes the ability of employees, honorary appointees, consultants, contractors, volunteers any other members of the public and other students to carry out their study, research or work at the University, to access or use the resources of the University including in the Library, Lecture theatres and Laboratories;
- Ensure that they do not become involved in or encourage discrimination against or harassment or bullying of employees, honorary appointees, consultants, contractors, volunteers any other members of the public or other students.

1.6.2 Academic Conduct

All students must:

- Ensure that their enrolment and progress in their awarded course is lawful and consistent with the rule and resolutions of the Daffodil International University. Students must not enroll with other University at the same time with this University.
- Read all official correspondence from the University, including email.
- Act ethically and honestly in the preparation, conduct, submission and publication of academic work, and during all forms of assessment, including formal examinations and informal tests;
- Avoid any activity or behavior that would unfairly advantage or disadvantage another student academically.
- Conform to the university's requirements for working with others.

Discipline is an important aspect of Daffodil International University (DlU). The University serves as an instrument for molding the character and behavior of the student and this prepares them to take up their future careers as well as the mantle of leadership. Also it is generally accepted that education constitutes the single most important instrument for the acquisition of knowledge and skills that are indispensable for the building of a manpower base to promote socio economic advancement. Therefore, DIU has formulated the above code of conduct. If students violate those, the university will take preventive measures and also will hand in punishment to offenders to maintain peace and the academic environment of the university. [See section 1.3 Disciplinary Sanction].

1.7 Violation of Code of Conduct and the punishments

SL	Type	Description	Punishment
1	Classroom Discipline	Students are expected to maintain respectful behavior in classrooms and on university premises. Ill-discipline includes interrupting learning, using mobile phones in class, arrogance, using slang/rude words, loud talking, or disruptive behavior during classes and exams.	Minor: VW, WL Medium: CG & DP Major: DSP & DEP
2	Undesirable Behavior	Behavior on or off campus that seems offensive to society or tarnishes the image of the University.	Minor: WL & CG Medium: DSP Major: DEP
3	Inappropriate Conduct	Any offensive conduct, act, or use of improper/vulgar expressions or language in communication with faculty, University officials, or others on campus.	Minor: WL & CG Medium: DSP Major: DEP
4	Unlawful Obstruction	Interference or obstruction preventing a person's free movement on campus or hindering their participation in university activities.	Minor: WL & CG Medium: DSP Major: DEP
5	Indecent Behavior	Behavior or expression intended to tease or annoy members of the opposite gender, or the use of improper words, gestures, clothing, or acts.	Minor: WL & CG Medium: DSP Major: DEP
6	Subversive Activities	Acts, behavior, or speech that threaten public or national security or sovereignty, including subversive activities via social media or written documents.	Minor: WL, CG & DP Medium: DSP Major: DEP
7	Group Affirmation Against DIU	Verbal or written affirmation, including via social media, that incites agitation or disrupts the University's reputation.	Minor: VW with DP Medium: DSP Major: DEP
8	Ragging and Bullying	Includes intimidation, humiliation, ridicule, physical threats, or exercising power over another person through negative behavior.	Minor: VW, WL with CG Medium: DSP Major: DEP
9	Cyber Bullying	Use of electronic communication to bully others, especially between students, if it occurs on university premises or adversely affects student safety.	Minor: WL with CG Medium: DSP Major: DEP
10	Violence / Physical Abuse	Physical violence, including beating, kicking, or unwanted physical contact.	Minor: VW, WL with CG Medium: DSP Major: DEP
11	Intolerance / Racism	Disrespect or intolerance towards others based on race, religion, class, gender, or status, within or outside the University community.	Minor: VW with DP Medium: DSP Major: DEP
12	False / Frivolous Complaints	Misleading complaints or misuse of university protocols.	Minor: VW with DP or WL Medium: DSP

13	Fraud / Deception	Providing false information or forging documents to derive benefits. Examples include submitting false emergencies or altering records.	Minor: WL Medium: DSP Major: DEP
14	Dress Code	Students must wear clean and appropriate clothing. Indecent dressing is prohibited.	Minor: WL, CG & DP Medium: DSP
15	Disorder / Agitation	Acts of agitation such as inciting riots, coercion, or organizing unauthorized demonstrations.	Minor: WL Medium: DSP Major: DEP
16	Disorderly Behavior	Any breach of university rules, regulations, or policies.	Minor: WL Medium: DSP Major: DEP
17	Disruption	Acts by individuals or groups that interfere with the smooth functioning of the University.	Minor: WL, DP, MF Medium: DSP, CPS Major: DEP
18	Disobedience	Refusal to obey University rules or authority.	Minor: WL & CG Medium: DSP Major: DEP
19	Unauthorized Recording	Recording, sharing, or distributing images, videos, or audio without consent.	Minor: VW, WL, CG & DP Medium: DSP
20	Misuse of ID	Entering the University premises without an ID card or lending ID to others.	Minor: VW, MF=500Tk Medium: WL with MF=2000Tk (added to semester fees)
21	Academic Dishonesty / Plagiarism	Cheating, using someone else's work without acknowledgment, or submitting false academic information.	Minor: WL & CG Medium: DSP Major: DEP
22	Copyright Infringement	Unauthorized use of DIU’s logo, media, or intellectual property.	Minor: WL Medium: CPS Major: DSP
23	Cyber-Crime	Crimes through digital platforms, such as fraud, harassment, or hacking.	Minor: WL & CG Medium: CPS & DSP Major: DEP
24	Mischief	Tampering with or unauthorized use of university property, including computers, doors, or equipment.	Minor: WL, CG & MF Medium: CPS & DSP Major: DEP
25	Possession of Weapons	Possession or use of firearms, explosives, or harmful objects.	Minor: WL Medium: DSP Major: DEP
26	Theft	Misappropriation or unauthorized removal of university or others' property.	Minor: WL, CG Medium: DSP Major: DEP
27	Damage of Property	Vandalism or reckless behavior resulting in property damage.	Minor: WL, CG & CPS Medium: CPS Major: DSP, DEP

28	Smoking	Smoking is prohibited on all DIU premises.	Minor: WL, MF & DP Medium: DSP
29	Drugs	Use, production, distribution, or possession of drugs or alcohol on university premises.	Minor: WL, CG & DP Medium: DSP Major: DEP
30	Gender Harassment / Eve Teasing	Unwanted conduct of a sexual nature that affects the dignity of individuals. These cases are overseen by the Gender Harassment Committee.	Minor: WL, CG & DP Medium: DSP Major: DEP

1.8 Policy on Prevention of Sexual Harassment and Violence Against Women

Daffodil International University

In line with the High Court Division's directives and the Private Universities Act 2010, Daffodil International University has adopted a "Zero Tolerance" approach to sexual harassment. This policy applies to all students, staff, faculty, and employees at the university.

Objectives

- Raise awareness about sexual harassment and its consequences.
- Promote gender equality and the protection of women's rights.
- Establish an effective mechanism for filing and addressing complaints.

Definitions

Sexual harassment includes unwelcome sexual advances, requests for sexual favors, inappropriate physical contact, verbal abuse, and other sexually charged behavior. Misconduct and harassment are defined as behavior causing physical or psychological harm.

Awareness and Prevention

- Regular campaigns and counseling will be conducted.
- Educational materials on rights and legal provisions will be distributed.
- The university will ensure a safe environment for women, free from gender discrimination.

Complaint Mechanism

- Complaints can be made confidentially through multiple channels, including a complaint box or directly to the Complaint Committee.
- The Complaint Committee, headed by a senior woman faculty member, will investigate all complaints and ensure fair treatment.
- Disciplinary actions, such as reprimands or dismissal, will be taken based on findings.

Punishments

Punishments for confirmed offenses may range from reprimands to permanent dismissal from the university. If the offense is criminal, the matter will be referred to the appropriate legal authorities.

This policy aims to provide a safe and respectful environment for all students and employees at Daffodil International University.

Complaint Form: http://surl.li/txtgbw

1.9 FEE PAYMENT PROCEDURES

For any queries, please contact:

Helpline: 09617901212

Email: accountssupport@daffodilvarsity.edu.bd

1. CASH PAYMENT AT DIU

Fees can be paid directly at the DIU cash counter on any working day from **08:00 AM to 04:00 PM**.

For payments in USD, the dollar rate applicable on the submission date will be considered.

2. BANK PAYMENT SYSTEMS

Fees can be paid through the following banks:

Eastern Bank Limited (EBL)

- Available at any branch in Bangladesh.
- No additional charges apply.
- Payment forms are available at the bank branches.

Southeast Bank Limited (SEB)

- Payments can be made only at the Dhanmondi Branch, located at Mirpur Road, Navana Tower (opposite Air Plaza).
- No additional charges apply.
- Payment forms are available at the branch.

Premier Bank Limited (PBL)

- Payments can be made at the DIU office cash counter (only during the scheduled collection time).

Islami Bank Bangladesh Limited (IBBL)

- Available at any branch in Bangladesh.
- **Account Name**: Daffodil International University
- **Account Number**: 20502900100059801
- **Branch Name**: Panthapath

Important: After making a payment through IBBL:

1. Write your DIU Student ID (e.g., 111-11-1111 or 024200…) on the top of the deposit slip.
2. Send an image of the deposit slip to both:
   - **finance.operation@daffodilvarsity.edu.bd**

- **cash@daffodilvarsity.edu.bd**

1.10 DIU LIBRARY

Welcome to the Digital Library of DIU - a world of endless knowledge and infinite discovery awaits you. We are dedicated to ensuring that the information is regularly updated to meet the evolving needs of our users on a daily basis.

Founded in 2002 DIU library slogan: Read, Learn, and Share Location: 3rd floor, AB-4 70,000sft. Size Total Seat Capacity 1,000 Collection 5,15,427 Hard Copy Resources 49,777 4,65,650

1.11 STUDENT SERVICES RELATED OFFICES

OFFICE OF THE DIRECTOR OF STUDENTS AFFAIRS (DSA)

The Office of the Director of Students' Affairs is a professional body dedicated to the social, psychological, ethical and cognitive development and well-being of all students of Daffodil International University. It also works collaboratively with the faculty members to implement the university's educational and developmental mission. In addition to it, the Office of the DSA looks after all club activities, peer scholarship, foundation classes, orientation of newly admitted students, psychosocial support to create incredible experiences that reach all students through learning, programming and servicing. It also organizes training on positive behavioral changes, national-international collaboration programs, and award programs with a vision to have a transformational impact on the lives of every student to create doers instead of learners.

1.12 REGULAR ACTIVITIES:

Student Counseling The core activity of the DSA Office is to provide student counseling. General Student Counseling All the officials of the DSA Office are ready to listen to our students' queries and problems to provide proper information and guidelines to them. Psychological Counseling/ Psychotherapy session: Our professional Mental Health Therapists (both male and female Psychologists) provide psychological counseling to all of our students, faculty members, and administrative employees. Individual counseling Group counseling Pair/Couple counseling Family Counseling

Club Activities:

The DSA Office coordinates all the clubs at Daffodil International University, including:

Departmental Club (24) :

1. Software Engineering Club
2. Data Science Club
3. Robotics Club
4. Cyber Security Club

5. DIU Business & Education Club (DIUBEC)
6. English Literary Club (ELC)
7. DIU Computer and Programming Club (DIUCPC)
8. DIU Girls Computer and Programming Club (GCPC)
9. DIU NFE Club
10. DIU Communication Club
11. Daffodil Moot Court Society (DMCS)
12. DIU Real Estate Club
13. DIU Textile Club
14. DIU Creative Park
15. HR Club
16. Marketing Club
17. ITM Club
18. Civil Engineering Club
19. Finance Club
20. DIU EEE Club
21. DIU ICE Club Cultural Club (3)
22. DIU Cultural Club (DIUCC)
23. All Stars Daffodil
24. DIU Band Society

Chapter 2 Academic System and General Information

2.1 Course Registration:

2.1.1 Registration:

In every semester, the date for registration will be notified. The students must be registered within the specified date. All fees to be paid at the time of registration are non-re-fundable except (i) where the university fails to provide a place to the students in a course and (ii) courses dropped by the student in the first week of registration. The student will, in such cases, get a refund of the tuition fee and other charges except registration/admission fee.

2.1.2 Registration procedure:

A student seeking registration for the semester should:

1. Pay registration fees to the accounts office within the scheduled date and collect a software generated registration clearance if all dues are cleared.
2. Collect the course offer paper from the corresponding department
3. Students have to contact their course advisor/mentor according to the course advising date with that clearance and select courses in consultation with the student's advisor
4. After successful completion of registration, you can check it from the registered course option of the student portal (http://studentportal.diu.edu.bd/#/registeredCourse). After selecting the semester, the registered course will be shown.

2.1.3 Course Advisor/ Mentor:

A course advisor who will be assigned by the head of the department to each student will provide career and academic-related guidance till your graduation. Sometimes they will provide guidance beyond the academic matters that will help you to excel your life or to solve any specific problem of your life.

2.1.4 Late Course Registration:

Students must complete course registration within the designated period by paying the required fees. Late registration will incur an additional fine of Tk. 500, and further delays will result in a fine of Tk. 1000. After the final deadline, registration will no longer be allowed. Students are strongly advised to complete their registration on time to avoid penalties.

2.1.5 Course Add/Drop Procedure:

A student may drop or add new courses during the first week of the semester. To add a course, one must have the approval of the faculty adviser. The procedure is given bellow:

1. Pick up a Drop/Add form from the Office of the Registrar
2. Fill up the relevant section of the form
3. Obtain the signature of the course teacher/ advisor on the form and if a course is being added; make sure that space is available in the course.
4. Submit the form to the office of the Registrar.
5. Check at the Accounts office about any change of fee

2.1.6 Transfer from other university:

Students with good academic records from other recognized universities are eligible for transfer of their credits to DIU. Students willing to transfer from another university must have transcripts of courses and grades, together with copies of the certificate/ mark sheet of SSC or HSC or transcripts of O and A levels. These transcripts will be evaluated against the minimum entry requirement at DIU.

2.1.7 Credit transfer under student exchange program:

DIU students wishing to achieve credits from international partner universities for one semester to one year student exchange programs are advised to contact the Office of International Affairs to apply. Credit transfer under the student exchange program is available at the following link for foreign universities: Link: https://daffodilvarsity.edu.bd/international-linkage DIU students wishing to transfer their credits to a foreign university are advised to go through the website of that university very carefully and must understand all the procedures regarding admission tuition and other fees, financial aid and insurance policies, and available part-time work facilities for students before enrollment. Exemption of Courses: Students with extensive academic or professional experience may apply to waive courses by completing a 'Request for Course Waiver' form. This form should be submitted to the coordinator of the program/ Head of the Department/ Dean of the Faculty with the relevant academic transcripts or evidence of an appropriate certification. A student having completed any course of a Bachelor degree from another recognized university is eligible for waiver provided that he/ she has obtained at least a 'B' grade or over 60% percent marks in that specific course. Waiver is given to foundation courses only. Course waiver requires approval from the equivalence committee of DIU. Course load and sequence: The course sequence and load vary from program to program and the students are advised to consult their respective course advisor. A student must follow the course sequence stipulated in the program curriculum. A student must pass all prerequisite courses in order to be eligible to register for a higher-level course required for a given program. Course load is allocated according to the course sequence of the program. Eighteen to twenty-two credit hours per semester are the normal course load for undergraduate or graduate students according to DIU standards. Attendance: Attendance is regarded as a part of the course requirement. Students are given marks on class attendance. All undergraduate students must maintain at least 60% class attendance of a course they study each semester. If the class attendance of any student falls below 60%, the student will not be allowed to sit for final examinations and evaluate the teaching evaluation form. Selecting the major: Students are advised to choose their major no later than the second semester of the third year. Before going to choose the major, students should try to complete all the courses of 2nd year level and should take the opinion of the course advisor/ mentor.

2.1.8 Student Dismissal:

Students are dismissed from the program in the future to make satisfactory academic progress.

Students failing to maintain the required CGPA (2.00) in two consecutive semesters will be dropped

out of the program. Students dropped out of the program may appeal to the respective Head/Program Coordinator and Dean for readmission. Re-admission will not be granted without strong evidence of significant change in student's ability to complete the requirement satisfactorily.

2.1.9 Teaching method and medium:

The university follows modern and effective teaching methods including class lectures, interactive Discussions, simulations, lab work, case analysis, and field study. A special feature of Daffodil International University teaching is the tutorial/workshop/lab sessions designed to assist students in learning application of concepts and theories. The medium of instruction at Daffodil International University is English.

2.2 ACADEMIC STANDING

To remain in good standing, a student must maintain a minimum SGPA of 2.00 in a semester. The SGPA is calculated on the basis of the number of courses taken, including the course(s) in which the student receives "F" grade, until he or she retakes the course(s) and the "F" grade is replaced by a passing grade.

2.2.1 Academic Probation and Dismissals:

A student with a SGPA of less than 2.00 in a semester is placed on probation and is allowed a maximum of two semesters to raise his/her SGPA. A student who fails to achieve a SGPA of 2.00 within two consecutive semesters may be allowed additional chance depending on the improvement made, may be asked to transfer to another degree program or may be dismissed from the university. 3. A student who did not formally dropped from a program or has been absent for 2 consecutive semesters, the student must have to take re-admission.

2.2.2 Re-admission:

To take re-admission, a student must apply through the prescribed form. The student will get the form from the respective department office. The student has to pay Tk. 5,000/- as the re-admission fees. If he/she remains absent for 2 consecutive semesters and Tk. 1,000/- will be charged for every additional semester. Re-admission is granted only once.

2.2.3 Semester drop:

1. If a student who has not registered in a semester and wishes to drop a semester or more must apply to the Registrar through the respective Head and Dean or can apply through the student Portal. (http://studentportal.diu.edu.bd/#/dropSemester)

2. A registered student who wishes to drop a semester (dropping all courses for the semester) must do so within the deadline by contacting the respective Course Advisor/Mentor. If a registered student wants to drop the semester after the deadline, he/she must apply to the Registrar through the respective Head and Dean for permission. The Registrar may allow such temporary drops only under convincing reasons. Such as, serious or prolonged illness, death of parents, etc. The Semester drop will not be allowed after the Mid Semester examination of the semester. The grade "F" is recorded for students who abandon their courses without officially dropping from a semester or from a course.

3. A student who did not formally drop from a program or has been absent for 2 consecutive semesters, the student must have to take re-admission. Re-admission: To take re-admission, a student must apply through the prescribed form. The student will get the form from the respective department office. The student has to pay Tk. 5,000/- as the re-admission fees. If he/she remains absent for 2 consecutive semesters and Tk. 1,000/- will be charged for every additional semester. Re-admission is granted only once.

2.3 DEGREE REQUIREMENTS

1. To earn the degree, a student must:

a) complete all the courses and credits required for the degree

b) Earn the minimum CGPA (2.00) required for the degree

c) Clear all dues and liabilities to the university

2. All students must finish their degree requirements within a specific timeframe. 4-6 years for 4-year graduate programs and 5-7 years for 5-year graduate programs. For a master's program a student can take a maximum 4-year to complete the degree from the date of his/her first admission.

3. Students are responsible for fulfilling all the requirements of their respective degree programs within the deadline. They should consult their Academic Advisors in planning their course schedule and be familiar with DIU policies and procedures related to registration for courses and graduation requirements for their degrees.

4. When a student completes the requirements for the degree, he/she should apply through the student portal to the Controller of Examinations Office for provisional certificate, transcript and for applying main certificate in convocation by paying required fees.

2.4 GRADE REPORT

Cumulative Grade Point Average (CGPA) of a student is (numerical value) obtained by dividing the weighted grade points by the credits hours taken. Only the courses graded A+, A, A-, B+, B, B-, C+, C and D are used to determine credits. In case students retake courses, CGPA will be calculated on the highest grade obtained in the courses. Grades obtained in course(s) in all examinations will be shown in the grade report.

Marks obtained out of 100	Grade	Grade point Equivalent	Remarks
80% and above	A+	4	Outstanding
75% to less than 80%	A	3.75	Excellent
70% to less than 75%	A-	3.5	Very Good
65% to less than 70%	B+	3.25	Good
60% to less than 65%	B	3	Satisfactory
55% to less than 60%	B-	2.75	Above Average
50% to less than 55%	C+	2.5	Average
45% to less than 50%	C	2.25	Below Average
40% to less than 45%	D	2	Pass
Less than 40%	F	0	Fail

2.4.1 The Incomplete Grade (“I”) :

The 'Incomplete' (“I”) grade is used in special circumstances. The 'Incomplete' “I” grade is given only at the end of a semester to a student who has completed all other requirements except that he did not participate in the semester final examination. The student has the responsibility to take initiative to sit for the improvement examination to make-up the Incomplete examination. If the incomplete examination is not completed in the improvement examination, which will be held after the publication of the semester result, then ‘I’ grade will automatically be converted into "F". Due to unfair means in the examination or some other reasons, a student has to repeat an examination, the result is shown as ‘W’. If the case is not settled in time, then ‘W’ will be automatically converted into ‘F’.

2.4.2 Grading and Performance Evaluation Process:

Final grade in each course will be given on the basis on the basis of the performance on class attendance, quiz, assignment presentation, midterm test and final examination as indicated below:

Theory:

Class attendance	7
Assignment	5
Presentation (Mandatory)	8
3 Quizzes	15
Midterm Test	25
Semester Final Examination	40
Total	100

Lab:

Class Attendance	10
Lab Final	40
Lab Report	25
Lab Performance	25

Project:

Class Attendance	10
Lab Final	40
Lab Project	25
Lab Performance	25

2.4.3 Academic Probation:

A student must maintain a good academic standing with a CGPA of at least 2.00. Students with CGPA and (or) SGPA of less than 2.00 will be placed on Probation. Students on Probation will be allowed a maximum of three semesters to upgrade CGPA and (or) SGPA minimum 2.00, failing of which the student will be dropped from the program.

2.4.4 Retake Policy:

A student who has passed a course with a grade "B" or below in any particular course, he/she may be allowed to retake the course twice at the most to improve the relevant grade. In all cases normal course fees will have to be paid to the university. Appeal for any

2.4.5 Unsatisfactory Result:

A student not satisfied with the grade he/she received in any course may apply for re-checking the answer script through the prescribed form from the respective department and needs to be submitted to the Office of the Controller of Examinations. Before making an appeal, the student will have to make a payment of fees Tk. 500/- (five hundred taka) only. For rechecking the answer script, students must apply within 30 days of the publication of the semester result.

2.5 Course Offer List

CREDIT	COURSE CODE	COURSE NAME
3	SE 111	Computer Fundamentals
1	SE 112	Computer Fundamentals Lab
3	SE 113	Introduction to Software Engineering
3	ENG 114/ ENG 101	English Reading, Writing Skills & Public Speaking/ English I
3	GE 314/ BNS 101	Bangladesh Studies
3	MAT 124/ MAT 101	Math-I: Calculus & Geometry/ Mathematics I
3	SE 121	Structured Programming
1	SE 122	Structured Programming Lab
3	PHY 125/ PHY 101	Physics: Mechanics, Electromagnetism & Waves/ Physics I
3	SE 212	Software Requirement Specifications & Analysis
3	SE 213	Digital Electronics & Logic Design
3	SE 123	Discrete Mathematics
3	MAT 134/ MAT 102	Math-II: Linear Algebra & Fourier Analysis/ Mathematics II
3	SE 131	Data Structure
1	SE 132	Data Structure Lab
3	SE 133	Software Development Capstone Project
3	SE223	Database Systems
1	SE224	Database Systems Lab
3	SE 222	Computer Architecture
3	GE 115/ AOL 101	Art of Living
3	STA 135/ STA 101	Probability & Statistics in Software Engineering/ Statistics I
3	SE214	Algorithms Design & Analysis

1	SE215	Algorithms Design & Analysis Lab
3	SE 216	Object Oriented Programming
1	SE 217	Object Oriented Programming Lab
3	SE 411	Software Project Management & Documentation
3	GE235	Principles of Accounting, Business & Economics
3	SE232	Operating System & System Programming
1	SE233	Operating System & System Programming Lab
3	SE 231	System Analysis & Design Capstone Project
3	SE 235	Desktop & Web Programming
1	SE 236	Desktop & Web Programming Lab
3	SE 225	Data Communication & Computer Networking
1	SE 226	Data Communication & Computer Networking Lab
3	SE 234	Theory of Computing
3	SE 311	Design Pattern
3	SE 312	Software Quality Assurance & Testing
1	SE 313	Software Quality Assurance & Testing Lab
3	SE 441	Software Engineering Professional Ethics
3	SE 323	Software Architecture & Design
3	SE 321	Software Engineering Web Application
1	SE 322	Software Engineering Web Application Lab
3	SE 332	Information System Security
3	SE532	Introduction to Robotics
3	SE 333	Artificial Intelligence
1	SE 334	Artificial Intelligence Lab
3	SE544/ SE XXX	Introduction to Machine Learning Guided Elective - II
3	SE 331	**Software Engineering Design Capstone Project**

3	SE 442/ SE XXX	Management Information System/ Open Elective - I
6	SE 431	Final Year Project/ Thesis/ Internship
3	SE 535/ SE XXX	Data Warehouse & Data Mining (Non-Major Only)
	DS 331	Introduction to Data Science and Data Management & Analysis
	DS 332	Introduction to Data Science and Data Management & Analysis Lab (ds major)
	CS418	Network and Communication Security
	RE 421	Robotics process Automation Design & Development
	RE 422	Robotics process Automation Design & Development Lab
3	SE 599/ SE XXX	Research Methodology & Scientific Writing/ Open Elective – III (Non-Major Only)
3	SE341/ SE XXX	Numerical Analysis / Guided Elective – III (Non-Major Only)
3	SE447/ SE XXX	Human Computer Interaction/ Guided Elective – IV (Non-Major Only)
	DS 411	Statistical Data Analysis
	DS 412	Statistical Data Analysis Lab (ds-major)
	CS211	Cyber Security Fundamentals
	RE 411	Embedded System Design & Development
	RE 412	Embedded System Design & Development Lab
	DS 421	Machine Learning Driven Data Analysis I(DS Major)
	DS 422	Machine Learning Driven Data Analysis Lab I(DS Major)
	DS 423	Machine Learning Driven Data Analysis II and Communicating Data Insights (DS Major)
	DS 424	Machine Learning Driven Data Analysis II and Communicating Data Insights Lab (DS Major)
	RE 331	Embedded Programming

	RE 332	Embedded Programming Lab
	RE 423	Advanced Robotics
	RE 424	Advanced Robotics Lab
	CS422	Digital Forensic
	CS334	Ethical Hacking & Countermeasures
	CS335	Ethical Hacking & Countermeasures LAB
3	GE 557/ GED 302/ EMP101	Employability 360
3	GE 324	Business Analysis & Communication

2.5.1 Course Breakdown:

CODE	COURSE TITLE	Prerequisite	Course Category	Theory Credit
SE 111	Computer Fundamentals		CORE	3
SE 112	Computer Fundamentals Lab		LAB	1
SE 113	Introduction to Software Engineering		CORE	3
ENG 114/ ENG 101	English Reading, Writing Skills & Public Speaking/ English I		GED	3
GE 314/ BNS 101	Bangladesh Studies		GED	3
MAT 124/ MAT 101	Math-I: Calculus & Geometry/ Mathematics I		GED	3
SE 121	Structured Programming	SE111, SE112	CORE	3
SE 122	Structured Programming Lab	SE111, SE112	LAB	1
SE 123	Discrete Mathematics		PGC	3
SE 212	Software Requirement Specifications & Analysis	SE113	CORE	3
SE 213	Digital Electronics & Logic Design	SE111, SE112	PGC	3
PHY 125/ PHY 101	Physics: Mechanics, Electromagnetism & Waves/ Physics I		GED	3
MAT 134/ MAT 102	Math-II: Linear Algebra & Fourier Analysis/ Mathematics II	MAT124/ MAT101	GED	3
SE 131	Data Structure	SE121, SE122, SE123	PGC	3
SE 132	Data Structure Lab	SE121, SE122, SE123	LAB	1
SE 133	Software Development Capstone Project	SE121, SE122	LAB-P	3

SE 215	Object Oriented ..	SE121, SE122	CORE	3
SE 216	Object Oriented Programming lab	SE121, SE122	LAB	1
SE 222	Computer Architecture	SE213	PGC	3
STA 135/ STA 101	Probability & Statistics in Software Engineering/ Statistics I		GED	3
GE 115/ AOL 101	Art of living		GED	3
SE 214	Algorithms Design & Analysis	SE131, SE132	PGC	3
SE 215	Algorithms Design & Analysis Lab	SE131, SE132	LAB	1
SE 235	Desktop and Web Programming		CORE	3
SE 236	Desktop and Web Programming Lab		LAB	1
SE 223	Database System		CORE	3
SE 224	Database System Lab		LAB	
SE 232	Operating System & System Programming	SE222	PGC	3
SE 233	Operating System & System Programming Lab	SE222	LAB	1
GE 235	Principles of Accounting, Business & Economics		GED	3
SE 532/SE XXX	Introduction to Robotics (G-1)/ Guided Elective- I	SE213	PGC	3
SE 225	Data Communication & Computer Networking		PGC	3
SE 226	Data Communication & Computer Networking Lab		LAB	1
SE 231	System Analysis & Design Capstone Project	SE133, SE212, SE221	LAB-P	3
SE 234	Theory of Computing		PGC	3
SE 311	Design Pattern	SE221	CORE	3
SE 312	Software Quality Assurance & Testing	SE212, SE221	CORE	3

SE 313	Software Quality Assurance & Testing Lab	SE212, SE221	LAB	1
GE 324	Business Analysis & Communication	ENG114/ ENG101, SE212	GED	3
SE 321	Software Engineering Web Application	SE121, SE122	CORE	3
SE 322	Software Engineering Web Application Lab	SE121, SE122	LAB	1
SE 323	Software Architecture & Design	SE212, SE221, SE223, SE311	CORE	3
SE 332	Information System Security		CORE	3
SE 411	Software Project Management & Documentation	SE312	CORE	3
SE 333	Artificial Intelligence	SE214, SE234	CORE	3
SE 334	Artificial Intelligence Lab	SE214, SE234	LAB	1
SE 544/SE XXX	Introduction to Machine Learning (G-2)/Guided Elective- II	MAT 101,MAT 102, STA 101, SE 121	PGC	3
SE 331	Software Engineering Design Capstone Project	SE231, SE312, SE321, SE323	LAB-P	3
GE 557/ GED 302/ EMP101	Employability 360 Non-Major Only		GED	3
SE 535/ SE XXX	Mobile Application Development/ (Open Elective-1) Non-Major Only		PGC	3
SE 447/ SE XXX	Human Computer Interaction (Open Elective-2) Non-Major Only		PGC	3
SE 599/ SE XXX	Research Methodology & Scientific Writing (Open Elective-3) Non-Major Only		PGC	3
SE 442/SE XXX	Management Information System (G-3)/Guided Elective-III		PGC	3
RE 331	Embedded Programming (RE Major Only)	SE 213, SE 121, SE 532	MAJOR	2

RE 332	Embedded Programming Lab (RE Major Only)	SE 213, SE 121, SE 532	MAJOR-L	1
RE 411	Embedded Systems Design & Development (RE Major Only)	RE 331, RE 332	MAJOR	2
RE 412	Embedded Systems Design & Development Lab (RE Major Only)	RE 331, RE 332	MAJOR-L	1
RE 421	Robotic Process Automation Design & Development (RE Major Only)	RE 331, RE 332, RE 411,RE 412,SE 442, SE 331	MAJOR	2
RE 422	Robotic Process Automation Design & Development Lab (RE Major Only)	RE 331, RE 332, RE 411,RE 412,SE 442, SE 331	MAJOR-L	1
CS 211	Cyber Security Fundamentals (CS Major Only)	SE 332	MAJOR	3
CS 418	Network & Communication Security (CS Major Only)	CS 211	MAJOR	3
CS 422	Digital Forensic (CS Major Only)	CS 418	MAJOR	3
DS 331	Introduction To Data Science and Data Management & Analysis (DS Major Only)	STA 101, SE 121	MAJOR	2
DS 332	Introduction To Data Science and Data Management & Analysis Lab (DS Major Only)	STA 101, SE 121	MAJOR-L	1
DS 411	Statistical Data Analysis (DS Major Only)	DS 331, DS 332	MAJOR	2
DS 412	Statistical Data Analysis Lab (DS Major Only)	DS 331, DS 332	MAJOR-L	
DS 421	Machine Learning Driven Data Analysis I(DS Major Only)	DS 411,DS 412, SE 544	MAJOR	2

DS 422	Machine Learning Driven Data Analysis Lab I (DS Major Only)	DS 411,DS 412, SE 544	MAJOR-L	1
SE XXX	Guided Elective-IV Non Major Only		PGC	3
SE341/ SE XXX	Numerical Analysis (G -5) Non –Major Only/Guided Elective-V		PGC	3
SEXXX/ GE 557/ GED 302/ EMP 101	Employability 360 (G-4) / Guided Elective-IV All Majors Only		PGC	3
RE 423	Advanced Robotics (RE Major Only)	RE 331, RE 332, RE 411,RE 412	MAJOR	2
RE 424	Advanced Robotics Lab (RE Major Only)	RE 331, RE 332, RE 411,RE 412	MAJOR-L	1
CS 334	Ethical Hacking & Countermeasures (CS Major Only)	CS 418	MAJOR	1
CS 335	Ethical Hacking & Countermeasures Lab (CS Major)	CS 418	MAJOR-L	2
DS 423	Machine Learning Driven Data Analysis II and Communicating Data Insights (DS Major Only)	DS 411,DS 412, SE 544	MAJOR	2
DS 424	Machine Learning Driven Data Analysis II and Communicating Data Insights Lab (DS Major Only)	DS 411,DS 412, SE 544	MAJOR-L	1
SE 431	Final Year Project/ Thesis/ Internship		PRO-THE	6
RE 431	Robotics & Embedded Systems Major Capstone Project (RE Major Only)	ALL RE Major Courses	PRO-THE	6
CS 439	Cyber Security Major Capstone Project (CS Major Only)	ALL CS Major Courses	PRO-THE	6

DS 431	Data Science Major Capstone Project (DS Major Only)	ALL CS Major Courses	PRO-THE	6

2.5.2 Course Categories:

- GED: General Education Courses
- PGC: Preparatory General Core
- CORE: Software Engineering Core
- LAB: Laboratory Courses
- LAB-P: Lab Based Project Courses
- MAJOR: Major Courses (All Majors)
- MAJOR-L: Major Laboratory Courses (All Majors)
- PRO-THE: Final Year Project/ Thesis

2.5.3 Curriculum of the Program:

Semester 1(1st Year 1st Semester)

Course Code: SE111		
ISCED: 0611-111		
Course Title: Computer Fundamentals		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 1	

Course Objectives

The goal of this course is to introduce the students to the concept of basic logic operation and the basics of computer function and operation. The main objectives of this course are,

- To integrate the basic components and functions of a computer system.
- To construct the digital circuits using logic gates and other electronic components.
- To apply the principles of software systems to solve problems and design solutions.
- To evaluate the security of computer systems and networks.

Course Content

Basic computer system, computer codes, convert number systems, logic gates, Application of logic gate, Basic concepts on microprocessors and microcomputers. Data and information, variables, Loops, Condition, identify errors in logical flow in flowcharts, correct the logic of the control structures of simple programs in programming language. Various parts of a computer system, input/output devices, Memory hierarchy, Types of memory, Memory operation, Data communication, Types of networks.

Textbook/Recommended Readings

Computer Fundamentals and ICT. 2nd Edition, 2017, DIU press. by M. Lutfar Rahman,M. Shamim Kaiser, M. Arifur Rahman, M. Alamgir Hossain

Reference Books/ Other Supplementary Readings

Computer Fundamentals(1st Edition) by Pradeep K. Sinha & Priti Sinh,

Course Code: SE112		
ISCED: SE112 /0611-112		
Course Title: Computer Fundamentals Lab		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1 (Lab)		
Prerequisite: N/A		Contact Hours: 1 Hour 15 minues (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 1	

Course Objectives

By the end of course through lectures, readings, home works, lab assignments and exams, students will be taught:

- To Understand the concepts of data and information and their relevance in programming and hands-on experience in creating websites using Google Sites;
- To understand basic computer tools like Draw.io, Canva, and various Google tools;
- To apply programming concepts through practical examples and exercises;
- To apply essential skills in using Microsoft Office tools such as Word, Excel, and PowerPoint.

Course Content

The Computer Fundamentals Lab is designed to provide students with a hands-on understanding of core concepts in computing, programming, and essential software tools. Throughout this course, students will delve into the fundamentals of data, programming logic, and software applications, enabling them to build a strong foundation in computer science and information technology. Emphasis will be placed on practical implementation, ensuring students gain real-world skills that are applicable in various academic and professional settings.

Textbook/Recommended Readings

- Computer Fundamentals" by P K Sinha.
- "Fundamentals of Computers" by Rajaraman V and Adabala N
- "FUNDAMENTALS OF COMPUTERS" by E Balagurusamy

Course Code: SE113		CIE Marks: 60
ISCED: 0611-113		SEE Marks: 40
Course Title: Introduction to Software Engineering		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 1	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Software Engineering. More specifically,

- To apply fundamental software engineering principles and practices to real-world scenarios.
- To compare and contrast different SDLC models (waterfall, agile, iterative, etc.) and their suitability for various projects. Also, core agile methodologies like Scrum and Kanban for flexible and adaptive project management.
- To analyze user needs and translate them into clear, concise, and measurable requirements, including various requirement elicitation techniques (interviews, surveys, observation) to capture user feedback.
- To create and interpret UML diagrams (use case, class, sequence, activity) to visualize software structure and behavior.
- To understand software security and quality through different approaches.
- To apply fundamental project management principles (planning, monitoring, control) to software projects and utilize project cost estimation techniques like Functional Point Analysis and COCOMO models.

Course Content

Software engineering fundamentals, software process, software process models, methodologies; prototyping, iterative process models, incremental software development, agile software development, extreme programming, Kanban, and SCRUM; Software requirement Engineering: functional and non-functional requirement, requirement engineering process, requirement elicitation, specification, validation, and change; software design. software modeling, UML diagrams; software testing, different types of testing, test-case design, white box testing: basis path testing with cyclomatic complexity, black box testing: interface testing, equivalence partitioning, boundary value analysis, object-oriented software testing: class testing, behavioral testing, Halstead's complexity, Decision table; maintenance, documentation, reliability engineering, software quality and security, reverse engineering, software risk management, software project management: phases of software project management, estimation techniques, scheduling techniques, COCOMO models.

Textbook/Recommended Readings

- Roger S Pressman, Software Engineering: A Practitioner's Approach, 9th Edition, McGraw-Hill, 2020, ISBN 10: 1259872971

Reference Books/ Other Supplementary Readings

- Ian Sommerville, Software Engineering, 10th edition, Pearson, 2016, ISBN: 10: 0133943038
- Ahmed, Ashfaque, and Prasad, Bhanu, Foundations of Software Engineering, CRC Press, Taylor & Francis Group, 2016, ISBN 9781498737593

Course Code: ENG101		Total Marks: 100

ISCED: 0611-101		
Course Title: English 1		
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 1	

Course Objectives

To improve the basic skills of English language to communicate confidently and naturally, more specifically,

- To enhance the ways to communicate opinions and information on everyday topics and common experiences, and express and justify opinions.
- To improve the ability to follow conversations, to retain information and assimilate factual details, and to draw conclusions from information gathered through effective listening.
- To develop the reading techniques for general sense, main ideas, and details, and also to understand the author's inferences and opinions
- To make the writing skill for writing a response, organize ideas, and use wide-ranging vocabulary and grammar well and accurately.

Course Content

Overview of Basic Skills of English:Speaking, Basic Grammar: Use of Articles, Identifying Parts of Speech, Syntax: Run on, Fragments, speaking: Self Introduction, Social English: Greeting, Answering to Greeting, Agreeing & Disagreeing, Small Talks etc., Relating and Demonstrating Ideas on Selective Topics; Introduction to IELTS Speaking: Part I and II, Reading: Reading techniques (Skimming and Scanning), Reading Comprehension: Practices from IELTS Reading Comprehension: (True/False/Not Given, Flow chart, Matching Heading, Matching Features, Multiple Choice Question, Short Answer etc.), Writing: Formal Letter Writing, Cover Letter, CV, Resume, Video Resume, Email Writing, Paragraph Writing, Essay Writing.

Textbook/Recommended Readings

- A Basic English Grammar: Exercises-John Eastwood
- Grammar Practice Activities for Intermediate Students of English-Leo Jones
- A Guide to Paragraph Writing-T C Jupp & John Milne
- Cambridge IELTS

Reference Books/ Other Supplementary Readings

- Essential English Grammar-Raymond Murphy
- Common Mistakes in English-TJ Fitikide

Course Code: BNS 101		CIE Marks: 60
ISCED: 0613-131		SEE Marks: 40
Course Title: Bangladesh Studies		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 1	Term: 1	

Course Objectives

This course aims to introduce the students to the multi-faceted concept of modern Bangladesh, along with its long historical background and inevitable emergence as a state entity in the modern world. The main objectives of this course are:

- To introduce students to the long political history of Bangladesh and the necessity of its emergence by discussing the actual events and facts.
- To make students' understanding clearer, authentic, and rational in the nation-building and state-building process.
- To prepare students for competitive exams by providing them with basic knowledge and realities about the origin and surrounding environment.
- To increase the sense of patriotism and aspirations among the learners that can strengthen their commitment to nation-building.

Course Content

Geography: location, borders, topography, resources, climate; Demographic traits: demographic dividend, human development; Society and culture: Social stratification, traditions, values, festivals; Ethnic identity of people of Bangladesh; Origin and development of the name of Bangladesh; Origin and development of Bangla language; Bangladesh in international affairs: principles, objectives and determinants of foreign policy, achievements and challenges; Constitution of Bangladesh: concept, essentials, principles, rights, and amendments; Organs and functions of government: Digitalization and Service Sector in Bangladesh; Historical background of Bangladesh: Language movement, Six-points demands, Liberation war, constitutional development in post-liberation; Economic profile of Bangladesh: macro perspective, blue economy, gig economy; Development approaches: Vision 2041, SDGs, Delta plans; Agricultural Productivity and Rural Development; Urbanization: push-pull model of migration; Environmental degradation and climate change; Industrial sector: overview of major industries, ICT & Software sector of Bangladesh.

Textbook/Recommended Readings

- A Handbook on “Bangladesh Studies” compiled by the Dept. of Development Studies, Daffodil International University.

Reference Books/ Other Supplementary Readings

- Bangladesh Economic Review Report, Ministry of Finance, Government of Bangladesh.
- Vulnerability and Adaptation to Climate Change for Bangladesh, S. Huq, M. Saduzzaman 2013, Springer Publication
- A History of Bangladesh, Willem van Schendel, Cambridge University Press, UK.
- Foreign Relations of Bangladesh, Harun ur Rashid, Rishi Publications, Dhaka, Bangladesh.
- The Unfinished Memoirs, Sheikh Mujibur Rahman, University Press Limited, 2012.
- The Constitution of the People’s Republic of Bangladesh, Ministry of Law, Justice and Parliamentary Affairs, Bangladesh.

Semester 2(1st Year 2nd Semester)

Course Code: SE 121		CIE Marks: 60
ISCED: 0613-121		SEE Marks: 40
Course Title: Structured Programming		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: SE 111, SE112		
Course Type: Core		
Level: 1	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the high-level, general-purpose Structured Programming Language. More specifically,

- To learn preprogramming steps like writing algorithms, and drawing flowcharts.
- To learn the syntax and semantics of C programming.
- To learn different control structures like decision control, and loop control.
- To Understand the limitations of basic data types and learn the concepts of derived data types and user-defined data types (Array and Structure).
- To use strings and learn about the string handling functions.
- To learn the concepts and benefits of using user-defined functions.
- To develop logical thinking and being able to analyze the execution of a C program.

Course Content

Overview of C: Basic structure of C programs, Importance of learning C programming, Execution of a C program. Constant, Variables, and Data Types: Different data types and their specifiers, declaration of variables, Assigning values to variables, taking input using scanf() function, Operators and Expressions: Arithmetic operator, Relational operator, Logical operator, Increment Decrement operator, Conditional operator, Conditional Statements: simple if statement, if...else statement, Nesting if... else statement, if...else if ladder, switch statement. Loops: while loop, do..while loop, for loop, nested for loop, continue and break, Array: Declaration and Initialization of 1D and 2D arrays. Strings: Declaration and Initialization of String variables, arithmetic operation on characters, string handling functions, User-defined Functions: Definition of user-defined function, Elements of user-defined functions, Category of user-defined functions, Structures: Defining a structure, Declaring structure variables, Accessing structure members, Structure initialization.

Textbook/Recommended Readings

- Programming in ANSI C By Balaguruswamy- Sixth Edition.

Reference Books/ Other Supplementary Readings

- Let us C by Ashavant P. Kanetkar- Fifth Edition
- Learn C the Hard Way by Zed Shaw

Course Code: SE 122		Total Marks: 100

ISCED: 0613-122		
Course Title: Structured Programming Lab		
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: SE 111, SE112		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Core		
Level: 1	Term: 2	

Course Objectives

The goal of this course is to introduce the students to the concept of structured programming. The main objectives of this course are,

- To analyze a problem and develop the logical thinking
- To design, implement, and evaluate an algorithm
- To apply knowledge of C programming in solving problems
- To become enabled to determine errors from a code and correct it.

Course Content

Overview of C: Basic structure of C programs, Importance of learning C programming, Execution of a C program. Constant, Variables, and Data Types: Different data types and their specifiers, declaration of variables, Assigning values to variables, taking input using scanf() function, Operators and Expressions: Arithmetic operator, Relational operator, Logical operator, Increment Decrement operator, Conditional operator, Conditional Statements: simple if statement, if…else statement, Nesting if…else statement, if…else if ladder, switch statement. Loops: while loop, do..while loop, for loop, nested for loop, continue and break, Array: Declaration and Initialization of 1D and 2D arrays. Strings: Declaration and Initialization of String variables, arithmetic operation on characters, string handling functions, User-defined Functions: Definition of user defined function, Elements of user defined functions, Category of user defined functions, Structures: Defining a structure, declaring structure variables, Accessing structure members, Structure initialization.

Textbook/Recommended Readings

- Programming in ANSI C By Balaguruswamy- Sixth Edition.

Reference Books/ Other Supplementary Readings

- Let us C by ashavant P. Kanetkar- Fifth Edition
- Learn C the Hard Way by Zed Shaw.

Course Code: SE 123		
ISCED: 0613-123		
Course Title: Discrete Mathematics		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Discrete Mathematics, More specifically,

- Express a logic sentence in terms of predicates, quantifiers, and logical connectives..
- Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.
- Use tree and graph algorithms to solve problems.
- Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

Course Content

The syllabus of the course has been divided into four core sections. These are propositional & predicate logic, set theory & probability, function & relation, and graph theory & binary three. These four sections have been expanded with necessary subsections. The propositional & predicate logic starts with a simple and compound logical statement. After that, with the discussion and application of logical connectives and the truth table, the students learn to apply the concept to solve relevant problems. The set theory and probability contain the basic terminologies, sample space formation, and probability concepts in appropriate contexts. The function and relation section introduces different types of functions, their scope of application, and the comparison between function and relation. Finally, graph theory and binary three cover the terminologies of graph theory, different types of graphs, and the essentials of the binary tree.

Textbook/Recommended Readings

- Discrete Mathematics and Its Applications, 6/e, Kenneth Rosen, ISBN: 0072880082© 2007

Reference Books/ Other Supplementary Readings

- Epp, S., Discrete Mathematics with Applications, 3rd edition, PWS Publishing Company.
- Bauer, D., Lecture Notes in Discrete Math, Stevens Tech edition.

Course Code: SE212		
ISCED: 0613-212		
Course Title: Software Requirements Specification & Analysis		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically,

- To learn the basic concepts of the Requirement Engineering Process.
- To learn different lifecycle models and explain their importance.
- To learn many approaches to gather requirements from users and design with proper documents.
- To learn the design requirements for developers.
- To learn the concepts and techniques in error detection and correction.

Course Content

Basic software requirements, Requirements Engineering, Functional and Non-Functional requirements, Feasibility Study, Stakeholders for a system, design user profile, Requirements Elicitation Techniques, Requirements Representation, SRS documentation, Use Case, Requirements Modeling, Actor of a use case, Include and Extended Use Case, Case description Requirements Prioritization Techniques, Requirements Traceability Matrix, Prototyping, Usability and UX, SUS calculation.

Textbook/Recommended Readings

- “Requirements Engineering: Processes and Techniques” by Gerald Kotonya, Ian Sommerville, Wiley Publishing, 1998.

Reference Books/ Other Supplementary Readings

- Sommerville, Ian. Software engineering. Addison-Wesley/Pearson, 2011.

Course Code: SE213		
ISCED: 0714-213		
Course Title: Digital Electronics & Logic Design		Total Marks: 100
Semester: Fall 2023		
Credit Value: 3 (Theory)		
Prerequisite: (If any)		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 2	

Course Objectives

The objective of this course is to deliver insights into digital electronics and logical designs as the circuits in the real-world works, specifically:

- To learn to represent numerical values in various number systems,
- To learn to demonstrate knowledge of logic gates, Boolean algebraic manipulation
- To learn to apply theorems and mappings for simplification of expressions
- To learn to design and implement types of decoders, encoders, multiplexers, and De-multiplexers.
- To learn to apply circuits for developing flip-flops and memory registers

Course Content

Foundation of Digital Electronics, Fundamental concepts, digital and analog quantities, advantages of digital electronics, Introduction to Number Systems, Conversion Number Systems, Expression, truth table, universal properties of NAND & NOR gates, Simplification of expression using Boolean algebra, Binary Subtraction using 1's and 2's complements, Design of Combinational Logic using TT, Boolean algebra, Adder Circuit, Half Adder, Full Adder, Parallel Adder, Introduction to K-Map, SOP, POS, MINTERM, MAXTERM,3-4 variable K- MAP, construction of map, implementation of expression using map, grouping and simplification, Advanced Combinational Circuits, Decoder (Binary to Decimal, Octal, Hexadecimal,Advanced Combinational Circuits, Converters (BCD to XS- 3), Introduction to Multiplexers and De- multiplexer,Design of Multiplexer Circuits, Design of De-multiplexer Circuits, Introduction to Parity, Design of Parity Generator Circuits, Design of Parity Checker Circuit to detect error during transfer or transmission of Data, Introduction to comparator circuit using complex combinational Logic, Introduction to Computer Memory, Introduction to Flip Flops, Design of J-K, S-R, Latche.

Textbook/Recommended Readings

- "Digital Logic & Computer Design" by M. Morris Mano (4th Edition)

Reference Books/ Other Supplementary Readings

- "Digital Systems: Principals and Applications" by Ronald J. Tocci et. Al.Pearson Education International, 2007
- https://www.tutorialspoint.com/digital_circuits/

Course Code: PHY101		Total Marks: 100

ISCED: 0533-101		
Course Title: General Mechanics, Waves, and Oscillations, Optics and Atom and Modern Physics		
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: (If any)		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 1	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Software Engineering. More specifically,

- To grasp the foundational concepts and development of mechanics, analyzing two-dimensional motion including projectile motion and forces such as friction.
- To explore key principles in work, energy, momentum, and moment of inertia.
- To Understand waves and oscillations, investigating simple harmonic motion and various wave types.
- To explore optics, covering historical context, geometrical optics, and physical optics.
- To examine the atomic structure, the nucleus, and the concept of nuclear energy.
- To introduce fundamental principles in modern physics, including the theory of relativity, the photoelectric effect, the Compton effect, pair production, X-rays, and radioactivity.

Course Content

Mechanics: Overview; history; classical mechanics; Newton's laws of motion; Motion in two dimensions: Projectile motion and its application; Force and friction force, Work & Energy, Momentum and Moment of inertia Waves and oscillations: Concepts of waves & oscillations; Simple harmonic motion: energy, composition, damped and forced vibration; types of waves, stationary and progressive wave and their applications.Optics: Concepts of the historical background of optics, classifications: Geometrical optics; reflection, refraction, total internal reflection; Physical optics: Interference, diffraction, polarization, their uses. Atom and Modern Physics: Atomic structure and atomic development, Atomic nucleus and nuclear energy. Basic concepts of modern physics: Theory of relativity; Einstein's photoelectric effect, Compton effect, pair production, X-Ray. Radioactivity.

Textbook/Recommended Readings

- Physics-I&II by D. Halliday& R. Resnick

Reference Books/ Other Supplementary Readings

- Physics for Engineers (Part-I an Part-II) by Prof. GiasUddin Ahmad*
- Waves and Oscillations by Brij Lal and N. Subrahmanyam
- Principles of Optics by B. K. Mathur
- Modern Physics by Arthur Beiser
- Atomic and Nuclear Physics: Subrahmaniyam Brijlal

Course Code: MAT 102		
ISCED: 0541-102		
Course Title: Mathematics II		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: MAT 101		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Guided Elective		
Level: 1	Term: 2	

Course Objectives

To provide a solid conceptual understanding of Linear Algebra, Complex Variables, and Fourier analysis. More specifically,

- To learn to solve problems using linear algebra
- Demonstrate comprehension of operations on matrices.
- To learn how to find Eigenvalues and Eigenvectors of a matrix
- To be able to use linear algebra in real-life applications.
- To learn the complex number system.
- To learn about analytic functions of complex variables.
- To learn about the Euler Theorem, and De Moivre's Theorem.
- To learn about the Fourier series & Fourier Transformation.

Course Content

Linear Algebra: Basic of Matrix and Matrix Algebra, Types of Matrix, Determinant of Matrix (Higher Order), Inverse Matrix, Rank of Matrix, RREF & NF of a Matrix, System of Linear Equations, Eigenvalues and Eigenvectors, Cayley-Hamilton Theorem; Complex Variables: Basic of Complex Numbers, Modulus, Argument, Different form of Complex Number, Cauchy Riemann Equation, Laplace's Equation, Harmonic Function, Euler Theorem, De Moivre's Theorem; Fourier Analysis: Fourier series, Fourier Transformation.

Textbook/Recommended Readings

- Linear Algebra: a first course by Mohammad Salek Parvez
- Complex Variable by Schaum's Series
- Fourier Analysis by Schaum's Series

Reference Books/ Other Supplementary Readings

- An Introduction to Linear Algebra by Prof. Md. Abdur Rahman
- Elementary Linear Algebra – Howard Anton, Chris Rorres.

Semester 3(2nd Year 1st Semester)

Course Code: SE 131		
ISCED: 0612-131		
Course Title: Data Structure		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE121, SE122, SE123		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 2	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data Structure, More specifically,

- To provide the knowledge of basic data structures and their implementations.
- To understand the importance of data structures in the context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem-solving.
- To learn how data are stored in our computer memory
- Be familiar with writing recursive methods

Course Content

Overview of Data Structures, Algorithm and Complexity, Time Space Tradeoff, Recursion, Iteration , Record, Pointer, Implementation of Memory, Array:Traverse, Insert, Insert at any position, Delete at any position, Linear Search, Linear Search complexity, Binary Search, Binary Search Complexity, Searching- Bubble Sort, Factorial and Tower of Hanoi Problem; Marge, Stack: Stack data Insertion, Stack Deletion, Stack : Search, Prefix, Infix and Postfix Expressions, Queue: Queue data Insertion, Queue Deletion, Queue: Search, Double Ended Queue, Priority Queue, Hashing: Hash Indices and Hash Functions, Static Linked List: List ADTs, Linked List data Insertion, Deletion, Search, Double Way Linked List: data Insertion, Deletion, Search, Circular Way Linked List: data Insertion, Deletion, Search, Tree, Tree terminologies, Binary Search Tree: Insertion, Deletion, Search, AVL Tree, Heaps, Heap Sort, Graph, Graph Terminologies, Adjacency matrix, Adjacency List, Graph data Insertion, Graph Deletion, Graph: Search.

Textbook/Recommended Readings

- Data Structures: A Pseudocode Approach with C, 2nd Edition, by ichard F. Gilberg (Author), Behrouz A. Forouzan (Author)

Reference Books/ Other Supplementary Readings

- Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" is a book written by Narasimha Karumanchi.
- Data Structures (SIE) Paperback – January 1, 2014
- https://www.geeksforgeeks.org/data-structures/

Course Code: SE 132		
0613-132		
Course Title: Data Structure Lab		Total Marks: 100
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: N/A		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Core		
Level: 2	Term: 1	

Course Objectives

The three main objectives of the Data Structure Lab Course are:

- Hands-on Implementation: Enable students to gain practical experience in implementing various data structures and algorithms studied in theoretical courses, thereby reinforcing their understanding of fundamental concepts through practical application.
- Algorithmic Analysis and Optimization: Develop students' ability to analyze the time and space complexities of different data structures and algorithms, fostering critical thinking skills and enabling them to optimize solutions for improved performance.
- Problem-Solving Proficiency: Enhance students' problem-solving skills by challenging them to apply appropriate data structures and algorithms to solve diverse computational problems, preparing them to tackle real-world challenges in software development and beyond.

Course Content

Array – Traverse, Insert, Insert at any position, Delete at any position, Linear Search, Linear Search complexity, Binary Search, Searching- Bubble Sort, Stack – Stack data Insertion, Stack Deletion, Stack – Search, Prefix, Infix and Postfix Expressions, Queue – Queue data Insertion, Queue Deletion, Queue – Search, Double Ended Queue, Priority Queue, Static Linked List – List ADTs, Linked List data Insertion, Linked List Deletion, Linked List – Search, Double Way Linked List – Double Way Linked List data Insertion, Double Way Linked List Deletion, Double Way Linked List – Search, Circular Way Linked List – Circular Way Linked List data Insertion, Circular Way Linked List Deletion, Circular Way ,Linked List , Binary Search Tree, Tree data Insertion, Tree Deletion, Tree Search, AVL Tree, Heaps, Heap Sort, Graph, Graph Terminologies, Adjacency matrix, Adjacency List, Graph data Insertion, Graph Deletion, Graph Search.

Textbook/Recommended Readings

- Data Structures: A Pseudocode Approach with C, 2nd Edition, by ichard F. Gilberg (Author), Behrouz A. Forouzan (Author).

Reference Books/ Other Supplementary Readings

- Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" is a book written by Narasimha Karumanchi.
- Data Structures (SIE) Paperback – January 1, 2014
- https://www.geeksforgeeks.org/data-structures/

Course Code: SE 216		
ISCED: 0612-216		
Course Title: Object-Oriented Programming		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE121, SE122		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 2	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Object-Oriented Programming, more specifically,

- Understand key OOP concepts, including classes, objects, and advanced topics like Abstraction and Inheritance.
- Learn effective code structuring with access specifiers, constructors, and advanced features like static members and object pointers.
- Apply Singleton, Factory, and Observer patterns. Understand refactoring for code improvement.
- Navigate the Software Engineering Life Cycle, focusing on modeling, internal components, and design principles.
- Gain a concise understanding of UML diagrams and Use Case Modeling for streamlined software development.

Course Content

Basic Concepts of Object-Oriented Programming, Classes and Objects, Characteristics of Objects, Relationships and Methods, Advantages of OOP over structured programming, Access specifiers, Static and non-static members, Constructors and Its types, Destructors, Array of objects, object pointers, and object references, Abstraction, Encapsulation, Inheritance, Polymorphism, Abstract classes and methods, Abstract methods, Abstract layer, Basic principles of Interfaces, Extending Interfaces, Multiple Interfaces, Interface Implementation, Definition of Refactoring, Different Types of Code Smells, Refactoring Techniques, Functions and Modules, Library like List, set, stack, queue, Tuple, Dictionary etc., Exception Handling, File Handling, Software Engineering Life Cycle, Modeling Problem and Solution, Moving to Code, Internal Component Definition, Design for Reuse, Design Class Diagrams, Iterating the Design, Refactoring, Design Best Practices, Cohesion, Complexity, Coupling, Congruence, Singleton pattern, Factory pattern, Observer pattern, Strategy pattern, Use Case Model, Use Case Diagram, Use Case Description, Main Success Scenario and Alternate Paths, Use Case Relationships (Generalization, <>, <>), Extension Points and Packages, Overview and Basic Concepts, Classifiers and Well-Formedness Rules, Basic Notation, Classes, Objects, Relationships, and Methods, UML Diagrams.

Textbook/Recommended Readings

- From Problem Analysis to Program Design in Java by D.S. Malik (4th edition)

Reference Books/ Other Supplementary Readings

- Introduction to Java Programming by Y. Daniel Liang (8th Edition)
- Fundamentals of OOP and Data Structures by Richard Wiener & Lewis J. Pinson

Course Code: SE 217		
ISCED: 0612-217		
Course Title: Object-Oriented Programming Lab		Total Marks: 100
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: SE121, SE122		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 2	Term: 1	

Course Objectives

The goal of this course is to introduce the students to the concept of Object Oriented Programming. The main objectives of this course are to,

- This course will provide students with a comprehensive understanding of object-oriented programming concepts.
- Students will learn how to use access specifiers to control the visibility of class members.
- This course will teach students how to implement design patterns in their code.
- Students will learn how to create and use libraries in their code.
- This course will teach students how to apply refactoring techniques to their code.

Course Content

Setting Up the Development Environment, Introduction to Classes and Objects, Implementing Access Specifiers, Working with Static and Non-Static Members, Constructor and Destructor Implementation, Handling Arrays of Objects and Object Pointers, Implementing Abstraction, Encapsulation in Action, Working with Inheritance, Exploring Polymorphism, Abstract Classes and Methods Implementation, Interface Implementation, Applying Refactoring Techniques, Creating and Using Libraries, Exception Handling in Practice, File Handling, Software Engineering Life Cycle, Transition from Design to Code, Design Class Diagrams, Refining Design Practices, Assessing Cohesion, Complexity, and Coupling, Implementing Design Patterns, Creating Use Case Diagrams, Use Case Descriptions and Relationships, UML Diagrams in Action.

Textbook/Recommended Readings

- From Problem Analysis to Program Design in Java by D.S. Malik (4th edition)

Reference Books/ Other Supplementary Readings

- Introduction to Java Programming by Y. Daniel Liang (8th Edition)
- Fundamentals of OOP and Data Structures by Richard Wiener & Lewis J. Pinson

Course Code: SE 222		
ISCED: 0612-222		
Course Title: Computer Architecture		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE 213		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 2	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Computer architecture, More specifically,

- Illustrate the organizations, architectures, structures and functions of modern digital computer systems.
- Organize the basic knowledge required to understand the architectures and organizations of modern digital computer systems.
- Conclude the hardware level arithmetic operation algorithms.
- Interpret parallelism both in terms of a single processor and multiple processors.
- Distinguish a wide variety of memory technologies both internal and external.
- Determine the system and memory performance measurements under measurement metrics.

Course Content

Instruction Set Architecture, Evolution of Computer, Processor performance (Moore's law), Benchmarks (Ahmdahl's law), clock speed and instruction per second, General Purpose Processor and its instruction patterns, Function of GPP, Hypothetical Processor, Instruction fetch and execute, Logical Units, Instruction Cycle States, Interrupt and Interrupt handling, Interconnection structure, Bus interconnection, Bus design (Address bus, control bus, data bus, multiple bus), Traditional bus architecture, high performance architecture, Elements of bus design, Method of arbitration, Timing, performance of memory, The memory hierarchy, Cache memory principles, Cache address, Mapping mechanism, Direct mapping, Full and Set associative cache, Replacement algorithms, Write policy, Line size, Number of cache, Interconnection structure, Data flow, Arithmetic logic unit (ALU), Number representation, Addition subtraction technique, Multiplication Technique (1 and 2's complement), Floating point representations, Machine instructions characteristics, Elements of machine instruction, Instruction representation, Instruction type, Number of address, Instruction set design, Operand types, Operation types, Branch instructions, Skip instructions, Procedure call instructions, Addressing technique, CPU internal structure, Register Organization, User visible registers (flags), Condition codes, Control and Status registers, Data flow, Instruction pipelining, Pipeline performance, Pipeline hazards, Dealing with branches.

Textbook/Recommended Readings

- "Computer organization and Architecture" by William Stallings, Seventh edition 2015

Reference Books/ Other Supplementary Readings

- "The Essentials of computer organization and architecture" by Linda Null, Fifth Edition , 2010

Course Code: STA 101		
ISCED: 0613-101		
Course Title: Statics I		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE 221		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Guided Elective		
Level: 2	Term: 1	

Course Objectives

The goal of this course is to introduce the students to modern operating system principles. The main objectives of this course are,

- To develop a solid foundation in statistical concepts.
- To acquire proficiency in constructing frequency distributions for both qualitative and quantitative data.
- To apply statistical methods to real-world problem-solving.
- To develop proficiency in quantitative and mathematical problem-solving related to statistical concepts, reinforcing theoretical knowledge with practical applications.

Course Content

Statistics is the science of data analysis, encompassing its collection, presentation, and interpretation. Key concepts include population and sample, variables and their types, levels of data, and sampling techniques. Data can be presented using frequency distributions, histograms, bar charts, and pie charts. Measures of central tendency (mean, median, mode) and location (quartiles, percentiles) are used for data summarization, while measures of dispersion (variance, standard deviation) analyze data spread. Shape characteristics like skewness and kurtosis help describe distributions. Correlation and regression analyses examine relationships between variables, with coefficients and interpretations aiding in decision-making. Probability explores likelihoods using rules, Bayes' theorem, and distributions like binomial, Poisson, and normal. Hypothesis testing involves null/alternative hypotheses, test statistics (Z, t-tests), and decision rules to infer conclusions about populations. These statistical tools are critical for problem-solving, interpreting data, and making informed decisions.

Semester 4(2nd Year 2nd Semester)

Course Code: SE 214		
ISCED: 0613-214		
Course Title: Algorithm Design & Analysis		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE131, SE132		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of algorithm, More specifically,

- To apply knowledge of computing and mathematics to algorithm design.
- To analyze a problem and identify the computing requirements appropriate for its solution.
- To design, implement, and evaluate an algorithm to meet desired needs.
- To apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.

Course Content

Basic strategies of algorithm design: top-down design, divide and conquer, average and worst-case criteria, asymptotic costs. Simple recurrence relations for asymptotic costs. Choice of appropriate data structures: arrays, lists, stacks, queues, trees, heaps, priority queues, graphs. Applications to sorting and searching, matrix algorithms, shortest-path and spanning tree problems. Introduction to discrete optimization algorithms: dynamic programming, greedy algorithms. Graph algorithms: depth-first and breadth-first search.

Textbook/Recommended Readings

- Introduction to Algorithms, (3rd Edition, MIT Press, 2009) ISBN: 9780262033848. Authors: Thomas H. Cormen, Charles E. Leiserson, Ronald, L. Rivest, and Clifford Stein.

Reference Books/ Other Supplementary Readings

- Algorithms (4th Edition) Author: Robert Sedgewick and Kevin Wayne.
- Algorithm Design, Author: Jon Kleinberg, Eva Tardos.
- Data Structures And Algorithms by Seymour Lipschurtz

Course Code: SE 215		
ISCED: 0613-215		
Course Title: Algorithm Design and Analysis Lab		Total Marks: 100
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: N/A		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

By the end of the course through lectures, readings, home works, lab assignments, and exams, students will be taught:

- To apply knowledge of computing and mathematics to algorithm design;
- To analyze a problem and identify the computing requirements appropriate for its solution;
- To design, implement, and evaluate an algorithm to meet desired needs;
- To apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems to demonstrate comprehension of the trade-offs involved in design choices.

Course Content

Big O Notation, Space and time complexity. Function and Recursion. Choice of appropriate data structures: Arrays, Lists, Stacks, Queues, Trees, Heaps, Priority Queues, Graphs. Sorting algorithms: Bubble Sort, Improved Bubble Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort. Search algorithms: Linear Search, Binary Search. Matrix Algorithms. Introduction to discrete optimization algorithms: dynamic programming techniques, Fractional Number, Knapsack, Longest Common Subsequence, Greedy algorithms: Coin Change Problem, Huffman Coding. Graph representations: Adjacency List, Adjacency Matrix. Graph algorithms: Depth First Search, Breadth First Search, Shortest Path, Minimum Spanning Tree, Floyd Warshall, Dijkstra Algorithm, Bellman-Ford, Kruskal's Algorithm, Prim's Algorithm.

Textbook/Recommended Readings

- Introduction to Algorithms, (3rd Edition, MIT Press, 2009) ISBN: 9780262033848. Authors: Thomas H. Cormen, Charles E. Leiserson, Ronald, L. Rivest, and Clifford Stein.

Reference Books/ Other Supplementary Readings

- Algorithms, 4th Edition. R. Sedgewick, and K. Wayne. Addison-Wesley, (2011)
- Algorithm Design. J. Kleinberg, and. Tardos. Addison Wesley, (2006)

Course Code: SE 235		CIE Marks: 60
ISCED: 0613-235		SEE Marks: 40
Course Title: Desktop & Web Programming		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the Desktop and Web Programming, More specifically,

- To introduce fundamental principles of desktop and web-based application development.
- To develop programming proficiency in languages for both desktop (Java, C#, Python) and web (JavaScript, PHP) environments.
- To attain mastery in frontend development, covering HTML, CSS, responsive design, and JavaScript frameworks.
- To gain competence in backend technologies, including server-side scripting, databases, and backend frameworks.
- To apply knowledge through practical projects, creating desktop applications and deploying web solutions.

Course Content

The Desktop & Web Programming course offers a comprehensive exploration of software development, covering essential concepts and practical skills necessary for crafting applications across desktop and web platforms. Encompassing programming fundamentals, frontend and backend development techniques, application security, and project deployment strategies, this course equips students with a robust understanding of creating functional, user-centric, and secure software solutions in both desktop and web environments. Additionally, the course touches upon emerging trends, providing insights into the future landscape of software development.

Textbook/Recommended Readings

- Data Structure

Reference Books/ Other Supplementary Readings

- Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" is a book written by Narasimha Karumanchi.
- Data Structures (SIE) Paperback – January 1, 2014
- https://www.geeksforgeeks.org/data-structures/

Course Code: SE 236		CIE Marks: 60
ISCED: 0613-236		SEE Marks: 40
Course Title: Desktop & Web Programming Lab		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1 (Lab)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

The goal of this course is to introduce the students about the concept of Database principles. The main objectives of this course are,

- To learn basic concepts of database
- To learn database language
- To learn various database tools
- To implement SQL programming through a variety of database problems.
- To Develop database applications using front-end tools and back-end DBMS.

Course Content

Setting up the development environment for Java, Basic Java syntax, and programming concepts, Hands-on exercises on variables, data types, and operators, Control structures in Java (loops and conditionals), Object-Oriented Programming (OOP) principles in Java. Implementing classes, objects, inheritance, and polymorphism in Java, Creating a basic HTML5 webpage, Introduction to CSS3 and styling web content, Building basic web pages using HTML and CSS, Fundamentals of JavaScript language, Manipulating the Document Object Model (DOM). Basic JavaScript functions and events handling, Introduction to a frontend framework (React, Angular, or Vue.js), Hands-on development using the selected framework, Implementing state management and component-based architecture, Server-side scripting with Node.js, Python, or PHP, Integrating databases (SQL, NoSQL) in backend development, Creating RESTful APIs for web applications, Identifying and mitigating common security threats, Implementation of security measures (authentication, encryption), Hands-on exercises on secure coding practices and avoiding vulnerabilities, Introduction to desktop application frameworks (JavaFX, .NET), GUI design principles and local data management, Project management, version control, and collaborative development practices

Course Code: SE 223		CIE Marks: 60
ISCED: 0613-223		SEE Marks: 40
Course Title: Database System		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

The main objectives of this course are, to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS. More specifically,

- To learn the basic concepts of databases.
- To learn the relational model.
- To learn database design.
- To learn transactions of data in a database.
- To learn the concepts and techniques for developing databases using database language.
- To learn normalization concept to reduce anomalies in database
- To learn the basic concept of a relational database.

Course Content

Databases and Database Users: Introduction - An Example, Characteristics of the Database Approach, Advantages of Using the DBMS Approach. Database System Concepts and Architecture: Data Models, Schemas and Instances. Three- Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architectures for DBMSs. Entity-Relationship (ER) Model :Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database - ER Diagrams, Naming Conventions, and Design Issues The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory. SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL INSERT, DELETE, and UPDATE Statements in SQL, Views (Virtual Tables) in SQL. Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Concurrency Control Techniques: Two-Phase Locking Techniques for Concurrency Control.

Textbook/Recommended Readings

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006

Reference Books/ Other Supplementary Readings

- Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003
- C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eight Edition, Pearson 2006
- P Raja Sekhar Reddy, A MallikarjunaReddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 (e-Book)
- https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html
- https://www.geeksforgeeks.org/data-structures/

Course Code: SE 224		
ISCED: 0613-224		
Course Title: Database Systems Lab		Total Marks: 100
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: N/A		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

The goal of this course is to introduce the students to the concept of database principles in practice. The main objectives of this course are,

- To learn the implementation of the basic concept of a database.
- To learn database language.
- To learn various database tools.
- To implement SQL programming through a variety of database problems.
- To Develop database applications using front-end tools and back-end DBMS.

Course Content

The "Database Systems Lab" course provides students with a comprehensive exploration of fundamental introduction to DBMS, Purpose of DBMS, Relational Model, Data Abstraction, Database Architecture, Keys, ER Model, ER Model Scenario and ER Model, Relational Schema, ER Model to Schema Practice Example, Relational Algebra, Basic SQL Queries, Join Operation, More SQL Queries, Sub-queries in DBMS, Different Operation on Table, Stored Procedure and Views, Transaction, More about Transaction, Trigger, Normalization, Join Operation etc.

Textbook/Recommended Readings

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill.

Reference Books/ Other Supplementary Readings

- Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.
- C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eighth Edition Pearson 2006
- P Raja Sekhar Reddy, A MallikarjunaReddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 (e-Book)
- https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

Course Code: SE 232		
ISCED: 0613-232		
Course Title: Operating System and System Program		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE222		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Software Engineering. More specifically,

- To explore the processes and threads roles, states, components, scheduling, and concurrency of the modern operating system.
- To demonstrate the process scheduler.
- To explain and analyze the concurrency problem including synchronization, mutual exclusion, deadlock and starvation.
- To explain and solve problems on memory management (primary and secondary) and virtual memory management systems and file management systems.

Course Content

This course introduces modern operating systems. It focuses on UNIX-based operating systems, though alternative operating systems, including Windows, are introduced. This course begins with an overview of the structure of modern operating systems. Throughout the subsequent units, discuss the history of modern computers, analyze in detail each of the major components of an operating system (from processes to threads), and explore more advanced topics in the field, including concurrency (synchronization, mutual exclusion, deadlock, starvation), memory (both primary and secondary) management and input/output file management and organization (segmentation, paging, swapping), file systems, and operating system support for distributed systems. Different CPU scheduling algorithms and disk scheduling algorithms have also been discussed in detail.

Textbook/Recommended Readings

- Operating Systems: Internals and Design Principles" William Stallings 9th Edition, Prentice Hall, 2015

Reference Books/ Other Supplementary Readings

- Silberschatz, Galvin, Gagne: Operating System Concepts, 10th Edition, Wiley
- Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall

Course Code: SE 233		
ISCED: 0613-233		
Course Title: Operating System & System Programming Lab		Total Marks: 100
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: SE 233		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Lab		
Level: 2	Term: 2	

Course Objectives

The goal of this course is to introduce the students to the concept of command based UNIX operating system in practical terms. The main objectives of this course are,

- To operate the UNIX command line to explore open-source software under GNU/Linux Operating System.
- To write basic code on Shell Script and controlling processes and threads in Modern OS. Write code for handling process concurrency mechanisms such as Mutual Exclusion, Synchronization, Deadlock and Starvation using semaphore (GNU/Linux POSIX API).
- To implement Algorithm implementation using shell scripting programming.

Course Content

This course introduces the tools used to develop modern operating systems (OS). The focus of this course is UNIX-based operating systems, though alternative operating systems, including MS Windows are introduced. This course is divided into two parts. The first part is about the GNU/Linux command line interface to operate basic operations .The second parts are about the GNU/Linux application programming interface. In this part the creation and control of processes and threads are practiced. The cooperative process resource share management system and some advanced topics in the field of process scheduling, concurrency (synchronization, mutual exclusion, deadlock, and starvation), memory (both primary and secondary) management and input/output file organization are practiced.

Textbook/Recommended Readings

- Richard Blum , Christine Bresnahan, Linux Command Line and Shell Scripting Bible, Wiley; 3rd edition (2015), ISBN-13: 978-1118983843

Reference Books/ Other Supplementary Readings

- M. Tim Jones, GNU/Linux Application Programming, Charles River Media; 2nd edition (2008), ISBN-13: 978-1584505686
- Example Link: https://www.tutorialspoint.com/unix/unix-what-is- shell.html
- Online Tool: https://repl.it/languages/bash

Course Code: GE 235		
ISCED: 0613-235		
Course Title: Principles of Accounting, Business and Economics		Total Marks: 100
Semester: Spring 2024		
Credit: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Guided Elective		
Level: 2	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of artificial intelligence. More specifically,

- To learn the basic concept of the accounting cycle, analysis, and recording of transactions.
- To learn about reporting financial information in accordance with Generally Accepted Accounting Principles (GAAP)
- To learn basic concepts of Business activities and different forms of Business.
- To learn fundamental concepts of economics and the theory of demand & supply are also included in this course. Students will be exposed to real-life scenarios by analyzing the financial statements of different companies in Bangladesh.

Course Content

Clear Concept of Accounting in action, Accounting Equation and effects of Transaction Analysis and preparing the Financial Statement, Recording Process (Journal, Ledger and Trial Balance), Adjusting the accounts, Completing the accounting cycle with the worksheet, case study, study on Financial report of a company, Foundation of Business, Barter Theory, Factors and Resources of Business, Proprietorship, Partnership, and Corporate Business, Basic concept of Economics, Micro and Macro Economics, Production Possibility Frontier, Factors of Production, Statements, Demand and Supply Curve with the schedule, Factor affecting on Demand and Supply, Law of Demand, Movement of the curve, Market Equilibrium.

Textbook/Recommended Readings

- Accounting Principles by J.J.Weygandt, D.E.Kieso and Paul D. Kimmel, 13th Edition, 2018

Reference Books/ Other Supplementary Readings

- Introduction to Business- How Companies Create Value for People by Gareth R. Jones, Latest Edition, Tata Mcgaw-Hill.
- Microeconomics 11th Edition, MICHAEL PARKIN.

Course Code: SE 532		CIE Marks: 60
ISCED: 0612-532		SEE Marks: 40
Course Title: Introduction to Robotics		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: SE 213		
Course Type: Core		
Level: 2	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Computer Architecture, More specifically,

- To learn the basics of Robotics and Robots.
- Demonstrate critical thinking and problem-solving using mechatronics.
- Develop Robotics programming and programming using MCUs.
- Design robotics solutions through complex programming and assembling of modules.
- Apply special tools, techniques and simulations in Robotics.

Course Content

This course includes definition of Robot, Types of Robots (manipulator, legged robot, wheeled robot, autonomous underwater vehicles), Use of Robots, Asimov's laws of Robotics, History of Robotics, Key components of Robot, Sensors: Introduction, working principles and use of sensors (vision, force, LDR, temperature, smoke, accelerometer gyroscope, laser, tilt, compass, PIR, Infrared, etc.), Actuators and different actuators (DC motor, servo motor, stepper motor, etc.) working principles and usage, Robot programming with AD conversion and interfacing different hardware, sensors, etc, Control theory of robotics; Obstacle avoidance, object tracking, and motion control, etc; Advance Robotic control and operations.

Textbook/Recommended Readings

- Introduction to Robotics: Mechanics and Control (3rd Edition) by John J. Craig

Reference Books/ Other Supplementary Readings

- Modern Robotics. Mechanics, Planning and Control. Kevin M. Lynch and Frank C. Park. May 3, 2017

Semester 5 (3rd Year 1st Semester)

Course Code: SE 225		
ISCED: 0612-225		
Course Title: Data Communication and Computer Networking		Total Marks: 100
Semester: Spring 2024		
Credit: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Guided Elective		
Level: 3	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of artificial intelligence. More specifically,

- To learn the basic concept of the accounting cycle, analysis, and recording of transactions.
- To learn about reporting financial information in accordance with Generally Accepted Accounting Principles (GAAP)
- To learn basic concepts of Business activities and different forms of Business.
- To learn fundamental concepts of economics and the theory of demand & supply are also included in this course. Students will be exposed to real-life scenarios by analyzing the financial statements of different companies in Bangladesh.

Course Content

Clear Concept of Accounting in action, Accounting Equation and effects of Transaction Analysis and preparing the Financial Statement, Recording Process (Journal, Ledger and Trial Balance), Adjusting the accounts, Completing the accounting cycle with the worksheet, case study, study on Financial report of a company, Foundation of Business, Barter Theory, Factors and Resources of Business, Proprietorship, Partnership, and Corporate Business, Basic concept of Economics, Micro and Macro Economics, Production Possibility Frontier, Factors of Production, Statements, Demand and Supply Curve with the schedule, Factor affecting on Demand and Supply, Law of Demand, Movement of the curve, Market Equilibrium.

Textbook/Recommended Readings

- Accounting Principles by J.J.Weygandt, D.E.Kieso and Paul D. Kimmel, 13th Edition, 2018

Reference Books/ Other Supplementary Readings

- Introduction to Business- How Companies Create Value for People by Gareth R. Jones, Latest Edition, Tata Mcgaw-Hill. Microeconomics 11th Edition, MICHAEL PARKIN.

Course Code: SE 226		
ISCED: 0612-225		
Course Title: Data Communication and Computer Networking Lab		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1 (Lab)		
Prerequisite: SE225		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

The goal of this course is to provide the students about the introductory concepts and technologies in networking. The main objectives of this course are,

- To familiarize students with some of the standard networking tools, devices, software and operating systems used to build modern day network infrastructures.
- To be able to explain, configure, verify and troubleshoot complex computer networks problem.
- To configure network router and switches so that both LAN and WAN traffic successfully traverses the network.

Course Content

Overview of Networks and layered communications, understanding of Network equipment, wiring in details, CAT6 UTP EIA/TIA 568A/B straight and cross-over wiring, testing, Overview of IP Addressing and sub-netting, static IP setting on Linux machine (Ubuntu) / Windows and testing, IP address and Packet Tracer, Creation of a LAN and connectivity test in the LAN, creation of VLAN and VLAN trunking, Basic concepts of Router Configuration -Static Routing Implementation, Implementation of Dynamic Routing (RIP, OSPF, BGP), Router Configuration using CLI, Firewall Implementation, Router Access Control List (ACL), Packet capture and header analysis by Wireshark (TCP,UDP,IP), Basic Frame Relay Implementation with PVC, DNS, Web, DHCP, FTP server configuration.

Textbook/Recommended Readings

- Data Structures: A Pseudocode Approach with C, 2nd Edition, by Richard F. Gilberg(Author), Behrouz A. Forouzan (Author)

Course Code: SE 231		
ISCED: 0613-231		
Course Title: System Analysis & Design Capstone Project		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Lab)		
Prerequisite: SE212		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

This course aims to equip students with skills in project planning, user requirement elicitation and specification, graphical modeling of objects, data, and processes, and the design of UML diagrams, user interfaces, and relational databases. The primary objectives are as follows:

- Application of software engineering knowledge in a practical project setting.
- Designing software through the analysis of requirements.
- Creating normalized databases on a large scale, meeting practical requirements.

Course Content

The "System Analysis and Design" course provides students with a comprehensive exploration of fundamental concepts in system analysis and design, emphasizing practical applications. Beginning with foundational topics such as planning, proposal development, and feature listing, the course progresses to delve into use case design, UI principles, and prototyping. Students then navigate the intricacies of databases, including RDBMS, design principles, and normalization. Subsequent weeks involve visualizing system processes through Activity and Sequence Diagrams, with a focus on implementing the MVC architecture. The course culminates in a semester-long group project, where students apply their knowledge to analyze, design, and implement a system, fostering a hands-on understanding.

Textbook/Recommended Readings

- System Analysis and Design by Dennis, Wixom, and Roth

Reference Books/ Other Supplementary Readings

- System Analysis and Design by Scott Tilley

Course Code: SE 234		
ISCED: 0613-234		
Course Title: Theory of Computing		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data Structure, More specifically,

- To learn the basic concepts of Finite Automata.
- To understand different types of finite automata and their design approaches.
- To learn regular expressions and its conversion to Regular Language and finite automata.
- To learn context free grammar and its construction techniques.
- To learn Turing machine and its basics

Course Content

Basics of finite automata, Finite automata Identification and Computation, Deterministic Finite Automata (DFA), Non-deterministic finite automata (NFA), NFA to DFA conversion (subset construction method), Regular expressions (RE) Basics, RE to Regular language and Regular language to RE, RE to Finite Automata, DFA to RE, Context free grammar (CFG) Basics, CFG construction, Turing machine (TM).

Textbook/Recommended Readings

- Introduction to the Theory of. Computation" by Michael Sipser, Third Edition.

Reference Books/ Other Supplementary Readings

- "Elements of the theory of computation" by Harry R. Lewis and. Christos H. Papadimitriou, 2nd edition.

Course Code: SE 311		CIE Marks: 60
IISCED: 0613-311		SEE Marks: 40
Course Title: Design Pattern		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: SE 221		
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

The goal of this course is to introduce the students to the concept of modern operating system principles. The main objectives of this course are,

- To Recognize the inherent and accidental complexities involved with developing object-oriented software.
- To Understand how pattern-oriented software architecture techniques can and cannot help to alleviate this complexity.
- To Apply key pattern-oriented software architecture techniques to develop reusable object-oriented software infrastructure and apps.
- To Utilize Java programming language features and libraries to object-oriented software.

Course Content

The four pillars of object-oriented programming – Abstraction, Encapsulation, Inheritance, Polymorphism. Abstract class and interface. Definition of Refactoring and Code Smells. Different types of code smells and refactoring techniques. Use of different refactoring techniques for different purposes. Introduction to Design Patterns. Definition and classification of design patterns. Definition, Use Case, Code examples of Creational Patterns – Singleton, Factory Method, Abstract Factory, Prototype, Builder. Definition, Use Case, Code examples of Creational Patterns – Adapter Pattern, Bridge Pattern, Composite Pattern, Decorator Pattern, Facade Pattern, Flyweight Pattern, Proxy Pattern. Definition, Use Case, Code examples of Creational Patterns – Chain of Responsibility Pattern, Command Pattern, Interpreter Pattern, Iterator Pattern, Mediato
r Pattern, Memento Pattern, Observer Pattern, State Pattern, Strategy Pattern, Template Pattern, Visitor Pattern. Design principles (SOLID)- Single Responsibility Principle, Open Close Principle, Liskov Substitution Principle, Interface Segregation Principle, Dependency Inversion Principle.

Textbook/Recommended Readings

- Design Pattern – Elements of Reusable Object-Oriented Software by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides.

Reference Books/ Other Supplementary Readings

1. https://refactoring.guru/design-patterns
2. https://www.tutorialspoint.com/design_pattern/design_pattern_overview.html\

Course Code: SE 312		CIE Marks: 60
ISCED: 0613-312		SEE Marks: 40
Course Title: Software Quality Assurance & Testing		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: SE 212, SE 221		
Course Type: Core		
Level: 3	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the Software Quality Assurance & Testing, more specifically,

- To learn the basic concepts of Software Quality Assurance & Testing.
- To learn different lifecycle models and explain the role of testing in the entire life cycle of a software system.
- To learn many techniques of Black Box Testing and White box testing.
- To learn about test management.
- To learn the concepts and techniques in error detection

Course Content

Fundamentals of Testing, testing terminology, necessities of testing, Verification, validation, Testing Principles, The Psychology of Software Testing, Testing throughout Software Life Cycle, Software Development Model, V Model, Test Levels, Test Types, Black Box Testing, Basics on black box testing, types of black box testing, Boundary Value Analysis, Equivalence Partitioning, Decision Table based Testing, State Transition based Testing, Use Case Testing , Test Planning & Documentation, Analyze the product, Design the Test Strategy, Define the Test Objectives, Define Test Criteria, Resource Planning, Plan Test Environment, Schedule & Estimation, Determine Test Deliverables, Test Case design, Test report, White box testing, Basic Path Testing, Cyclomatic complexity, Statement coverage, Branch coverage, Condition Coverage, Path Coverage, Bug Life Cycle, Capability Maturity Model, Capability Maturity Model Integration, Quality Metrics, Mutation Testing, Decision mutations, Mutation Testing, value mutations, Statement mutations, Test tools, Types of Test Tools, Selection of test tools.

Textbook/Recommended Readings

- Naresh Chauhan, Software Testing: Principles and Practices. 2nd Edition, Oxford University Press. 2010

Reference Books/ Other Supplementary Readings

1. Glenford J. Myers, Corey Sandler, and Tom Badgett. The Art of Software Testing, 3rd Edition, John Wiley & Sons. 2012
2. https://www.youtube.com/results?search_query=software+testing

Course Code: SE 313		
ISCED: 0613-313		
Course Title: Software Quality Assurance & Testing Lab		Total Marks: 100
Semester: Spring 2024		
Credit: 1 (Lab)		
Prerequisite: N/A		Contact Hours: 1 hour 15 minutes (18 weeks)
Course Type: Core		
Level: 3	Term: 1	

Course Objectives

The goal of this course is to introduce the students about the concept of software testing. The main objectives of this course are,

- To learn various testing techniques
- To develop skills to apply appropriate testing knowledge in problem-solving

Course Content

The syllabus of the course has been divided into four core sections. These are propositional & predicate logic, set theory & probability, function & relation, and graph theory & binary three. These four sections have been expanded with necessary subsections. The propositional & predicate logic starts with a simple and compound logical statement. After that, with the discussion and application of logical connectives and the truth table, the students learn to apply the concept to solve relevant problems. The set theory and probability contain the basic terminologies, sample space formation, and probability concepts in appropriate contexts. The function and relation section introduces different types of functions, their scope of application, and the comparison between function and relation. Finally, graph theory and binary three cover the terminologies of graph theory, different types of graphs, and the essentials of the binary tree.

Textbook/Recommended Readings

- Naresh Chauhan, Software Testing: Principles and Practices. 2nd Edition, OxfordUniversity Press. 2010

Reference Books/ Other Supplementary Readings

- Glenford J. Myers, Corey Sandler, and Tom Badgett. The Art of Software Testing, 3rd Edition, John Wiley & Sons. 2012

Course Code: GE 324		
ISCED: 0613-324		
Course Title: Business Analysis & Communication		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Business Analysis and Communication More specifically,

- To describe the basic concepts of Business Analysis and Communication
- To apply the components of Business Analysis and Communication
- To cretic Business Analysis and Communication components and case
- To compose Business Analysis and Communication tools for use.

Course Content

Introduction to Business Analysis (BA), BA Practices and uses, Business analysis Vs Business Analytics, DIKW model, Sources of data , Understanding problem and symptom, Business analysis techniques, Requirement, SMART Technique for writing Requirements, Requirement management, Requirement Implementation, Stakeholders, Managing Stakeholders, Communication & Business Communication, Written Communication, Non verbal communication, Office memos, face to face communication, types of report, Types of Letters, CV.

Textbook/Recommended Readings

- Business Analysis 4th ed. Edition by Debra Paul
- Communication for Business, Shirley Taylor,4th Edition

Reference Books/ Other Supplementary Readings

- Lesikar’s Business Communication, 12th edition

Course Code: SE 321		
ISCED: 0613-321		
Course Title: Software Engineering Web Application		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE 121, SE 122		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 1	

Course Objectives

To introduce different technologies that are used for building complex web applications for solving real world problems. The main objectives of this course are:

- To understand the working principles of rendering a website from the internet.
- To be able to design web applications using different frontend technologies based on the use requirements.
- To grow expertise in creating interactive components in web pages for better user experience.
- To learn techniques and technologies for developing dynamic web applications that meet the requirement specifications.

Course Content

Software Engineering Web Application; History of Internet and Web; Protocols; Domain Name and URL; Attributes & Categories of Web Application; Anatomy of Web Page and URL; Overview of HTTP; Persistent and Non-Persistent HTTP; Response Time Modeling; HTTP GET & POST Request; HTTP Methods, Response Code; User-Server Interaction; Introduction to HTML; Basic structure of HTML; Tag and Attribute in HTML; Examples and usage of various HTML Elements; HTML Forms; Types of HTML Elements; Introduction to CSS; Adding CSS in HTML; Basic CSS Syntax; Common CSS Properties; Generic Containers - Div and Span; Advance Selectors; Colliding Styles and !important exceptions; CSS Box Model; CSS Layout; Box-Sizing Properties; Responsive Web Design; Rendering Mode: Flexbox, Position; CSS Variables, Web Fonts; Mobile Web; Getting started with Bootstrap; Basic Grid and Columns in Bootstrap; Using Common Components in Bootstrap; Introduction to JavaScript; Basic JavaScript Syntax; JavaScript DOM; Introduction to PHP; Basic PHP Syntax; Object Oriented PHP; Declaring Classes Properties and Methods in PHP; Inheritance, Abstract Class and Interface in PHP; Method Chaining in PHP; Database Connection and CRUD operations using PHP; Introduction to MVC Framework; CRUD operations using Laravel framework; Introduction to NoSQL Database; Using Firebase as a Database Server; Connecting and Operating with Firebase using Laravel.

Textbook/Recommended Readings

- “Web Engineering: The Discipline of Systematic Development of Web Applications” by Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzegger, 1st Edition, 2006

Reference Books/ Other Supplementary Readings

- “Learning PHP, MySQL & JavaScript with jQuery, CSS & HTML5” by Robin Nixon, 5th edition, 2018.

Course Code: SE 322		
ISCED: 0613-322		
Course Title: Software Engineering Web Application		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE 121, SE 122		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 1	

Course Objectives

To introduce different technologies that are used for building complex web applications for solving real world problems. The main objectives of this course are:

- To understand the working principles of rendering a website from the internet.
- To be able to design web applications using different frontend technologies based on the use requirements.
- To grow expertise in creating interactive components in web pages for better user experience.
- To learn techniques and technologies for developing dynamic web applications that meet the requirement specifications.

Course Content

Software Engineering Web Application; History of Internet and Web; Protocols; Domain Name and URL; Attributes & Categories of Web Application; Anatomy of Web Page and URL; Overview of HTTP; Persistent and Non-Persistent HTTP; Response Time Modeling; HTTP GET & POST Request; HTTP Methods, Response Code; User-Server Interaction; Introduction to HTML; Basic structure of HTML; Tag and Attribute in HTML; Examples and usage of various HTML Elements; HTML Forms; Types of HTML Elements; Introduction to CSS; Adding CSS in HTML; Basic CSS Syntax; Common CSS Properties; Generic Containers - Div and Span; Advance Selectors; Colliding Styles and !important exceptions; CSS Box Model; CSS Layout; Box-Sizing Properties; Responsive Web Design; Rendering Mode: Flexbox, Position; CSS Variables, Web Fonts; Mobile Web; Getting started with Bootstrap; Basic Grid and Columns in Bootstrap; Using Common Components in Bootstrap; Introduction to JavaScript; Basic JavaScript Syntax; JavaScript DOM; Introduction to PHP; Basic PHP Syntax; Object Oriented PHP; Declaring Classes Properties and Methods in PHP; Inheritance, Abstract Class and Interface in PHP; Method Chaining in PHP; Database Connection and CRUD operations using PHP; Introduction to MVC Framework; CRUD operations using Laravel framework; Introduction to NoSQL Database; Using Firebase as a Database Server; Connecting and Operating with Firebase using Laravel;

Textbook/Recommended Readings

- “Web Engineering: The Discipline of Systematic Development of Web Applications” by Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzegger, 1st Edition, 2006

Reference Books/ Other Supplementary Readings

- “Learning PHP, MySQL & JavaScript with jQuery, CSS & HTML5” by Robin Nixon, 5th edition, 2018.

Course Code: SE 323		
ISCED: 0613-323		
Course Title: Software Architecture & Design		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE 212, SE 221, SE223, SE311		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically, to learn

- To learn the basic concepts of software architecture..
- To learn different architecture models and explain their importance.
- To learn many approaches to gathering requirements from users and designing with proper documents.
- To learn how to design an architecture for a software.
- To learn the quality attributes and tradeoff analysis of a software architecture.

Course Content

Software Architecture Introduction, Architecture Overview and Process, Architectural Structures and Views, The 4+1 View Model of Architecture, Layered Architecture, Broker Architecture, Monolithic Architecture, Microservices Architecture, Architecture Evaluation, S.O.L.I.D. Principles, Architecture Trade-off Analysis Method (ATAM) Understanding Quality Attributes, Availability, Performance, Usability, Modifiability.

Textbook/Recommended Readings

- Software Architecture in Practice Third Edition" by Len Bass, Paul Clements, Rick Kazman, Addison-Wesley

Reference Books/ Other Supplementary Readings

- Sommerville, Ian. Software engineering. Addison-Wesley/Pearson, 2011.
- Software Architecture: Foundations, theory and practice. 1st Edition. Richard N. Taylor,

Course Code: SE 332		
ISCED: 0613-332		
Course Title: Information System Security		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: NA		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically,

- Demonstrate the basic security concept in information systems and explain the measures of securing the software development life cycle.
- Illustrate the 10 common vulnerabilities in web applications due to bad design and understand how such weaknesses can be mitigated using current best practices.
- Demonstrate the classifications of malware and explain the countermeasures to hinder them.
- Apply the principles of classic and modern cryptography and use it to secure the system.
- Analyze the key management, message authentication and hash function.
- Construct the digital signature and authentication protocol.

Course Content

Information security concept, secured software development life cycle (secSDLC), secured web application design solution, threats and defense mechanisms on current web application, the classifications of malware and its prevention. Classic Cryptographic algorithm that includes Caesar Cipher, One Time Pad, Transposition, Playfair, and hill cipher. Feistel Network, Data Encryption Standard, Advanced Encryption Standard, Public Key CryptoSystem, RSA, Key management- Diffie-Hellman, Elliptic Curve, etc..Digital Signature, authentication protocol.

Textbook/Recommended Readings

- “Cryptography & Network Security” by William Stallings, Prentice Hall, 2005.

Reference Books/ Other Supplementary Readings

- Cryptography” by Buchanan, W., CRC Press, 2022.

Course Code: SE 411		
ISCED: 0613-411		
Course Title: Software Project Management & Documentation		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE312		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

The goal of this Project Management and Documentation course is to provide the concept of modern information systems for different levels of management in business organizations. The main objectives of this course are,

- To make students understand the requirements and the contents of project management.
- To make students understand the role of the manager in each phase of the software development life cycle.
- To make students capable of writing a plan for a project according to an established standard.
- To make students capable of using current Software Project Management (SPM) tools and develop new SPM ideas.
- To grow capability among students to work in a team environment and be aware of different modes of communications

Course Content

Introduction to Software Project Management, understanding of the profession of project manager. Project Scope, Schedule and Budget Management. Quality issues in project, Resources, Risk and Communication Management, Network Diagram, Gantt Chart, Project Budget, PERT analysis, Quality tools-Six Sigma, Quality Plan & Quality documents, Procurement management Process. DevOps, Documentation Management Process, Documentation Communication, Risk Identification, Risk Communication, Finally project Communication, Stakeholder and integration of a project.

Textbook/Recommended Readings

- Kathy Schwalbe, Information Technology Project Management, Cengage Learning, Inc. 2016

Reference Books/ Other Supplementary Readings

- Scott Berkun, Making Things Happen: Mastering Project Management, 2020
- Peter Taylor, The Lazy Project Manager: How to be twice as productive and still leave the office early, 2010
- You Tube: https://www.youtube.com/watch?v=uWPIsaYpY7U
- Website slide link: https://www.udemy.com/course/earned-value-management-technique-with-examples/

Course Code: SE 333		
ISCED: 0613-333		
Course Title: Artificial intelligence		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: SE 214, SE 234		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of artificial intelligence. More specifically,

- Understand the foundational principles of Artificial Intelligence (AI) and its components.
- Explore search algorithms, both informed and uninformed, and gain proficiency in adversarial search techniques.
- Master logical sentence formation, compound statements, and inference algorithms, including resolution and Bayesian networks.
- Acquire knowledge in optimization algorithms, machine learning, and neural networks, with a focus on practical applications.
- Develop expertise in natural language processing, covering syntax, semantics, and text categorization, while evaluating the performance and addressing limitations of NLP projects.

Course Content

Introduction to AI, Components of AI, Agents, Environments, and Fundamental Challenges of AI, Limitation of Electronic Systems, The Concept of Human Complex, Human Perception to Logical Sentence Conversion, Terminologies related to AI, and Forming the based idea of Search Algorithms, Working Principle for Informed Search Algorithms: BFS, and DFS. Working Principle of Uninformed Search Algorithms: GBFs, A* Search. Introduction to Adversarial Search Algorithm & Designing Simple AI Game Logic, Forming Logical Sentences, Compound Statements using Logical Connectives, and Statement Modeling. Inference Algorithm, and Knowledge Engineering. Inference through Resolution, Bayesian Networks. Approximate Inference. Markov Assumption, Markov Chain, Markov Hidden Models, and Sensor Model. Concept of Optimization, and Formation of the State Space Landscape, AI Optimization Algorithm Design. Different Existing Optimization Algorithms, and Their Applications.Mathematical Background of Machine Learning. Learning Algorithm Formation, and Optimization. Single Layer Neural Network, Deep Neural Network, Activation Functions, Backpropagation Algorithm, Handling Overfitting, and Underfitting, Different Optimization Algorithms. Convolutional Neural Networks. Syntax & Semantics, Formal Grammar to Context Free Grammar, Tokenization, Markov Model. Text Categorization, Naïve Bayes, Smoothing (Additive, Laplace), Topic Modeling. Word Vector Formation, Training Neural Network for NLP, Evaluating the Performance of the Trained Model, Exploring the Limitations of the NLP Project.

Textbook/Recommended Readings

- Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig.

Reference Books/ Other Supplementary Readings

- Developing Intelligent Agent Systems: A Practical Guide by Lin Padgham, Michael Winikoff,
- Intelligent Agent Technology by Ahmed Elmahalawy.
- Harvard CS50: Artificial Intelligence with Python

Course Code: SE 334		CIE Marks: 60
ISCED: 0613-334		SEE Marks: 40
Course Title: Introduction to Machine Learning		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1 (Lab)		Contact Hours: 1 hour 15 minutes (18 weeks)
Prerequisite: N/A		
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

The goal of this course is to guide the students to develop the skill sets necessary to implement AI algorithms. The main objectives of this course are:

- Be able to apply the concept of basic object-oriented programming using Python.
- Developing the skillset to think algorithmically and plan solutions using AI algorithms.
- Gaining the capability of implementing AI algorithms using python.
- Understanding the application domain of AI to solve real-world problems.
- Be able to design, implement and present AI-based solutions.

Course Content

The "Artificial Intelligence Lab" course provides students with a comprehensive exploration of Basic Python Programming, Implementation of Search Algorithms, Knowledge Representation using Propositional Statements, Dealing with Uncertainty, Optimization Algorithms Implementation, Machine Learning Coding, Implementation of Neural Network, and Natural Language Processing.

Textbook/Recommended Readings

- Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig

Reference Books/ Other Supplementary Readings

- Human Compatible: Artificial Intelligence and the Problem of Control by Stuart J. Russell
- https://cs50.harvard.edu/ai/2024/

Course Code: SE 544		Total Marks: 100

ISCED: 0613-544		
Course Title: Introduction to Machine Learning		
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: MAT 101, MAT 102, STA 101, SE 121		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 3	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Machine Learning. More specifically,

- To be taught about the basic concepts of machine learning techniques such as its types, fundamental challenges, and applications.
- To be taught about the theories of supervised and unsupervised machine learning algorithms so that they can apply them in real world scenarios.
- To evaluate and interpret machine learning models properly to the stakeholders.
- To discover any potential biases, misinterpretations, and ethical or fairness concerns of machine learning models.

Course Content

Definitions, Types, K-Nearest Neighbor, Euclidean Distance, Manhattan Distance, Differentiation, Partial Differentiation, Gradient Descent, Hypothesis Function, Loss Function, Learning Rate, Learning Rate Scheduling, Early Stopping, Stochastic Gradient Descent, Batch Gradient Descent, Mini-Batch Gradient Descent, Simple Linear Regression, Multiple Linear Regression, Logistic Regression, Binary Log-Loss Function, Polynomial Regression, Overfitting And Underfitting, Bias-Variance Trade Offs, Regularization Methods, Ridge Regression, Lasso Regression, Elastic Net, Ensemble Learning: Voting, Bagging, Pasting, Random Patches, Random Subspaces, Random Forest, Boosting, and Stacking, Model Selection: Hyperparameter Tuning, Grid Search, Random Search and Cross-Validation, Model Evaluation: Bootstrapping, Mean Absolute Error, Mean Square Error, Root Mean Square Error, Confusion Matrix, Type I Error, Type II Error, Accuracy, Precision, Recall, Sensitivity, Specificity, True Positive Rate, False Positive Rate, AUC-ROC, Precision-Recall Curve, Feature Engineering: Normalization, Standardization, and Augmentation, K-Means Clustering, Agglomerative Clustering, Single Linkage, Complete Linkage, Average Linkage, DBSCAN, Dimensionality Reduction: PCA and t-SNE.

Textbook/Recommended Readings

- “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow” by Aurélien Géron, 2nd Edition, 2019

Reference Books/ Other Supplementary Readings

- Deep Learning” by Ian Goodfellow, and Yoshua Bengio, and Aaron Courville, Final Edition, 2016.

Course Code: DS 331		
ISCED: 0613-331		Total Marks: 100

Course Title: Introduction to Data Science and Data Management & Analysis		
Semester: Spring 2024		
Credit Value: 2 (Theory)		
Prerequisite: SE 121, STAT 101		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

The goal of this course is to introduce the students about the concept of Data Science. The main objectives of this course are-

- To Learn the introduction of data science.
- To Learn and understand the data engineering tools.
- To learn and demonstrate data visualization and algorithm.
- To learn and apply data science methodology and understand the ETL.

Course Content

Intro To Data Science, Learn about data science engineer and data analyst, Learn the difference among data science engineer and data analyst, Old problems, new problems, Data Science solutions, Applications of Data Science, Data Science Real life problems and solutions, Applications of Machine Learning, Introduction Languages of Data Science. Introduction to Python, Python Libraries for Data Science, Introduction to Jupyter Notebook, Open-Source Tools for Data Science, Introduction to R and RStudio, Commercial Tools for Data Science, Data Sets - Powering Data Science, Analytic Approach, Data hb Requirements, Data Collection, Data Understanding, Data Preparation - Concepts, Introduction to Data Visualization, Data Visualization Tools, Data Ethics, Basic Statistics, Data Modeling- Case Study, Database and SQL for data science, ETL Process and architecture, Time series Forecasting, Business Understanding and Deployment.

Textbook/Recommended Readings

- A Hands-On Introduction to Data Science [Book by Chirag Shah]

Reference Books/ Other Supplementary Readings

- Introduction to Machine Learning with Python: A Guide for Data Scientists [Book by Andreas C. Müller and Sarah Guido]
- https://www.youtube.com/watch?v=N6BghzuFLIg

Course Code: SE 444		CIE Marks: 60
ISCED: 0613-444		SEE Marks: 40
Course Title: Data Warehouse and Data Mining		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 4	Term: 2	

Course Objectives

The goal of this course is to introduce the students about the concept of Data warehouse and Data Mining principles. The main objectives of this course are:

- Students will be taught about the necessity and the appropriate scenarios where warehouse and data mining are relevant and beneficial.
- Students will be taught about different components and architectures of data warehouse.
- Students will be taught to apply different data mining algorithms.
- Students will be taught to evaluate and interpret the results of data mining algorithms.

Course Content

Transactional Processing Vs. Decision Support Systems, Data Warehousing Fundamentals, Characteristics of Data Warehouse, Data Warehouse Architectures, Maturity Models, Potential Applications, OLTP, OLAP, Data Cubes, Fact Tables, Dimensions, Relational Models, Integrity Rules, Entity Relationship Diagrams, Modification Anomalies, Database Normalizations, Star Schema, Snowflake Schema, Constellation Schema, Time Representation, Types of Change, ETL, Naïve Bayes, Train-Test-Validation Set, Cross-Validation, Bootstrapping, Mean Square Error, Mean Absolute Error, Root Mean Square Error, Confusion Matrix, Accuracy, Precision, Recall, F1 Score, Association Rule Mining, Apriori Algorithm, Linear Regression, Logistic Regression, Decision Tree, K-Means Clustering, Agglomerative Clustering, Graph Theory, Graph Clustering.. Community Detection, Girvan Algorithm, Louvain Algorithm.

Textbook/Recommended Readings

- Database Design, Application Development, and Administration, by Michael Mannino, Sixth Edition, Chicago Business Press, 2015.

Reference Books/ Other Supplementary Readings

- Data Mining: Practical Machine Learning Tools and Techniques by Mark A. Hall, Ian H. Witten, Eibe Frank, Christopher Pal, Third Edition, Morgan Kaufmann. 2011.

Course Code: SE 447		Total Marks: 100

ISCED: 0613-447		
Course Title: Human Computer Interaction		
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 4	Term: 1	

Course Objectives

The goal of this course is to introduce the students about human-computer interaction and the design and evaluation of user interfaces. The main objectives of this course:

- To apply an interactive design process and universal design principles to designing HCI systems.
- To describe and use HCI design principles, standards and guidelines.
- To analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.
- To illustrate typical human–computer interaction (HCI) models and styles, as well as various historic HCI paradigms
- To analyze and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

Course Content

Foundations of Human Computer Interaction (Human Capabilities, Computer usability Interaction Paradigms), The Design Process (Interaction Design Basics, HCI in the Software Process, Design Rules, Universal Design), Implementation Support (Implementation Tools), Device Evaluation and User Support (Evaluation ,User Support), User-Centered Design (Participant Observation and User Personas, Low-Fidelity Prototyping, Usability Testing Computer Prototyping), Users Models (Cognitive Models, Socio-organizational Issues and Stakeholder Requirements), Task Models and Dialogs (Analyzing Tasks, Dialog Notations and Design), Groupware, Ubiquitous Computing, Virtual and Augmented Reality, Hypertext and Multimedia (Groupware and Computer-supported Collaborative Work, Ubiquitous Computing, Virtual Reality and Augmented Reality, Hypertext, Multimedia and the World Wide Web), Challenges and technologies (Perception and Visualization, Design and evaluation challenges), Interactions (Wearable and Mobile Interaction, UbiComp, Haptics), Physiological & Social Computing (Tangible and Gestural interfaces, Physiological Computing, Social Computing, Digital addiction), Behavioral Computing (Human persistency and actuator compliance).

Textbook/Recommended Readings

- “Human Computer Interaction”, by Dick, Finley, Aboad, Beale, Fourth Edition, 2004.

Reference Books/ Other Supplementary Readings

- “Human computer Interaction”, by. I. Scott Mackenzie, Fifth edition, 2012.

Course Code: RE331		
ISCED: 0714/331		
Course Title: Embedded Programming		Total Marks: 100

Semester: Spring 2024		
Credit Value: 2(Theory)		
Prerequisite: RE 331, RE 332		Contact Hours: 2.5 (Total weeks: 12)
Course Type: Major		
Level: 4	Term: 2	

Course Objectives

The objective of this course is to provide a solid conceptual understanding of the fundamentals of embedded programming. More specifically,

- To Introduce students to the fundamentals of embedded programming
- To familiarize students with low-level programming techniques for microcontrollers
- To provide an understanding of real-time operating systems and their application in embedded systems
- To develop skills in device driver development and hardware interfacing
- To equip students with debugging and testing strategies for embedded systems
- To explore power optimization techniques in embedded programming
- To introduce various communication protocols used in embedded systems
- To create awareness of security considerations in embedded programming
- To enhance practical skills through a project development component

Course Content

Introduction to Embedded Programming, Low-Level Programming for Embedded Systems, Real-Time Operating Systems (RTOS), Device Drivers and Hardware Interfacing, Debugging and Testing Techniques for Embedded Systems, Power Optimization Techniques in Embedded Programming, Communication Protocols for Embedded Systems, Embedded System Security, ROS, Important ROS Concepts, ROS Commands, Middleware and Simulation, Advanced ROS Concepts, Project Development, Compilers for Embedded systems, Dynamic voltage scaling, Dynamic power management, Interrupts, timers, and advanced features in microcontroller programming, Advanced motor control techniques, Overview of robotics middleware (e.g., Robot Middleware (RTM), DDS), Understanding control systems in robotics PID controllers and their applications, Trajectory planning and motion control, Hands-on projects on robot control systems, Sensors and actuators for robotics applications, Circuit design and analysis, prototyping circuits on breadboards and PCB's, Overview of Arduino platform, Arduino IDE and basic programming, GPIO programming with Arduino.

Course Code: RE 332		
ISCED: 0613-332		
Course Title: Embedded Programming Lab		Total Marks: 100

Semester: Spring 2024		
Credit Value: 1		
Prerequisite: SE 213, SE 121, SE 532		Contact Hours: 1.15 (Total 18 weeks)
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

The Objective of this Course is to provide a solid conceptual understanding of the fundamentals of embedded programming. More specifically,

- To Introduce students to the fundamentals of embedded programming
- To familiarize students with low-level programming techniques for microcontrollers
- To provide an understanding of real-time operating systems and their application in embedded systems
- To develop skills in device driver development and hardware interfacing
- To equip students with debugging and testing strategies for embedded systems
- To explore power optimization techniques in embedded programming
- To introduce various communication protocols used in embedded systems
- To create awareness of security considerations in embedded programming
- To enhance practical skills through a project development component

Course Content

Introduction to Arduino and ESP Microcontrollers, Programming with Arduino and ESP, Real-time Operating Systems (RTOS) Implementation, Hardware Description Languages (HDLs) and FPGA Programming, IoT Concepts and Applications with Arduino and ESP, Wireless Communication Protocols in Embedded Systems, Building a Wireless Sensor Network, ROS Introduction, ROS Setup, ROS setup and run, Integrating Arduino and ESP with ROS, Project Development.

Course Code: RE411		CIE Marks: 60
ISCED: 0714/411		SEE Marks: 40
Course Title: Embedded System Design and Development		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: RE331, RE332		
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

The Objective of the fundamentals of embedded programming is To provide a solid conceptual understanding. More specifically,

- To Introduce students to the fundamentals of embedded programming
- To familiarize students with low-level programming techniques for microcontrollers.
- To provide an understanding of real-time operating systems and their application in embedded systems.
- To develop skills in device driver development and hardware interfacing
- To equip students with debugging and testing strategies for embedded systems
- To explore power optimization techniques in embedded programming
- To Introduce various communication protocols used in embedded systems
- To create awareness of security considerations in embedded programming
- To enhance practical skills through a project development component

Course Content

Overview of Embedded Systems, Importance of Embedded Systems in various applications, Overview of robotics applications and industries, Introduction to Microcontrollers and Microprocessors, types, Understanding electronic components used in robotics, Sensors and actuators for robotics applications, Circuit design and analysis, prototyping circuits on breadboards and PCB's, Overview of Arduino platform, Arduino IDE and basic programming, GPIO programming with Arduino, Sensor interfacing with Arduino and ESP boards, analog electronics, digital electronics, tri-state outputs and logic gates, VLSI and Integrated circuit design, Electronic design Automation tools, Embedded Firmware, Understanding the kinematics of robotic systems, Task level concurrency management, High level optimizations (Loop tiling/blocking, loop splitting, Array folding), Compilers for Embedded systems, Dynamic voltage scaling, Dynamic power management, Interrupts, timers, and advanced features in microcontroller programming, Advanced motor control techniques, Overview of robotics middleware (e.g., Robot Middleware (RTM), DDS), Understanding control systems in robotics PID controllers and their applications, Trajectory planning and motion control, Hands-on projects on robot control systems.

Textbook/Recommended Readings

- A textbook on Embedded System Design for engineering students by Dr. Jaikaran Singh, Dr. Raghavendra S.

Reference Books/ Other Supplementary Readings

- Embedded System Design by Peter Marwedel

Course Code: RE412		CIE Marks: 60
ISCED: 0613-412		SEE Marks: 40
Course Title: Embedded System Design and Development Lab		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1		Contact Hours: 1.15 (Total 18 weeks)
Prerequisite: RE331, RE332		
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

The objective of this course is to provide a solid conceptual understanding of the fundamentals of embedded programming. More specifically,

- To Introduce students to the fundamentals of embedded programming
- To familiarize students with low-level programming techniques for microcontrollers.
- To provide an understanding of real-time operating systems and their application in embedded systems.
- To develop skills in device driver development and hardware interfacing
- To equip students with debugging and testing strategies for embedded systems
- To explore power optimization techniques in embedded programming
- To Introduce various communication protocols used in embedded systems
- To create awareness of security considerations in embedded programming
- To enhance practical skills through a project development component

Course Content

Microcontroller Architecture and I/O Interfacing, Advanced Programming with Arduino and ESP, Embedded Programming Techniques, Actuator Control and Closed-Loop Systems, Implementing Navigation in ROS Projects, Advanced ROS Features and Applications, Security Measures in Embedded Systems, Optimizing Code for Performance, Project-Based Experiments and Project Development.

Textbook/Recommended Readings

- A textbook on Embedded System Design for engineering students by Dr. Jaikaran Singh, Dr. Raghavendra S.

Reference Books/ Other Supplementary Readings

- Embedded System Design by Peter Marwedel
- Arduino – Home - https://www.arduino.cc/
- ROS Wiki – https://wiki.ros.org/Documentation
- Gazebo Tutorials - https://classic.gazebosim.org/tutorials

Course Code: RE 422		CIE Marks: 60
ISCED: 0714-422		SEE Marks: 40
Course Title: Robotic Process Automation Design & Development Lab		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Theory)		Contact Hours: 2.5 (Total weeks: 12)
Prerequisite: SE 213, SE 532, RE331, RE332, RE 411, RE 412		
Course Type: Major		
Level: 4	Term: 2	

Course Objectives

- To prepare students to be Junior RPA Developers.
- To learn the basic concepts of Robotic Process Automation.
- To develop familiarity and deep understanding of UiPath tools.
- To develop the ability to independently design and create robots for business processes.
- To develop skills required to pass the UiPath RPA Associate v1.0 Exam successfully.

Course Content

This course includes history of Automation; Story of Work; Introduction to RPA; RPA vs Automation; RPA and AI; RPA and emerging ecosystem; Industries best suited for RPA; Processes that can be automated, UiPath and its Products; Robots and their Types; Studio Overview; Orchestrator; UiPath Studio Installation & Updating; The User Interface; Features of Studio; Building 'Hello World' Robot, Variables and their Types; Variables Panel; Scope of Variable; Arguments; Arguments Panel; Argument Directions; Arguments vs. Variables, UI interactions; Input Actions and Input Methods; Containers; Recording and its types; Selectors and their types; Anchors; Debugging Selectors, Sequences; Control Flow and Its Types; Decision Control; Loops; Other Control Flow Activities; Flowcharts; Error Handling, Data Manipulation and Its importance; String Manipulations ; Data Table Manipulations; Collection, Types and Manipulations, Extraction and Its Techniques; Automation Techniques; Orchestrator Overview; Publishing a Robot to Orchestrator; Orchestrator Functionalities.

Textbook/Recommended Readings

- Learning Robotic Process Automation-Alok Mani Tripathi

Reference Books/ Other Supplementary Readings

- https://academy.uipath.com/

Course Code: RE 421		CIE Marks: 60
ISCED: 0714-421		SEE Marks: 40
Course Title: Robotic Process Automation Design & Development		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1		Contact Hours: 1.15 (Total 18 weeks)
Prerequisite: SE 213, SE 532, RE331, RE332, RE 411, RE 412		
Course Type: Major		
Level: 4	Term: 2	

Course Objectives

- To prepare students to be Junior RPA Developers.
- To learn the basic concepts of Robotic Process Automation.
- To develop familiarity and deep understanding of UiPath tools.
- To develop the ability to independently design and create robots for business processes.
- To develop skills required to pass the UiPath RPA Associate v1.0 Exam successfully.

Course Content

Robotics Process Automation (RPA) Lab course introduces students to the fundamental principles and practical application of RPA using UiPath Studio. Beginning with an overview of automation history and the RPA landscape, students delve into UiPath Studio installation, user interface navigation, and the construction of foundational robots. Subsequent weeks cover essential topics such as UI interactions, control flow, error handling, data manipulation, and automation techniques. Advanced concepts, including the integration of RPA with AI, are explored, followed by an examination of industry-specific applications and case studies. The course culminates with a focus on Orchestrator functionality, exploration of emerging trends in RPA, and hands-on preparation and presentation of a final project, ensuring students acquire comprehensive skills in designing, implementing, and managing RPA solutions for real-world scenarios.

Textbook/Recommended Readings

- Learning Robotic Process Automation-Alok Mani Tripathi

Reference Books/ Other Supplementary Readings

- https://academy.uipath.com/

Course Code: CS 211		CIE Marks: 60
ISCED: 0613-211		SEE Marks: 40
Course Title: Cyber Security Fundamentals		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Major Core		
Level: 4	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of cyber security. More specifically,

- Interpret Key Cybersecurity Concepts: Gain an in-depth understanding of key cybersecurity principles using real-life examples to demonstrate comprehensive knowledge and application.
- Analyze and Design Cyber Security Architectures: Develop skills in analyzing diverse technology architectures, network models, and defense-in-depth concepts, and adeptly design and evaluate comprehensive cybe rsecurity architectures.
- Validate Cybersecurity Controls Implementation: Acquire the ability to validate the implementation of cybersecurity controls across networks, systems, applications, data, and emerging technologies.

- Measure and Manage Cyber Incidents: Learn to measure the impact of cyber incidents and demonstrate the ability to manage these incidents effectively, implementing appropriate controls.

Course Content

Cybersecurity is one of the most significant challenges of the contemporary world, due to both the complexity of information systems and the business they support. Software running on current systems is exploited by attackers despite many deployed defense mechanisms and best practices for developing new software. In this course students will learn about overview of cybersecurity domains, global challenges related to cyber security, cyber security governance, concepts of digital trusts, cyber risk, common attack types and attack vectors, implementing cyber security controls, security architecture principles, different architect model like OSI, defense in depth, information flow control, isolation and segmentation, logging, monitoring and detection, encryption fundamentals, techniques and applications of encryption, security of networks, security of systems, security of applications, security of data, risk assessments, vulnerability management, penetration testing, network security, operating system security, application security, data security, security implications and adoption of evolving technology, like threat landscape, cloud and digital collaboration, block chain, zero trust, privilege access management (PAM), security devices, cyber security incident management, investigations, legal holds and preservation, forensics, disaster recovery plan, business continuity plans, etc. The students will work with real-world problems and technical challenges by implementing security solutions in web applications.

Course Code: CS 418		CIE Marks: 60
ISCED: 0612-418		SEE Marks: 40
Course Title: Network & Communication Security		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 4	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically,

- To know about network and cyber security concepts
- To know about cyber-attack, vectors, risk, controls
- To know about Security architecture principles
- To know about cybersecurity of network, systems, applications and data
- To know about cyber incident Management and Monitoring

Course Content

In this course, students will learn about Basic Computer Networks, Introduction to Computer Security, Aspects of Computer Security, Cryptographic Processes, Network Security-issues, Cryptographic Hash Functions, Security Workshop, Firewall Configuration and Administration, Overview of VPN, Advanced Features of VPN, Advanced Routing, NAT & PAT, Network Monitoring and Tools and Network Security infrastructure.

Textbook/Recommended Readings

- "Computer Networks and Security (2IC60)
- T. Ozcelebi and J.I. den Hartog, version 0.38 (2019)

Reference Books/ Other Supplementary Readings

- Online tutorial.
- Handoutryptography" by Buchanan, W., CRC Press, 2022.

Course Code: CS 422		CIE Marks: 60
ISCED: 0612-422		SEE Marks: 40
Course Title: Digital Forensics		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Core		
Level: 4	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically,

- To understand the fundamental concepts of digital forensics, including data acquisition, preservation, and analysis.
- To develop practical skills in forensic investigation techniques, tools, and methodologies used in cybercrime investigations.
- To learn how to identify, collect, and analyze digital evidence from various sources, such as computers, networks, and mobile devices.
- To gain knowledge of legal and ethical considerations in digital forensics, including chain of custody, privacy laws, and expert witness testimony.

Course Content

The necessity of Digital Forensic and Computer Forensics Investigation Process, Understanding the Hard Disks, Understanding the File Systems, Data Acquisition and Duplication, Defeating Anti-Forensics Techniques, Fundamentals of Operating Systems Forensics, Windows Forensic and Linux Forensic, Fundamentals of Network Security Architecture, Different Network Attack Methodologies, Network Attack Forensics, Fundamentals of Web Application Security Posture, Web Application Attack Methodologies, Investigating Web Attacks, Database Forensics, Cloud Forensics, Investigating Email Crimes, Malware Forensics, Mobile Forensics, IoT Forensics, Fundamentals of Web Application Security Posture, Web Application Attack Methodologies, Investigating Web Attacks, Database Forensics, Cloud Forensics, Investigating Email Crimes, Mobile Forensics, Malware Forensics, Importance of different types, Purposes, Scope of Forensic.

Textbook/Recommended Readings

- A Practical Guide to Digital Forensics Investigations, 2nd Edition, by Darren R. Hayes, Released October 2020
- Publisher(s): Pearson IT Certification, ISBN: 9780134878942

Reference Books/ Other Supplementary Readings

- Digital Forensics and Incident Response: A practical guide to deploying digital forensic techniques in response to cyber security incidents, by Gerard Johansen, ISBN-13: 978-178728868

Course Code: DS 331		CIE Marks: 60
ISCED: 0613-331		SEE Marks: 40
Course Title: Introduction to Data Science and Data Management & Analysis		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Theory)		Contact Hours: 2 (Total weeks: 18)
Prerequisite: SE 121, STAT 101		
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

The goal of this course is to introduce the students about the concept of Data Science. The main objectives of this course are-

- To Learn the introduction of data science.
- To Learn and understand the data engineering tools.
- To learn and demonstrate data visualization and algorithm.
- To learn and apply data science methodology and understand the ETL

Course Content

Intro To Data Science, Learn about data science engineer and data analyst, Learn the difference among data science engineer and data analyst, Old problems, new problems, Data Science solutions, Applications of Data Science, Data Science Real life problems and solutions, Applications of Machine Learning, Introduction Languages of Data Science. Introduction to Python, Python Libraries for Data Science, Introduction to Jupyter Notebook, Open-Source Tools for Data Science, Introduction to R and RStudio, Commercial Tools for Data Science, Data Sets - Powering Data Science, Analytic Approach, Data hb Requirements, Data Collection, Data Understanding, Data Preparation - Concepts, Introduction to Data Visualization, Data Visualization Tools, Data Ethics, Basic Statistics, Data Modeling- Case Study, Database and SQL for data science, ETL Process and architecture, Time series Forecasting, Business Understanding and Deployment.

Textbook/Recommended Readings

- A Hands-On Introduction to Data Science [Book by Chirag Shah]

Reference Books/ Other Supplementary Readings

- Introduction to Machine Learning with Python: A Guide for Data Scientists [Book by Andreas C. Müller and Sarah Guido]
- **https://www.youtube.com/watch?v=N6BghzuFLIg**

Course Code: DS 411		CIE Marks: 60
ISCED: 0613-411		SEE Marks: 40
Course Title: Statistical Data Analysis		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Theory)		Contact Hours: 2 (Total weeks: 18)
Prerequisite: MAT 101, STA 101		
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of statistics. More specifically,

- Students will be taught to apply appropriate statistical tests to answer research queries that will solve real-world problems.
- Students will be taught to critique existing statistical experiments so that they can identify any issues with experiment design, analysis, and interpretation.
- Students will be taught to evaluate any societal, cultural, or ethical issues in statistical experiments.
- Students will be taught to develop their self-learning capabilities so that they can keep themselves updated with the dynamic field of data science.

Course Content

Data Types, Data Quality, Mean, Median, Mode, Percentiles, Quantiles, Variance, Standard Deviation, Interquartile Range, Range, Correlation, Pearson Correlation, Spearman's Rank Correlation, Histogram, Density Plot, Bar Chart, Grouped Bar Chart, Stacked Bar Chart, Heatmap, Scatter Plot, Line Plot, Sampling Methods, Probability Sampling, Simple Random Sampling, Systematic Sampling, Cluster Sampling, Stratified Sampling, Non-Probability Sampling, Snowball Sampling, Quota Sampling, Convenience Sampling, Probability Theory, Counting Theory, Permutation, Combinations, Random Variables, Discrete Random Variable, Continuous Random Variable, Probability Mass Function, Probability Density Function, Cumulative Density Function, Probability Distributions, Bernoulli Distribution, Binomial Distributions, Poisson Distribution, Hypergeometric Distribution, Normal Distribution, Uniform Distribution, Sampling Distribution, Central Limit Theorem, Confidence Intervals, Hypothesis Testing, P-Value, Type-I Error, Type-II Error, Statistical Power, Z-Test, T-Test, Two Sample T-Test, Paired T-Test, Analysis Of Variance, Chi-Square Test, F-Statistic, Simple Linear Regression, Multiple Linear Regression.

Textbook/Recommended Readings

- Griffiths, D. (2008). Head First statistics. O'Reilly Germany.
- Wasserman, Larry. All of statistics: a concise course in statistical inference. Vol. 26. New York: Springer, 2004.

Reference Books/ Other Supplementary Readings

- Field, Andy, Jeremy Miles, and Zoë Field. Discovering statistics using R. Sage publications, 2012.

Course Code: DS 421		CIE Marks: 60
ISCED: 0613-421		SEE Marks: 40
Course Title: Machine Learning Driven Data Analysis I		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Theory)		Contact Hours: 2 (Total weeks: 18)
Prerequisite: DS 331, DS 332, DS 411, DS 412		
Course Type: Major		
Level: 4	Term: 1	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of Machine Learning. More specifically,

- Students will be taught to apply appropriate machine learning models to automate real-world problems.
- Students will be taught to critique existing models so that they can identify any issues with experiment design, analysis, results, conclusions, and interpretation.
- Students will be taught to evaluate any societal, cultural, or ethical issues in existing machine learning.
- Students will be taught to develop their self-learning capabilities so that they can keep themselves updated with the dynamic field of machine learning.

Course Content

Gradient Descent, Hypothesis Function, Loss Function, Learning Rate, Learning Rate Scheduling, Early Stopping, Stochastic Gradient Descent, Batch Gradient Descent, Mini-Batch Gradient Descent, Simple Linear Regression, Multiple Linear Regression, Vectorization of Gradient Descent, Logistic Regression, Binary Log-Loss Function, Polynomial Regression, Overfitting And Underfitting, Bias-Variance Tradeoffs, Regularization Methods, L1 Penalty, L2 Penalty, Ridge Regression, Lasso Regression, Elastic Net, Artificial Neural Networks, Activation Functions: ReLU, Hyperbolic Tangent Function, SoftMax, etc., Dropout Layer, Advanced Optimization Techniques: Momentum, RMSProp, and ADAM, Decision Tree, Gini, Entropy, CART Algorithm, Ensemble Learning: Voting, Bagging, Pasting, Random Patches, Random Subspaces, Random Forest, Boosting, and Stacking, XGBoost, Model Selection: Hyperparameter Tuning, Grid Search, Random Search and Cross-Validation, Model Evaluation: Bootstrapping, Mean Absolute Error, Mean Square Error, Root Mean Square Error, Confusion Matrix, Type I Error, Type II Error, Accuracy, Precision, Recall, Sensitivity, Specificity, True Positive Rate, False Positive Rate, AUC-ROC, Precision-Recall Curve, Feature Engineering: Normalization, Standardization, and Augmentation, K-Means Clustering, Agglomerative Clustering, Single Linkage, Complete Linkage, Average Linkage, DBSCAN, Anomaly Detection, Recommendation Systems, Collaborative Filtering, Content-Based Filtering, Dimensionality Reduction, Principal Component Analysis, Locally Linear Embedding, t-SNE, Reinforcement Learning, Q-Learning.

Textbook/Recommended Readings

- “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow” by Aurélien Géron, 2nd Edition, 2019

Reference Books/ Other Supplementary Readings

- Kochenderfer, M. J., & Wheeler, T. A. (2019). Algorithms for optimization. Mit Press.
- “Deep Learning” by Ian Goodfellow and Yoshua Bengio and Aaron Courville, Final Edition, 2016

Course Code: SE 341		
ISCED: 0613-341		
Course Title: Numerical Analysis		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		
Prerequisite: N/A		Contact Hours: 2.5 (Total weeks: 18)
Course Type: Core		
Level: 4	Term: 2	

Course Objectives

This course is an introduction to numerical analysis. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer. The main objectives of this course are that students will be able to

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyze and evaluate the accuracy of common numerical methods.

Course Content

In this course students will be introduced to the mathematical analysis of numerical methods by emphasizing on different algorithms that are encountered in many disciplines like physical sciences and engineering. By the end of this course, students will be competent to solve complex mathematical problems using simple arithmetic operations such as bisection method, Newton Raphson's method, differentiation, matrix problems, finding roots of equations, overview of Gaussian elimination, partial pivoting, LU decomposition, boundary value.

Textbook/Recommended Readings

1. Numerical Methods for Engineers, By Raymond Canale and Steven C. Chapra, 7th Edition.

Reference Books/ Other Supplementary Readings

Numerical Methods by Balagurusamy

Course Code: RE 423		CIE Marks: 60
ISCED: 0714-423		SEE Marks: 40
Course Title: Advanced Robotics		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2		Contact Hours: 2.5 (Total weeks: 12)
Prerequisite: SE532		
Course Type: Major		
Level: 4	Term: 2	

Course Objectives

To provide a solid understanding of different components and design of Advanced Robotics solutions. More specifically

- To explore advanced robotics components.
- To learn the advanced concepts of advanced robotics.
- To develop a deep understanding of advanced robot control systems.
- To develop the ability to solve social problems using advanced robotics.

Course Content

The basic terminologies related to Advanced Robotics applications, advanced sensors, actuators and algorithms. Working principles of advanced robotics components like, Lidar sensor, IMU sensor, encoder sensor, GPS sensor, Depth Camera, encoder motor, hub motor, Brush less motor. In-depth knowledge about robot kinematics. Mathematical representation of forward kinematics and inverse kinematics. Introduction to Robot Operating System (ROS). Components of ROS. Brief discussion about Gazebo, RVIZ and Rqt graph. Introduction to robot navigation system. In-depth knowledge about robot localization, sensor fusion, mapping, and motion planning. Designing advanced robotics solution architecture.

Textbook/Recommended Readings

- Craig, J. J., Introduction to Robotics, Mechanics and Control, 3rd Edition, Addison Wesley, 2005.

Reference Books/ Other Supplementary Readings

- LOW, K.H., "Robotics, principles and systems modeling," 2nd edition, Prentice Hall, 2004
- https://ros.org/

Course Code: RE424		CIE Marks: 60
ISCED: 0714-423		SEE Marks: 40
Course Title: Advanced Robotics Lab		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1 (Lab)		Contact Hours: 1.15 (Total 18 weeks)
Prerequisite: SE532		
Course Type: Major		
Level: 4	Term: 2	

Course Objectives

The goal of this course is to introduce the students about the concept of Advanced Robotics applications. The main objectives of this course are,

- To learn the implementation of advanced robotics components.
- To practice advanced concepts of robotics.
- To develop familiarity and deep understanding of advanced robotics tools.
- To develop the ability to independently design and create robotics solutions for industrial purposes.

Course Content

The Advanced Robotics Lab course encompasses a diverse range of topics aimed at providing students with comprehensive knowledge and practical skills in robotics. Beginning with the study and implementation of DC encoder motors and HUB motors, participants delve into sensor technologies such as IMUs and Lidar, exploring their integration with the Robot Operating System (ROS) environment. Concepts like PID control and fuzzy logic are covered for advanced motion control and decision-making. Students learn to install and utilize ROS on Ubuntu systems, write basic nodes, and implement navigation stacks for autonomous robot movement. Practical exercises involve sensor fusion, 2D map building with Lidar, and optimizing navigation algorithms. By the end of the course, participants gain proficiency in various robotic components, algorithms, and systems integration, preparing them for complex robotics applications in research and industry.

Textbook/Recommended Readings

- Craig, J. J., Introduction to Robotics, Mechanics and Control, 3rd Edition, Addison Wesley, 2005.

Reference Books/ Other Supplementary Readings

- LOW, K.H., “Robotics, principles and systems modeling,” 2nd edition, Prentice Hall, 2004
- https://ros.org/

Course Code: CS 334		CIE Marks: 60
ISCED: 0613-334		SEE Marks: 40
Course Title: Ethical Hacking and Countermeasure		Total Marks: 100
Semester: Spring 2024		
Credit Value: 1 (Theory)		Contact Hours: 1.15 (Total weeks: 18)
Prerequisite: SE532		
Course Type: Major Core		
Level: 4	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals Ethical Hacking, more specifically

- To know about ethical hacking, information security controls, related laws & standards, and countermeasures to ensure the System's security.
- To know how to perform footprinting and reconnaissance, the network scanning techniques and scanning countermeasures, enumeration techniques and enumeration countermeasures,
- To know about System hacking methodology, steganography, steganalysis attacks, and covering tracks to discover System and network vulnerabilities.
- Know about Different types of malwares (Trojan, Virus, worms, etc.), system auditing for malware attacks, malware analysis, and countermeasures.
- Learn about encryption algorithms, cryptography tools, Public Key Infrastructure (PKI), email encryption, disk encryption, cryptography attacks, and cryptanalysis tools.
- Learn different cloud computing concepts, various cloud computing threats, attacks, hacking methodologies, and cloud security techniques and tool

Course Content

In this course students will learn about Necessity of ethical hacking knowledge to protect the infrastructure, footprinting & reconnaissance process, vulnerability assessment, analyze them to prepare attack vector, exploiting vulnerabilities to hack the system, web application attack, different attack methodology, sniffing, malware analysis, cryptography & cloud computing etc.

Textbook/Recommended Readings

- All In One CEH Certified Ethical Hacker Exam Guide, 3rd Edition, by Matt Walker, Released 2017

Reference Books/ Other Supplementary Readings

- CEH Study Materials from EC-COUNCIL, V-12.0, Published in 2022.

Course Code: CS 335		CIE Marks: 60
ISCED: 0613-335		SEE Marks: 40
Course Title: Ethical Hacking and Countermeasure LAB		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Lab)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: N/A		
Course Type: Major Core		
Level: 4	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals Ethical Hacking, more specifically

- To know how to perform Footprinting and reconnaissance, the network scanning techniques and scanning countermeasures, enumeration techniques, and enumeration countermeasures;
- To know about packet sniffing techniques, social engineering techniques, session hijacking techniques, and web server attack methodology with their uses for discovering network vulnerabilities, plus countermeasures against these attacks.
- To know about Wireless encryption, wireless hacking methodology, wireless hacking tools, and Wi-Fi security tools;
- To know about Mobile platform attack vectors, android vulnerability exploitations, and mobile security guidelines and tools;
- To know about Firewall, IDS, honeypot evasion techniques, evasion tools, and techniques to audit a network perimeter for weaknesses and countermeasures;

Course Content

The ethical hacking and countermeasures course with LAB intends to provide students with hands-on practice to identify information system security vulnerabilities and exploit those and implement countermeasures to prevent unauthorized use of corporate information. This course will give students a practical experience of acquiring information from various sources and targeted organizations using various tools and techniques, assessing and detecting vulnerabilities, and exploiting the identified weaknesses using different ethical hacking methodologies. The tools and techniques covered in class will practically prepare students for performing hacking ethically to protect corporate information. Furthermore, it would prepare them to understand and implement appropriate countermeasures to prevent unauthorized corporate information systems.

Textbook/Recommended Readings

- Kali Linux tutorialpoint SIMPLY EASY LEARNING, by Tutorials Point (I) Pvt. Ltd., Published 2017 Publisher(s): Tutorials Point (I) Pvt. Ltd.

Reference Books/ Other Supplementary Readings

- CEH Study Materials from EC-COUNCIL, V-12.0, Published in 2022.

Course Code: DS 423		CIE Marks: 60
ISCED: 0613-423		SEE Marks: 40
Course Title: Machine Learning Driven Data Analysis II and Communicating Data Insights		Total Marks: 100
Semester: Spring 2024		
Credit Value: 2 (Theory)		Contact Hours: 2 (Total weeks: 18)
Prerequisite: DS 411, DS 412, SE 544		
Course Type: Major		
Level: 4	Term: 2	

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data communications. More specifically,

- To learn deep neural networks, implement vectorized neural networks, identify architecture parameters, and apply DL to real world applications.
- To learn test sets and analyze bias/variance for building DL applications, use standard NN techniques, apply optimization algorithms, and implement a neural network in TensorFlow.
- To learn strategies for reducing errors in ML systems, understand complex ML settings, and apply end-to-end, transfer, and multi-task learning.
- To learn a Convolutional Neural Network, apply it to visual detection and recognition tasks, use neural style transfer to generate art, and apply these algorithms to image, video, and other 2D/3D data.
- To learn the Recurrent Neural Networks and its variants (GRUs, LSTMs), apply RNNs to character-level language modeling, work with NLP and Word Embeddings, and use HuggingFace tokenizers and transformers to perform Named Entity Recognition and Question Answering.

Course Content

Introduction to deep learning, create and train neural network architectures like Basic of Neural Network, Action Function, Forward Propagation, Back Propagation, Chain Model Convolutional Neural Networks, Recurrent Neural Networks, LSTMs, and Transformers, as well as how to improve them with tactics like Dropout, BatchNorm, Xavier/He initialization, and more. Students will be able to grasp theoretical principles and their industry applications using Python and TensorFlow, and to take on real-world problems like object detection, speech recognition, music synthesis, and chat bots, and more.

Textbook/Recommended Readings

- Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media, 2019

Reference Books/ Other Supplementary Readings

- Weidman, Seth. Deep Learning from Scratch: Building with Python from First Principles. " O'Reilly Media, Inc.", 2019.
- Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.

2.6 Examination

2.6.1 EXAMINATIONS PROCEDURE

Class Tests & Assignments:

Class Tests are taken in class hour or tutorial hour. The duration of a class test will be 15 to 20 minutes. Assignments may be done in class/tutorial hour/at a home work.

Mid-Term Examination:

Mid Semester Examination is held in the weeks announced in the Semester Calendar. The duration of the mid semester exam is one hour and 30 minutes.

Final Examination:

Semester Final Examination will be held as announced in the Semester Calendar by the university. The duration of the semester final examination is 2 hours.

2.6.2 Exam Guidelines for Students

- **Exam Hall Entry Time:** Students must report to the assigned exam room at least 15 minutes before the exam starts. Late arrivals of more than 60 minutes will not be permitted to take the exam.
- **Exam Rooms:** Students must sit in the exam rooms specifically allotted for their sections. If a student enters an unassigned room, his/her exam scripts may be forfeited. The department will not be responsible for any such inconvenience.
- **Examination Duration Extension:** Exam time will not be extended to accommodate late arrivals under any circumstances.
- **Breaks:** Breaks are not allowed during the exam, except for emergency toilet use. Only one student will be allowed to leave at a time, and this must be done under the supervision of the invigilator. No extra time will be allotted for breaks.
- **Leaving the Exam Hall:** No student is permitted to leave the exam hall within the first hour or during the last 10 minutes of the exam, except in emergencies. Students must remain seated after the exam ends until the invigilator gives permission to leave.
- **Exam Termination:** In case of emergencies (e.g., fire alarms), students must follow the invigilator's instructions to evacuate and leave the exam scripts on the desks.
- **Identity Verification:** Students are required to bring their official university ID card to the exam. Entry into the exam hall will not be allowed without proper identification. If you forget your ID card, you must immediately contact the SWE office, where your identity will be verified and a one-day permission slip will be issued. Faculties or any member of the exam committee will not provide this permission.
- **Accounts Clearance:** Students must bring their accounts clearance slip to the exam. Invigilators will verify the clearance when signing your answer script. If you forget to bring the clearance slip, you should immediately go to the SWE office for further instructions. Faculties or any member of the exam committee will not provide this permission.
- **Answer Script Protocol:** Each answer script, including any additional sheets, must bear the invigilator's signature to be considered valid for submission.
- **Exam Question Clarification:** Invigilators are not permitted to discuss or explain exam questions. Any concerns about the questions should be brought to the invigilator's attention, and they will record them for review by the course instructor.
- **Assistance of Course Teacher:** Students may request the presence of the course instructor or teaching assistant in the exam room. The instructor or assistant can clarify questions within the scheduled exam time.

- **Personal Belongings:** All personal items, including bags, notes, and electronic devices, must be left in areas designated by the invigilator. Under no circumstances are personal belongings allowed at the student's desk during the exam.
- **Electronic Devices:** All electronic and telecommunications devices are strictly prohibited inside the exam room. This includes but is not limited to cellular phones, pagers, MP3 players, programmable or graphing calculators, personal assistant devices, digital watches, personal computers, etc. The invigilator reserves the right to inspect any items brought into the exam room and determine whether the device is suitable for keeping with you or not.
- **Academic Integrity:** Any form of cheating, including the use of unauthorized materials, notes, communicating with other students, writing on the desk or wall before the exam begins (even if you do not use those materials in the exam), etc., will lead to cancellation of your exam and disciplinary action in accordance with university policy. Invigilators or members of the exam committee have the complete authority to cancel your exam script if you are found engaging in any of these offenses.
- **Invigilator Authority:** Invigilators have full authority in the exam hall regarding all matters during the exam. Any form of misbehavior toward an invigilator will result in the immediate cancellation of your exam. Further disciplinary action will be taken by the university or departmental discipline committee. If you believe the invigilator is acting inappropriately or making an incorrect decision, remain calm and comply with their instructions. After the exam, you may report the incident to the exam committee, who will review the situation and take any necessary action.
- **Overlap Examinations:** Students with two exams scheduled at the same time on the same day are eligible for overlap exams. Students are responsible for regularly checking the SWE notice board for any updates or announcements related to overlap exams. The notice will contain the necessary instructions regarding application for overlap exams. The exam committee will not be responsible if any student misses notice deadlines.
- **Final Improvement Examination:** Students who receive a grade below B are eligible for the final improvement examination. Students are responsible for regularly checking the SWE notice board for updates or announcements related to improvement exams. The notice will contain the necessary instructions regarding application for overlap exams. The exam committee will not be responsible if any student misses notice deadlines.
- **Missed Exams:** Students who were admitted to the hospital during an exam, or whose immediate family members (such as parents or siblings) experienced a medical emergency, may be considered for a second exam. Students must email the exam committee with appropriate documentation of their situation, ensuring that their advisors, course instructors, department head, and associate head are copied (CC'd) on the email. Each case will be assessed individually with strict criteria, and the exam committee will have full discretion in determining eligibility. The committee's decision will be final.
- **Email and Communications:** All communication with the SWE Exam Committee must be conducted through the official email: exam.swe@daffodilvarsity.edu.bd. Emails sent to individual committee members will not be accepted under any circumstances. In addition, the SWE Exam Committee will communicate to the students only through Notice Board and CR Groups.
- **Amendments:** The exam committee, department, and the university reserve the right to make changes to the above guidelines at any time if deemed necessary for the betterment of the students.

Chapter 3 Facilities

3.1 Computer Labs

There are 7 general lab rooms available for regular lab classes, each equipped with 25 desktop computers and a projector for lectures. The lab room numbers are 610, 616, 710, 711A, 711B, 814A, and 903. In addition to these, there are specialized lab rooms designed for specific purposes.

3.1.1 Data Science Lab

The Department of Software Engineering at Daffodil International University offers a B.Sc. in Software Engineering designed to equip students with the necessary skills for the global IT market. The program covers key areas such as Software Engineering, Computer Programming, Computer Systems Engineering, Telecommunication Engineering, and Electronics Engineering, preparing graduates to work in both local and international tech industries.

Our Focus: Data Analysis, Visualization & Business Intelligence

- We analyze and visualize real-life data to help businesses grow by providing deep insights into customer behavior, market trends, and optimization strategies.
- A data-driven approach ensures that decisions are based on factual analysis rather than intuition, using techniques like data mining, visualization, and optimization.
- Machine Learning Algorithms enhance our ability to model problems effectively, improving decision-making and predictive analytics.
- Business Intelligence (BI) plays a crucial role in digital transformation, allowing companies to maximize their data investments and improve operational efficiency.

At the Data Science Lab, we explore the latest trends in data-driven decision-making, machine learning, and business intelligence, helping organizations leverage data for strategic success.

3.1.2 Cyber Security Lab

The Cyber Security Centre at DIU is a non-profit organization dedicated to applied research in cybersecurity with the mission of combating cybercrime. We focus on awareness programs, research initiatives, training sessions, and security services to protect both public and private sectors from cyber threats.

Our Focus: Cybersecurity Research, Awareness & Protection

- We conduct applied research to tackle modern information security challenges and develop innovative cybersecurity solutions.
- Our security awareness programs educate individuals and organizations on best practices, cyber threats, and preventive measures.
- Training sessions & vendor certifications help professionals stay ahead in cybersecurity with cutting-edge knowledge.
- Collaboration with industry leaders & global experts enables us to work on policy frameworks, security strategies, and digital defense mechanisms.

- We assist government & enterprises in safeguarding their critical infrastructure and services from cyber threats.

Key Activities

Applied Research in Cybersecurity
Security Awareness & Training Programs
Technical & Vendor Certifications
Cybersecurity Innovation Projects
Implementation of Security Solutions
Information Security Services for Public & Private Sectors

At the Cyber Security Centre, DIU, we are committed to building a cyber-resilient future by empowering individuals, businesses, and government entities with the knowledge, tools, and strategies needed to stay secure in an increasingly digital world.

3.1.3 Robotics Lab

The DIU Robotics Club is one of the largest and most dynamic clubs at Daffodil International University, dedicated to fostering creativity, technical skills, and teamwork among engineering students. Through free seminars, workshops, and training programs, we empower students to explore, innovate, and excel in the field of robotics.

Our Focus: Robotics, Innovation & Skill Development

- We provide hands-on training in robotics to help students develop engineering, programming, and problem-solving skills.
- Our mentor-based programs inspire young minds to innovate and lead in the field of robotics and automation.
- We promote teamwork, leadership, and communication through engaging competitions and collaborative projects.
- By offering students real-world exposure to robotics and technology, we prepare them for future careers in STEM fields.

At DIU Robotics Club, we believe in shaping the future of robotics and technology by empowering students with knowledge, skills, and a vision for innovation.

3.2 Seminar/Conference Halls:

3.2.1 Human Resource Development Institute (HRDI)

The Human Resource Development Institute (HRDI) at Daffodil International University is dedicated to enhancing professional skills and preparing individuals for the evolving job market. HRDI offers specialized training programs in areas like CCNA, Microsoft, ORACLE, RHCL, and SUN certifications, along with a Postgraduate Diploma in Fashion Design & Technology.

With expert mentorship and a well-balanced curriculum, HRDI ensures that participants gain both theoretical knowledge and practical experience. The institute collaborates with national and international organizations, such as the Bangladesh Society for Human Resources Management (BSHRM), to provide enriched learning opportunities.

HRDI is committed to empowering students and professionals with the skills needed to excel in their careers and contribute to a highly competent workforce.

3.2.2 The International Conference Hall (ICH)

The International Conference Hall at Daffodil International University (DIU) is a premier venue located within the Knowledge Tower at Daffodil Smart City (DSC). Designed to host a variety of events, the hall offers a seating capacity of 500, accommodating up to 1,000 attendees for conferences, seminars, and workshops.
The facility is equipped with modern amenities, including IT support, maintenance services, air conditioning, all-in-one boards, and dedicated staff for cleaning and support, ensuring a seamless experience for event organizers and participants.
The International Conference Hall is a hub for significant academic and extracurricular activities at DIU. Many of our events, organized by our department as well as the Faculty of Science and Information Technology (FSIT), are often held there.
This versatile venue is integral to DIU's commitment to fostering a vibrant academic community, providing a space for knowledge exchange, innovation, and collaboration.

3.2.3 Prof. Dr. Aminul Islam Seminar Hall

The Prof. Dr. Aminul Islam Seminar Hall is a dedicated venue within the Knowledge Tower at Daffodil Smart City (DSC), designed to host academic and professional events. It offers a seating capacity of 50 units, accommodating seminars, workshops, and conferences.
This seminar hall is named in honor of Prof. Dr. Aminul Islam, a distinguished academician and former Vice-Chancellor of Daffodil International University. Dr. Islam was a prominent figure in the field of soil science and served as the President of the Bangladesh Academy of Sciences.

The hall is equipped with modern amenities to support various events, including IT support and maintenance services. It is conveniently located within the DSC campus, providing easy access for attendees.

3.3 Transportation Facilities

Transportation is a key concern for both students and parents. DIU understands this and offers a dedicated fleet of over 100 buses exclusively for students, faculty, staff, and admin personnel. The transport service operates from the Ashulia campus, covering various routes to different campuses. Students can access this service by presenting their ID card and paying a small fee based on distance. Additionally, a parents' car and an ambulance are available for emergencies.

Key Features of DIU Transportation:

- CCTV Cameras for security
- Fire Extinguishers and First Aid Kits for safety
- Air-conditioning and comfortable seating with safety belts

Benefits:

- Timely, safe, and efficient travel
- Cost-effective with monthly subsidies
- Promotes time management
- Helps reduce traffic and pollution
- Especially helpful for female students, ensuring their safety and comfort

This service not only saves money but also provides a reliable and convenient way for students to travel to and from the university.

3.4 Hall Facilities

In-Room Amenities:

- Fully furnished rooms with beds, under-bed drawers, study tables, and chairs
- Tube lights, fans, and dustbins in each room
- Room Size: 300 sq. ft., accommodates 4 students per room

Self-Help Amenities:

- Laundry service and filtered water
- Medical facility with first aid and doctor on-call
- Dining area for meals

Security & Housekeeping:

- 24/7 security with CCTV cameras and security guards
- Daily cleaning of rooms, washrooms, and common areas

Electricity & Internet:

- Electricity in each room with generator backup (if needed)
- High-speed broadband and Wi-Fi

Entertainment:

- Common room with indoor games like carom, chess, and table tennis

Halls:

- Younus Khan Scholar Garden 1 (Block A)
- Younus Khan Scholar Garden 2 (Block A)
- Rowshan Ara Scholar Garden 1 & 2
- Creative International

The rooms are designed to provide a comfortable, secure, and convenient living experience for DIU students.

3.5 Medical Facilities

Daffodil International University (DIU) prioritizes the health and well-being of its students, faculty, and staff. Located at Daffodil Smart City, the Medical Centre operates 16 hours a day, from 8 am to 12 am, providing emergency medical care and first aid whenever needed.

Services Offered:

- Emergency Support: Available from 8 am to 12 am
- First Aid and Prescriptions for students, teachers, and staff
- Health Support: Including nebulization, sugar tests, blood pressure checks, and oxygen therapy
- Referrals to authorized hospitals for serious cases
- Health Cards: Issued upon request
- Event Medical Support: For sports tournaments, convocation, Foundation anniversary, etc.
- Health Check-ups and ensuring public health and sanitation on campus
- Vaccination Programs and health campaigns like blood donation drives

The Medical Centre plays a crucial role in maintaining the health of DIU's community, providing accessible healthcare at a nominal cost.

3.6 Active Directory and Email Accounts

Daffodil International University provides all students with access to Google Workspace, which includes official university email, Google Drive, Docs, Sheets, Meet, and other essential collaboration tools. This service enhances communication, file storage, and academic productivity for students.

Chapter 4 General Information

4.1 Clubs and Club Activities:

Daffodil International University (DIU) encourages students to engage in extracurricular activities through a variety of clubs that cater to different interests, including technology, business, arts, and social initiatives. These clubs provide students with opportunities to develop their skills, network with like-minded peers, and participate in events such as workshops, competitions, and industry collaborations.

The Department of Software Engineering (SWE) actively supports student engagement through its two specialized clubs:

4.1.1 DIU Software Engineering Club (DIUSEC):

The Daffodil International University Software Engineering Club (DIUSEC) was founded in 2013 and reorganized in 2022 under the supervision of the Department of Software Engineering (SWE), DIU. This club is an outcome of combined collaboration and hard work among honorable department authorities, respected faculty members, our alumni, and enthusiasts. DIUSEC is a dynamic community that provides a platform for members to enhance their programming skills, engage in problem-solving activities, and collaborate on innovative projects. DIUSEC organizes workshops, hackathons, coding competitions, and seminars to keep students abreast of the latest trends and technologies in the software industry. Through its events and initiatives, the club aims to cultivate a strong foundation in software development, promote teamwork, and encourage continuous learning among its members. Stay tuned for more updates from this vibrant and forward-thinking community!

4.1.2 Data Science Club:

This club is supervised by The DATA SCIENCE LAB which is a concern of Department Of Software Engineering. Data science club founded in August 2022. Our mission is to help students of all skill levels learn about data science and machine learning through tutorials, presentations from industry professionals, and hands-on experience. The club aims to organize Seminars, Workshops, Exhibition and Quiz competition to inculcate students knowledge and skill in the field of science.

4.2 Website and E-learning Portal (BLC)

Daffodil International University provides students and faculty with access to the Blended Learning Center (BLC), a comprehensive digital teaching and learning platform designed to enhance the educational experience. The BLC serves as the central hub for academic activities, fostering seamless interaction between teachers and students.

The platform enables faculty members to effectively manage courses, upload learning materials, assign tasks, conduct online assessments, and monitor student progress through real-time analytics. It provides an interactive space where instructors can engage with students beyond the classroom, ensuring a more personalized and efficient learning process.

For students, BLC offers a structured environment to access course content, submit assignments, participate in discussions, and track their own academic progress. The system ensures that learning is not confined to physical classrooms, supporting a blended learning approach that integrates both online and offline methods.

Additionally, the School Website and E-learning Portal streamline communication between students and faculty, keeping them updated with academic schedules, announcements, and other university resources. The integration of BLC with university systems ensures a smooth and organized approach to learning, allowing students to engage with their courses anytime, from anywhere.

By utilizing the Blended Learning Center (BLC), Daffodil International University continues to advance its mission of providing a technology-driven education system, ensuring that students receive high-quality learning experiences that are interactive, accessible, and efficient.