BANGLADESH ARMY UNIVERSITY OF ENGINEERING & TECHNOLOGY (BAUET)

Qadirabad Cantonment, Natore-6431

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Final Year Thesis/Project Guidelines

CSE-4100 & 4200

(Effective from Fall-2020)

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1.1. Introduction

The Final Year Thesis/Project is the culmination of students' degree program. The main purpose of this project is to encourage students to apply the knowledge acquired during their studies. It allows them to work on a substantial problem for an extended period of time, show how proficient they are in solving real world problems. It brings them a sound opportunity to demonstrate their competence as professionals and to apply what they have learnt in the other components of the degree. Besides, they get a chance to improve their technical skills, communication skills by integrating writing, presentation and learn how to work in teams. With a real-world problem at hand, they get to learn professional practice and a variety of non-technical issues such as management, finance, safety, reliability, environment and social impacts. Moreover, it provides an integrated assessment of the progress of the students toward the training they went through during their academic tenure at the college.

Thesis/Project course is different other courses because it demands independent objective formulation, planning, management and self-motivation. It is therefore essential to design fair and comprehensive guidelines for the students, supervisors and the evaluators. A structured manual and lifecycle process is therefore essential in order to help students conform to the required quality standards, outline general expectations from the supervisors and sketch assessment criteria for the evaluators. Hence, contribute as a fundamental underpinning to achieve high quality learning outcomes of the thesis/projects.

1.2. Program Outcomes (POs)

Program Outcomes are the narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills and attitude that the students acquire while progressing through the program. The program must demonstrate that by the time of graduation the students have attained a certain set of knowledge, skills and behavioral traits, at least to some acceptable minimum level. Specifically, it is to be demonstrated that the students have acquired the following graduate attributes:

Engineering Knowledge: Apply knowledge of mathematics, natural science,engineering fundamentals and an engineering specialization as specified in **K1 to K4**respectively to the solution of complex engineering problems.

Problem Analysis: Identify, formulate, research literature and analyze complexengineering problems reaching substantiated conclusions using first principles ofmathematics, natural sciences and engineering sciences**(K1 to K4).**

Design/Development of Solutions: Design solutions for complex engineeringproblems and design systems, components or processes that meet specified needswith appropriate consideration for public health and safety, cultural, societal, andenvironmental considerations. **(K5)**.

Investigation: Conduct investigations of complex problems using research-basedknowledge **(K8)** and research methods including design of experiments, analysis andinterpretation of data, and synthesis of information to provide valid conclusions.

Modern Tool Usage: Create, select and apply appropriate techniques, resources,and modern engineering and IT tools, including prediction and modeling, to complex engineering problems, with an understanding of the limitations**(K6).**

The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems**(K7)**.

Environment and Sustainability: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts **(K7)**.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice**(K7)**.

Individual Work and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project Management and Finance: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

After successful completion of the Final Year Theis/Project, a student would achieve the 12 Program Learning Outcomes (POs) as defined by their Final Year Thesis/Project.

In addition to incorporating the above-listed POs (graduate attributes), the educational institution may include additional outcomes in its learning programs. An engineering program that aims to attain the abovementioned POs should ensure that its curriculum encompasses all the attributes of the Knowledge Profile (K1 – K8) as presented inTable 1.2(a) and as included in the PO statements. The ranges of Complex Problem Solving (P1 – P7) and Complex Engineering Activities (A1 – A5) that should be addressed in the program are given in Tables 1.2(b) and 1.2(c), respectively.

Table 1.2(a): Knowledge Profile

Attributes	
K1	A systematic, theory-based understanding of the natural sciences applicable to the discipline
K2	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable tothe discipline
K3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline

K5	Knowledge that supports engineering design in a practice area
K6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
K7	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability
K8	Engagement with selected knowledge in the research literature of the discipline

Table 1.2(b): Range of Complex Engineering Problem Solving

Attribute	**Complex Engineering Problems** have characteristic P1 and some or all of P2 to P7:
Depth of knowledge required	**P1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
Range of conflicting requirements	**P2:** Involve wide-ranging or conflicting technical, engineeringand other issues
Depth of analysis required	**P3:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
Familiarity of issues	**P4:** Involve infrequently encountered issues
Extent of applicable codes	**P5:** Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholderinvolvement and conflictingrequirements	**P6:** Involve diverse groups of stakeholders with widely varying needs.
Interdependence	**P7:** Are high level problems including many component parts or sub-problems

Table 1.2 (c): Range of Complex Engineering Activities

Attribute	**Complex activities** means (engineering) activities or projects that have some or all of the following characteristics:
Range of resources	A1: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies)
Level of interaction	A2: Require resolution of significant problems arising frominteractions between wide-ranging or conflicting technical,engineering or other issues
Innovation	A3: Involve creative use of engineering principles and researchbased knowledge in novel ways
Consequences for society and the environment	A4: Have significant consequences in a range of contexts,characterized by difficulty of prediction and mitigation
Familiarity	A5: Can extend beyond previous experiences by applyingprinciples-based approaches

The program should describe the process involved in defining and refining the POs.The correlation between the course outcomes (COs) and POs should be demonstrated through the mapping of COs onto POs.The way in which each attribute of the Knowledge Profile (K1 – K8) is addressed in thecurriculum should be demonstrated through mapping. The program should alsodemonstrate how each attribute of the Range of Complex Engineering Problems (P1 –P7) and Complex Engineering Activities (A1 – A5) is incorporated in the teaching, learning and assessment.

For each course, a course file must be maintained. The course file should include the assessment of outcomes, curriculum, and examination questions and answer scripts, the results of other assessments, and a summary of performance and attainment ofcourse outcomes with suggestions or feedback for future development.POs should be assessed using direct methods. Direct methods of assessment areaccomplished through the direct examination or observation of students'

knowledge or skills against measurable performance indicators or rubrics. In addition, indirect methods may also be used for PO assessment. Indirect methods of assessment are based on opinions or self-report from different stakeholders. The way in which various assessment tools, including examinations and rubrics, contribute to the evaluation of attainment of each PO should be described. The results of the evaluation of PO attainment should be shown.

Table 1.2 (d): Bloom's Taxonomy Domain

CognitiveDomain		**PsychomotorDomain**		**AffectiveDomain**	
C1	Remembering	P1	Perception	A1	Receive
C2	Understanding	P2	Set	A2	Respond
C3	Applying	P3	GuidedResponse	A3	Value
C4	Analyzing	P4	Mechanism	A4	Organize
C5	Evaluating	P5	Complex Overt Response	A5	Internalize
C6	Creating/Designing	P6	Adaption		
		P7	Origination		

1.3. Final Year Thesis/Project Course Outcomes

Final Year Thesis/Project COs along with its mapping to POs, quantification of POs via COs and description about assessment methods are shown in Table 1.3 (a) and Table 1.3 (b) respectively. To assess student's performance in final year thesis/project rubrics are utilized that are given in **Appendix-I.**

Table 1.3 (a): Mapping CO-PO, Knowledge Profile, Complex Engineering Problem (WP), Complex Engineering Activities (EA) and Bloom's Level.

COs	CO Statements (Upon completion of the course, the students will be able to)	PO	KP	WP	EA	Bloom's Level	Assessment Tools
CO1	Analyze complex engineering problems related to computer science and engineering to reach substantiated conclusions by	1 2	3 4	1-7	1-5	C3, C4	Report, Project,

	applying knowledge of mathematics, engineering fundamentals and engineering specialization						Presentation
CO2	Conduct literature survey to make necessary assumptions and approximations about possible solution and design an appropriate solution process of a complex engineering problem	3 4	5 8			C4,C5, C6,P3, P7	
CO3	Employ appropriate professional software/tools and Methodology in solving complex engineering problems	5	6			C5,P5	
CO4	Explain the relationship of an engineering system towards environmental, societal, health, safety, legal, cultural issues and needs.	6 7 8	7			C5,P4, A3,A4	
CO5	Perform effectively apply engineering and management principles as an individual or as a member or leader in diverse team to manage projects in multidisciplinary environments	9 11				C3 P5,A2	
CO6	Excel in communication skills through presentations, written document (thesis) and /or publications/poster.	10 12				P5,A1, A2	

Legends: CO-Course Outcomes PO-Program Outcomes, KP-Knowledge Profile

Bloom's Level: Cognitive Domain (C1-C6), Psychomotor Domain (P1-P7), and Affective Domain (A1-A5)

COs	Program Outcomes (POs)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	H	H										
CO2			H	H								
CO3					H							
CO4						H	H	H				
CO5									H		H	
CO6										H		H

Legends: High (H)=3, Medium(M)=2 and Low(L)=1

Table 1.3(b): Quantification of POs via COs of Final Year Thesis/Project

Course	**POs**	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
Thesis/Project	1	50%					
	2	50%					
	3		50%				
	4		50%				
	5			100%			
	6				33.33%		
	7				33.33%		
	8				33.33%		
	9					50%	
	10						50%
	11					50%	
	12						50%

Assessment Methods (Rubrics) and Marks distribution has been reported in of Final Year Thesis/Project are defined in the **Appendix-I**.

1.4. Overview of Final Year Thesis/Project

A Final Year Thesis/Project is a two-semester course in which students usually of 2/3 members select a thesis/project and are supervised by a faculty member. In this course, students choose a thesis/project subject and define the objectives of the thesis/project under the supervision of a faculty member, and prepare the thesis/project proposal including: **defining the statement of the problem, defining system requirements, defining different candidate solutions for the problem of study, making feasibility study for different candidate solutions, defining the best candidate solution, defining time table schedule**. Students present the final thesis/project report at the end of the semester to an evaluation a committee. The final year thesis/project is assigned to solve a complex engineering problem based on the knowledge and skills achieved while studying the Computer Science and Engineering program. A comprehensive policy has been prepared to assign, track, evaluate and assess the final progress. The purpose of the policy is to provide a uniform system of guidelines to students and supervising faculty to realize their Bachelor of Science Final Year Projects (Thesis/Project). The aim of the Thesis/Project is to give each student the opportunity to experience the engineering design process in the context of a topic related to the Computer Science and Engineering curriculum while working in a less structured environment. Currently, the thesis/projects can be undertaken individually or in small groups. In the latter case the student must still fulfill the requirements laid out by the departmental policy. The academic supervisor is a faculty member of Department of Computer Science and Engineering. COs for the final year thesis/project are defined as the part of the Thesis/Project policy. The progress of Thesis/Project is monitored in various steps throughout the thesis/project duration. The Thesis/Project is offered in seventh semester and continues till the eighth semester.

1.4.1. Timeline of the Thesis/Project Activities

A tentative timeline of the Thesis/Project activities is shown in Figure 1.4.1.

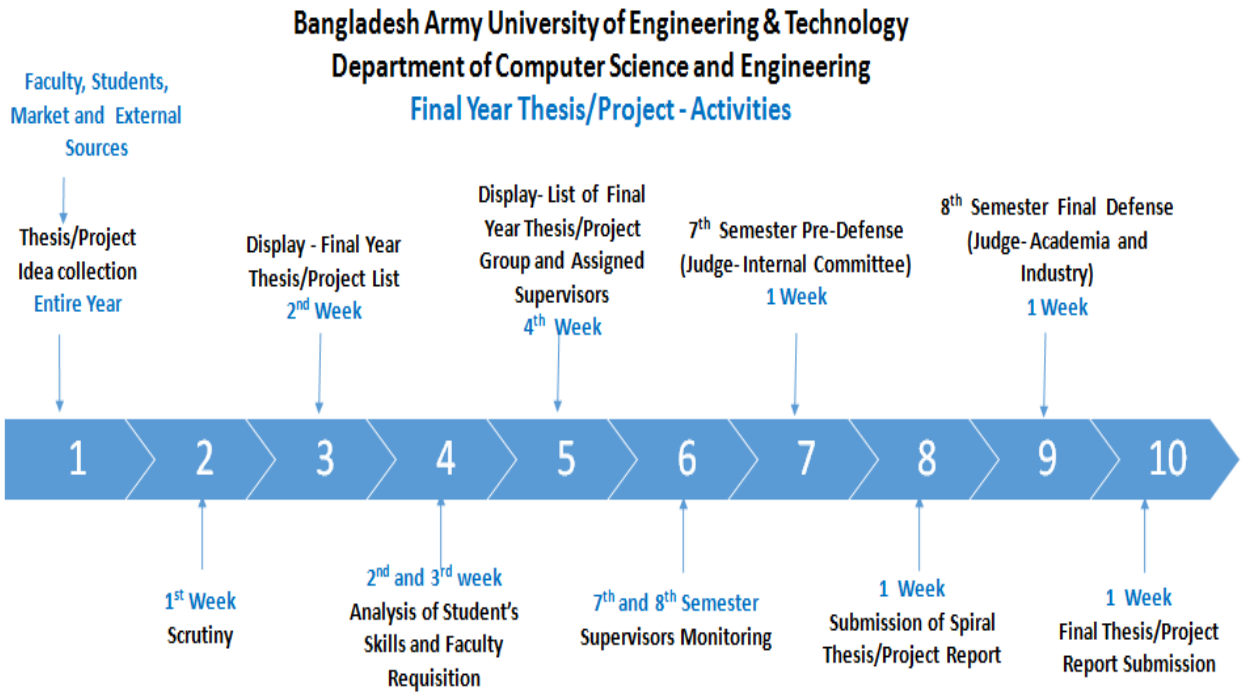

Figure 1.4.1 Tentative Thesis/Project Activities Timeline

First phase involves the collection of Thesis/Project ideas from the academia, software industry and other sources, which is then compiled and scrutinized by Thesis/Project Committee (list of committee members is given in Table 1.4.1 to form final ideas list. The list is displayed to the student groups and they are then interviewed to finalize an appropriate Thesis/Project idea for them along with the faculty supervisor. The supervisors guide the student groups during entire seventh and eighth semesters in their selected Thesis/Project completion and make sure the student groups work according to the Thesis/Project timeline. These Thesis/Projects ideas are displayed as prototypes at Initial defense in 7th semester exams and are evaluated by judges (Thesis/Project Defense Board form by department). At the end of 8th semester, student groups are first required to submit a spiral copy of their Thesis/Project for the final viva voce examination. The final viva voce examination is conducted and graded by an examination committee consisting of the chairman, supervisor, internal and an external subject expert in the final seminar. The internal and external examiners are invited from academia (other universities) and software industry (professional experts).

Table: 1.4.1. List of Thesis/Project Defense Committee Members (Final Defense)

Sl.No.	Name and Designation	Responsibility
1.	Head of the Department	Chairman
2.	Concern Thesis/Project Supervisor	Member
3.	(Academic and /Industry)	External Expert

1.5. Thesis/Project Milestones and Evaluation Stages

The Thesis/Project milestones, deliverables, evaluation stages along with their timelines are given the Table 1.5.1.

Table 1.5.1. Milestones and Marks Distribution

Pre-defense (7th Semester Exam)	**50% (100 Marks)**
Comprehensive Knowledge about Project/Thesis – 30% Presentation Skills – 20% Design & Methodology – 15% Design Tools/Technologies – 15% Individual/Team efforts – 10% Professional Ethics – 10%	Internal Expert – 50% Supervisor – 25% Chairman – 25%
Final Defense(8th Semester Exam)	**50% (100 Marks)**
Presentation Skills –20% Sustainability – 20% Design Tools/Technologies – 20% Professional Ethics – 10% Individual/Team efforts – 15% Life-long learning (Internship/Continuing Professional Development/Community Work/Society Membership) – 15%	External – 50% Supervisor –25% Chairman – 25%
Total	**100%(200 Marks)**

1.5.1. Pre-Defense (7th Semester Exam)

The students must choose a thesis/project from the thesis/project list displayed by the thesis/project Committee. Once the thesis/projects and their supervisors finalized and displayed. Each group remains in touch for the successful completion of the thesis/project with their respective supervisors (we encourage to have co-supervisor from industry). At the end of 7th semester, a Pre-defense is conducted for the evaluation of the thesis/project. The evaluators are from academia (Internal,Supervisor and Chairman). The format of Thesis/Project proposal defense and evaluation forms and their rubric are given in Annex-A. Also the template for Thesis/Project proposal is added in **Appendix-I**.

1.5.2. Final Defense (8th Semester Exam)

Final Defense is the final activity for Thesis/Project students, which is evaluated by Board of Final Defense Committee. At the end of 8th semester, once thesis submission is carried out for the final via voce. The evaluator panel (External Expert, Supervisor and Chairman Details: Table 1.4.1). The format of thesis/project final defense and evaluation forms and their rubric are given in **Appendix-I**. Also, the template for thesis/project final report submission is attached in **Annex-B.**

1.6. Guidelines for Project Supervision

Following rules should be taken under considerations during thesis/project supervision.Each group will work under the supervision of an assigned supervisor throughout the final year (term-7 and term-8).Students are recommended to meet with their supervisor at least once a week or as suggested by supervisor. The students are expected to discuss their progress with their supervisors in these weekly meetings. The meetings are preferably scheduled on allocated "thesis/project day" but depending on students' requirements and the supervisor's availability, supervisors may also arrange additional meetings (physical/online) as requested.

Supervisors might also arrange communication with student groups via email or other means for the purpose of advising thesis/project groups.

It is the responsibility of the supervisor to inform his students with this handbook and all the included instructions and regulations.

1.6.1. Tasks Expected From Supervisors

During these meetings supervisors are expected to responsibilities given in Table 1.6.1(a) :

Table 1.6.1 (a) : List of responsibilities for supervisors during meetings

To provide Thesis/Project Outlines / Objectives	**Orientation**
Discuss thesis/project expectations and the plan with the group	
To share previous practice experience, research, skills and expertise	
Assign /Recommend digital libraries and/or tools for gathering/ collecting state of the art	**Provide Knowledge**
To guide the students regarding online courses (preferably free) for the enhancement of technical knowledge	
To clarify students queries effectively as needed	
To make students aware of professional ethics and standards	
To advise students on how to deal effectively as a team while working under pressure, remaining optimistic and persistent, and how to meet milestone deadlines	
To monitor the thesis/project progress on a weekly/fortnightly basis	**Assess**
To ensure students are completing outlined thesis/project deliverables	
To grade students work (at individual/group level) at the end of each semester	

1.6.2. Thesis Project Development Life Cycle

The supervisors will guide the group through different steps in the Computer Science and Engineering life cycle and describe, discuss, assign, receive and review the corresponding outcomes/artifacts at the end of each step as described in Table 1.6.2 (a).

Table 1.6.2 (b) : Thesis/Project Lifecycle and Respective Artifacts

Phase - I	Topic Submission
Phase - II	Objectives, Methodology, Literature review
Phase - III	Design and partial implementation (Prototype/Demo)
Phase - IV	Complete Implementation, testing and result analysis, report generation
Phase - V	Report evaluation, final observation and correction

During the Project Proposal, students undertake the initial phases of thesis/project planning, selection, analysis and designing phases. In the Project Implementation, students proceed with the implementation phase of their proposed thesis/project. The supervisors should guide the students to follow, but not limited to, the following best-practices as shown in **Table 1.6.2 (b) :**

Table 1.6.2 (c) :Best practices for students to follow

a.	Ensure proper research and background knowledge is acquainted
b.	Feasibility study is conducted on the proposed thesis/project
c.	Scope of the thesis/project is precise and crystal clear
d.	Generating and comparing alternative designs to determine best match for the requirements
e.	Roles & responsibilities of individual student working within the group is clear and accepted
f.	Able to apply thesis/project resources as per the approved thesis/project plan
g.	Track and report any issues and risks in completing assigned tasks
h.	Both logical and physical design aspects are analyzed
i.	Proper programming standards are maintained during the development of the thesis/project
j.	Auto or Manual Test Cases are implemented and executed
k.	Source control with versioning tools are used for developing as a team
l.	Documenting required deliverables using industry standards
m.	Participating in Seminars, Events, Publications and Workshops relevant to the thesis/project

1.7. Group Leadership

Every final year thesis/project group is assigned with a Group Leader (GL) who is essentially a cross- functional key player working within the thesis/project group. It is extremely important to get the right student within each group fit for the role of team leader which is crucial for the success of any thesis/project. GL is preferably the student with highest CGPA among other group members. Team leader should work very closely with the supervisor with the following, but not limited to, the primary tasks as given in **Table 1.7.1**:

Table 1.7.1: Primary tasks of the team leader

a.	Provide input on the performance of team members
b.	Resolve any conflicts within group members and maintain healthy group dynamics
c.	Inform supervisor of any task delays and meeting hours change requests from students
d.	Ensure rest of the group understands their roles and responsibilities on the assigned tasks;
e.	Coordinate with internal or external thesis/project stakeholders on behalf of the team
f.	Provide weekly status report – completed and signed by each team member as per the Schedule

Note: During the course of the thesis/project, if the supervisor finds team leader is not performing as per the above expectations, the supervisors can request for the replacement of team leader with an alternative group member fit for this role.

1.8. Students Responsibility

During the Final Year Project, students are responsible for the following as provided in **Table 1.8.1**.

Table 1.8.1: Responsibilities of students during Thesis/Project

a.	Agree with their assigned supervisors on the topic
b.	Perform weekly tasks, assigned by the supervisor (or distributed by the team leader)
c.	Discuss problems and seek advice from the supervisor in order to accomplish the assign

	tasks.
d.	Provide supervisor weekly status reports and get his/her feedback
e.	Apply recommendations to refine the previous task
f.	Finalize the thesis/project proposal and implementation, incorporating all the feedbacks andcomments provided by the supervisor and evaluators.
g.	Conduct presentation at the end of each semester and defend thesis/project to the evaluation panel

1.9. Late Submissions

It is the responsibility of each group to ensure they complete the milestones of each semester and submit deliverables by the cutoff submission date. No thesis/project will be accepted after the cutoff date and necessary actions will be taken as per the supervisor and the evaluation committee decision policy.

1.10. Plagiarism

Each thesis/project must be the original work of student groups. At the end of each semester, students will be required to present their thesis/project proposal and implementation outcomes as per the provided deliverables guidelines and the original work undertaken throughout each semester.

In the Thesis/Project, for instance, if students have taken ideas or referencing other work as part of the proposed thesis/project, then, it must be cited and reference should be clearly specified. Same is the case while implementing the proposed solution. For instance, if students are developing thesis/project using 3rdparty tools and libraries, it must be referenced and relevant comments and notes must be highlighted and will not be regarded as part of the original work of student groups. Hence, it is extremely important to note that it is the responsibility of students to ensure they are not plagiarizing knowingly or unknowingly.

In order to prevent plagiarism related issues, students are encouraged to get familiar with plagiarism specified in [1] and general referencing guidelines specified in [2].In order to prevent plagiarism related issues during implementation, students are strongly encouraged to get familiar with software plagiarism specified in [3]. Students can get the plagiarism report via Turnitin

account [4]. The report must be verified and signed by the supervisor. The maximum plagiarism from different sources should not exceed 20%.If students are found plagiarizing either in thesis/project proposal report or in the thesis/project implementation solution/code, immediate strict action will be taken as per the university policy.

References:

[1] PLAGIARISM.ORG, Available Online:http://plagiarism.org

[2] London South Bank University, "How to do your referencing: Numeric Style", Available Online:http://www.lsbu.ac.uk/library/helpsheets/hs28.pdf

[3] Neal R. Wagner, University of Texas, Plagiarism by Student Programmers, Available Online: http://www.cs.utsa.edu/~wagner/pubs/plagiarism0.html

[4] https://www.turnitin.com/