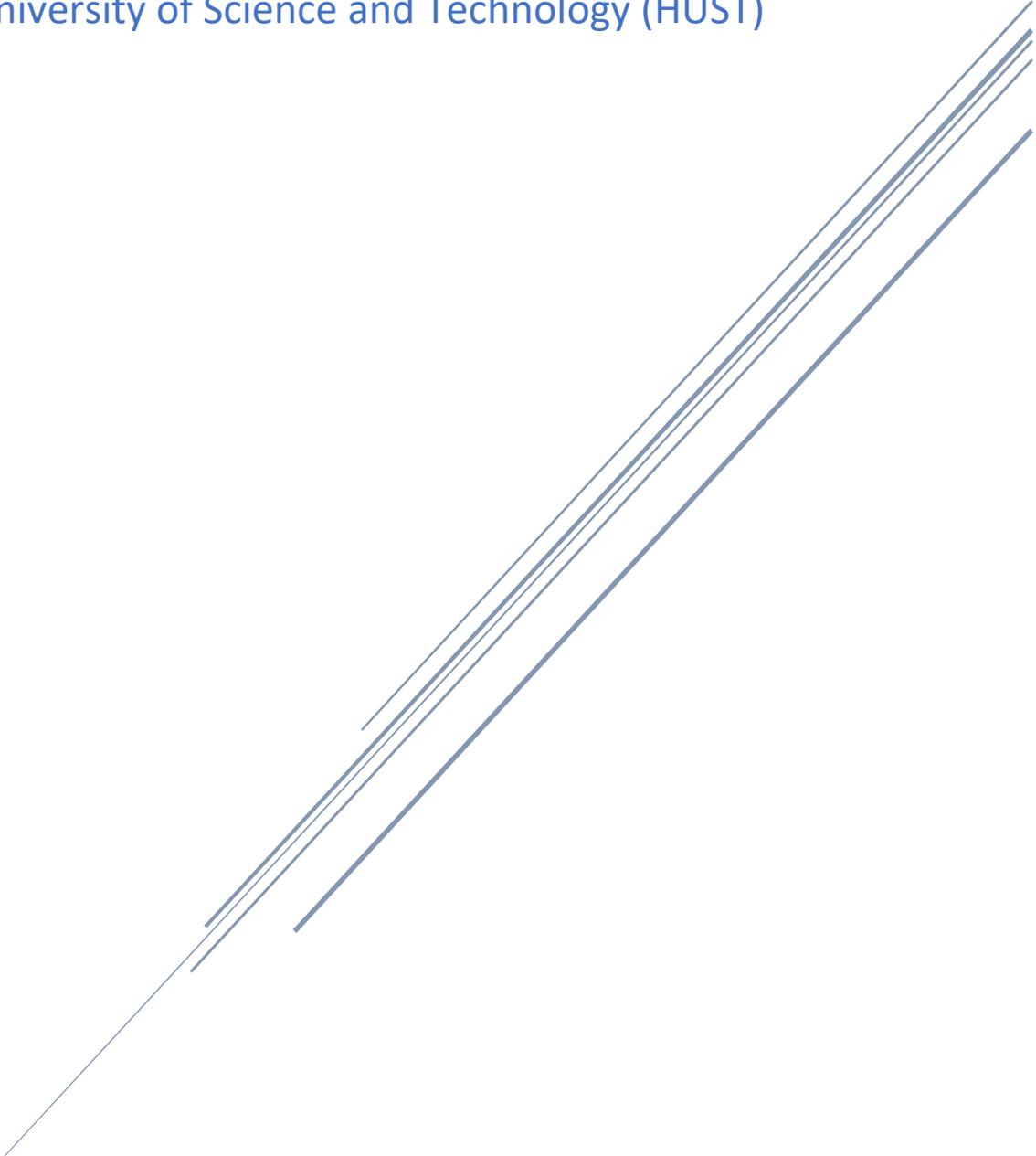


# OBJECTIVE 2 – QUALIFICATION BENCHMARKING

Bachelor in Cyber Security

Hanoi University of Science and Technology (HUST)



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## Introduction

The Bachelor in Cyber Security at Hanoi University of Science and Technology provides fundamental concepts and applications of information technology and how they can be applied to business, finance and economics. This is a multidisciplinary programme and for this benchmarking exercise we focus only on modules/courses related to data analytics.

For this benchmarking exercise we have developed a scoring matrix where we identified 5 themes (programming, knowledge management, knowledge abstraction, knowledge representation/communication and research/soft skills). **Programming** theme entails criteria related to design and development of not only software, but also other artefacts like algorithms, network, IoT framework etc. The theme also includes the evaluation process and collaborative management of the artefacts. **Knowledge management** primarily focuses on processes and techniques of warehousing different types of data. The theme also includes security and privacy issues related to data management. **Knowledge abstraction** theme focuses on different data analytics and machine learning techniques applied to different types of data. **Knowledge representation/communication** theme includes different visualisation techniques used to represent the results (from database query through to data analytics to algorithm) to a wide range of stakeholders. **Research/Soft skills** theme focuses on the understanding and practice of research methods along with the ability to undertake teamwork and present results to a wider audience.

Within each theme, we have a set list of criteria against which each course is scored. The score is within the range of 50 – 100. 90 – 100 (fully meets the criteria); 75 – 89 (mostly meets the criteria); 60 – 74 (partially meets the criteria); 50 – 59 (barely meets the criteria). The marks are indeed subjective and therefore debatable. However, the pattern that emerges as a result of the scoring of each module/course provides a holistic view of the programme and clearly identifies the areas of strengths and improvements.

## Design of the programme

1. This 132/180 credit programme equips students with the capability to address cyber security challenges with the ICT sector. The programme has two levels, Bachelor degree with (132 credits) and engineering degree (180 credits) that take 4 years and 5.5 years respectively.
2. The programme provides a strong foundation in mathematics and basic science (32 credits) covering calculus, algebra and statistics (both probabilistic and applied). Here also students are introduced to programming and experimental design.
3. The basic and core modules (47 credits) are labelled under Engineering but are mostly IT related courses. In addition to the engineering/IT related courses, the programme also has soft skill development related courses (9 credits) that facilitate the development of skills in technical writing, presenting, and project management.
4. For specialisation, the course offers a wide range of elective courses (17 credits) where students can specialise in areas like biometrics, blockchain or forensic.
5. Finally, students for the bachelors undertake internship and thesis/courses (8 credits) to gain industrial and academic research experience.
6. For the engineering degree, the next 1.5 years comprises of undertaking compulsory courses (19 credits) that provide advanced security engineering related subjects like wireless security as well as a project that addresses a real-life scenario.
7. The engineering degree also includes elective courses in advanced security engineering like mobile and IoT security and a project.
8. The engineering degree completes with an internship and thesis.

9. For this benchmarking exercise only data/computer science related courses were evaluated.

## Mode of Delivery

10. All courses are delivered in English and have theory, practice and self-study credit hours. From the course structure document, we could not identify any course with allocated self-directed study time.
11. Most of the courses are theory based and as such assessments are exam/class test based.
12. The programme provides a strong emphasis on soft skill development with technical writing and presentation as a mandatory course.
13. From the documents provided, it is not clear how the theory part of each course is delivered. A strong foundation in maths and the development of soft skills create a multidisciplinary mindset for the students, which in the long run helps them to understand the mathematical theory (e.g. cryptography) behind security, privacy etc.
14. For practical sessions, information regarding class size and available resources is necessary to evaluate the effectiveness of the practical sessions.

## Learning and Teaching

15. The programme offers a wide range of topics with its 77 courses/modules for the bachelors and additional 15 courses for the engineering degree. This is primarily due to the low credit value (2 usually) for the associated modules. However, delivering such a wide range of courses requires resources and may impact module quality. Therefore, combining some modules would benefit the students as well as staff, in terms of resources and quality.
16. The programme provides an excellent foundation for mathematics (algebra etc.) and statistics. This is critical for all computer science related modules. However, due to the low number of programming related courses, students may not develop the required programming skills.
17. For IT related industries, user requirement gathering (in relation to security) and analysis is pivotal. The programme would benefit from more emphasis in this regard.
18. With regard to cyber security, the industry 4.0 era introduces a new dimension of challenges, courses addressing or outlining these emerging challenges would benefit the students.
19. The programme has only one course related to data management (Databases). The course also lacks cloud-based unstructured/real-time data warehousing systems like AWS/Datalake.
20. Critical understanding about code sharing (github etc.) seems to be missing. For data science programmes it is important that students are aware and have experience of code sharing, documentation and different licenses used for open-source software/algorithm development.

## Assessment and feedback

21. No information was available with regard to assessment or exam samples.
22. No information was provided as to how student feedback is captured, evaluated and utilised for the improvement of the courses.

## Conclusion and Recommendations

### 23. Teaching modality

- a. More discussion-based teaching approach including flip classroom type teaching model could be introduced to increase student engagement and self-directed study.
- b. Industry 4.0 focused case studies could be implemented to get more knowledge about different real-life projects, their short comings etc.

### 24. Teaching content

- c. Low code/No code-based programming are becoming popular (10.3390/electronics10101192) in universities with the rise of online education and as a result of COVID-19. Adaptation to new trends will help students to develop new applications/algorithms more easily. This impacts not only skill development but confidence also.
- d. More emphasis can be given to scripting languages like Python as well as users' requirement analysis.
- e. Less emphasis can be given to remotely related subjects like psychology, physics.
- f. Analysis of real-life data from different domains (finance, healthcare, social media etc.) is essential to get an understanding of different design, development and deployment of IT in these domains.
- g. Engagement with stakeholders and requirement capture is pivotal. Therefore, with different types of programming/machine learning courses these aspects need to be included.
- h. Use of online content/courses can introduce students to new topics and a choice of learning sources (in contrast to recommended book). This diversity of content and modality of delivery not only helps students to be in line with current trends but also initiates peer learning.
- i. Skill development on code sharing (through github etc.) and open licence needs to added to the course curriculum along with collaborative code development (e.g. Google Colab, AWS).
- j. Basic understanding of how to protect intellectual property rights related to algorithms and the process of protecting these rights through third party.
- k. Critical understanding of research methods in higher education and steps involved from idea generation through to publication and/or application can be incorporated.
- l. Basic knowledge of social media-based profile creation e.g. LinkedIn profile that will facilitate future job prospects can be incorporated to develop profile.

### 25. Assessment

- m. More emphasis on project based assessments (instead of exams) would help students to get experience of team work and other aspects of project management.

