ASIIN

ASIIN Seal &Euro-Inf-Label

Accreditation Report

Bachelor's Degree Programmes
Software Engineering
Information Technology

Provided by
National University of Mongolia

Version: 28 June 2019

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for[1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Програм хангамж	Software Engineering	ASIIN, Euro-Inf® Label	National Commission of Education Accreditation 2011-2017	04
Мэдээллийн технологи	Information Technology	ASIIN, Euro-Inf® Label	-	04
Date of the contract: 21.06.2017				
Submission of the final version of the self-assessment report: 03.07.2017				
Date of the onsite visit: 19.-20.10.2017				
at: National University of Mongolia, Ulan Bator, Mongolia				
Peer panel:				
Prof. Dr. Bettina Harriehausen-Mühlbauer, Hochschule Darmstadt;				
Prof. Dr. Jürgen Friedrich, Universität Bremen;				
Zorig Gunjee, Mongolian University of Science and Technology, Director for Research and Innovation;				
Tugsbayar Bat-Ulzii, Student Peer Mongolian University of Science and Technology				
Representative of the ASIIN headquarter: Dr. Martin Foerster				
Responsible decision-making committee: Accreditation Commission for Degree Programmes				

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[1] ASIIN Seal for degree programmes; Euro-Inf®: Label European Label for Informatics
[2] TC: Technical Committee for the following subject areas: TC 04 - Informatics/Computer Science.

Criteria used:	
European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria, as of 10.03.2015 Subject-Specific Criteria of Technical Committee 04 – [Informatics] as of 09.12.2011	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Software Engineering	B.Sc.	/	6	Full time	/	8 Semester	120 Mongolian Credit Hours	Fall Semester / 1994
Information Technology	B.Sc.	/	6	Full time	/	8 Semester	120 Mongolian Credit Hours	Fall Semester / 2002

For the Bachelor's degree programme Software Engineering the institution has presented the following profile in the self-assessment report:

„The SE program is for full time Bachelor degree students of software engineering. This program is designed to be integrated with mathematics, computer science and engineering. The purpose is to prepare the professionals who are equipped with general mathematics and computer science knowledge; skilled with professional software engineering education; able to utilize their knowledge of software engineering environment, methodologies and technologies in practice; able to improve their professional skills and develop themselves; able to function effectively in a team and individually; able to solve the problems individually or by managing a project; able to work with high professional ethics and have required English language skills."

For the Bachelor's degree programme Information Technology the institution has presented the following profile in the self-assessment report:

„The IT program is for the full time Bachelor degree students of information technology. The purpose is to prepare the professionals who are equipped with core knowledge and skills of computer science and information technology; able to use latest technologies and methods in information technology in practice; continually learn to stay competent; work with high professional ethics; able to communicate with others clearly and have required

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[3] EQF = The European Qualifications Framework for lifelong learning

English language skills. In addition these professionals are able to find appropriate solutions by determining information technology needs in an organization; able to administer and manage the practical installations; and bring together necessary components in system integration."

C Peer Report for the ASIIN Seal[4]

1. The Degree Programme: Concept, content & implementation

> **Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)**

Evidence:

- SSC-based Objectives-Module-Matrices for all programmes in the respective Self-Assessment Reports

Preliminary assessment and analysis of the peers:

For all study programmes under review the HEI presented a list of programme learning outcomes as well as Objective-Module-Matrices matching the respective learning outcomes of the modules with the learning outcomes of the programmes. The peers learned and appreciated that the curricula have been continuously modified and developed within the last years (changes have been introduced in 2010, 2012, 2013 and most recently2015) in terms of internationally recognized bodies of knowledge. Thereby the opinion of local employers is taken into account on a regular basis. However, in the discussion with the industry representatives it became clear that there is a certain variety of enterprises ranging from Mongolian government and independent Mongolian enterprises to international (especially Japanese and Korean) enterprises that may require partly different skills from their employees and not all can be satisfied.

The described learning outcomes as well as the Objectives-Module-Matrices were considered by the peers to be generally precise, detailed but not over-extensive, moreover covering all important aspects of the Subject-Specific-Criteria of the ASIIN Technical Committee 04 Informatics (SSC 04). For all programmes the coordinators defined a set of general educational objectives and programme specific learning outcomes (see Appendix) that have been matched with the SSC of the Technical Committee 04. In another matrix the defined programme outcomes have been related to the respective module categories (such

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[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

as Computing essentials, Mathematical and engineering fundamentals, etc.) thus clearly indicating in which module are being conveyed which qualifications. Nevertheless, the peers recommended, that the learning outcomes should emphasizes more clearly the distinction between the programmes although they agreed, that both programmes are closely related. The Software Engineering programme has a stronger focus on programming while Information Technology stresses the wide range uses of Information Technology in different stages of implementation. This distinction should be made clear in the learning outcomes for the relevant stakeholders. Further, the structure and outline of the courses and curricula of the two programmes were presented in a slightly different way of denomination. For example, Software Engineering first comprises modules of the body of knowledge "Computing essentials" while Information Technology denominates the category "Information Technology Fundamentals" and so on. In the discussions on site it was made clear that these differences are being based on the fact that both designs were created in different contexts but to the peers it seemed important that both programmes follow the same structure in order to allow for a clear understanding as well as distinction.

Consequently, the peers understood that students in Software Engineering gain knowledge in the fundamentals of Software Engineering and Mathematics. In the course of study they shall be enabled to analyse and solve computing problems as well as to identify and document the customers' needs. They know how to use software tools, possess administrative skills and can work in teams. Additionally, aspects of professional ethics are known to them, they are aware of their responsibilities and know the norms of professional computing practice.

Similarly, in Information Technology the students are being equipped with core knowledge and skills of Computer Science and Information Technology as well as Mathematics. They are able to find appropriate solutions by determining information technology needs in an organization, can administer and manage the practical installations and bring together necessary components in system integration. As with Software Engineering the graduates shall also be qualified to work in teams, communicate their research results and take responsibility for professional, ethical, legal, security related and social problems.

Furthermore, the University applies for the Euro-Inf® (European Informatics) Label for the Bachelor Software Engineering and the Bachelor Information Technology. The Euro-Inf® Label is a quality certificate for informatics degree programmes and is recognized Europewide. During the accreditation process, the reviewers moreover verified whether the degree programmes comply with the criteria fixed in the Euro-Inf® Framework Standards, operationalized by ASIIN SSC 04. The Subject-Specific Criteria (SSC) of the Technical Committee for Informatics are closely linked to the Euro-Inf® Framework Standards; consequently,

the analysis of the Subject-Specific Criteria encompasses the Euro-Inf® Framework Standards. The peers confirm that the Euro-Inf® Framework Standards regarding the intended learning outcomes are largely fulfilled for the Bachelor Programmes in line with the Bologna Declaration.

In conclusion, the peers clearly saw that the described learning outcomes for both degree programmes adequately reflect the ASIIN Subject-Specific Criteria as well as the EQF-level 6 for Bachelor programmes.

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Report

Preliminary assessment and analysis of the peers:
The panel considered the names of the study programmes to be adequately reflecting the respective aims and learning outcomes.

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Report
- Curriculum for Software Engineering
- Curriculum for Information Technology
- Module Descriptions

Preliminary assessment and analysis of the peers:
The curricula of all study programmes under review were being reviewed by the panel in order to identify whether the described learning objectives can be achieved by the available modules. This proved difficult insofar as the HEI provided a study plan broken down to each of the eight semesters only in Mongolian. A translation of the study plan clearly indicating which courses need to be taken in which semester will be provided by the HEI in the aftermath of the on-site-visit. Further, the plan provided in the student handbook proved to be incorrect in its presentation of semester workload. The columns indicating the total number of credit hours per semester were not correct or, as it appeared, belonged to the following semester. This was discussed with the programme co-ordinators and should be corrected immediately. Nevertheless, with the great help of the local peers and the programme responsible the panel was able to understand the curricula and for all modules translations of the learning outcomes were provided offering the possibility to trace if the curricula adequately reflect the described programmes objectives.

From the present documentation the peers could see that students of <u>both programmes</u> have to pass a number of general education courses prescribed by the government. These are elective courses comprising eight categories out of all subjects available at the University. In each category one module of three credit hours needs to be selected. Only out of the categories of "Natural Sciences" and "English and other languages" the students have to take two modules.

In the following in <u>Software Engineering</u> the courses are divided into core and major programme courses each again divided into mandatory and elective courses. As of core modules the students have to pass Engineering Mathematics and Engineering Physics in semester two and three with additional courses such as "Basics of Algorithms", "Programming Language C", "Database Fundamentals", etc. In semester four the students start taking major programme courses including subjects such as "Computer Structure and Assembly Language", "Visual Programming", "Software Engineering Design and Architecture" or "Software Project Management". This can be supported by electives such as "Artificial Intelligence" or "Cyber Security".

<u>Information Technology</u> largely follows the same structure. After the general education courses students pass the same mandatory core courses "Engineering Mathematics" and "Engineering Physics" and several elective courses. Differences first appear at the level of major programmes courses where students take courses such as "Platform Technologies", "System Integration and Architecture" or "System Administration and Maintenance". Further, electives can be chosen such as "Data Structure and C Programming Language Project/Data Structure and Algorithm Analysis", "Game Programming" or "Introduction to Pattern Recognition".

The peers were of the opinion, that the presented curricula support the achievement of the envisaged programme learning outcomes. Nonetheless, in the discussion with the industry representatives it discussed, that some aspects of innovative technologies such as Big Data could be strengthened in the curricula. Another aspect in which, according to the employers, graduate skills could be improved is communication. Since the communication with clients as well as among each other in working teams is essential in IT companies these are skills that could be enhanced in form of project management modules or as an integrative part of the already existing courses.

Criterion 1.4 Admission requirements

Evidence:
- Self-Assessment Report

- 2016 Full-Time Undergraduate Admission Procedure of the National University of Mongolia

Preliminary assessment and analysis of the peers:

From the "2016 Full-Time Undergraduate Admission Procedure of the National University of Mongolia" the peers gathered all relevant information about the admission requirements. In general, all students completing school take the General Entrance Examination which is conducted by the Education Evaluation Centre (EEC) of the Ministry of Education Culture and Science (MECS). Those with the highest score may first select their desired majors after passing the year of general education. The programmes of Software Engineering and Information Technology at the NUM require a high score and are usually frequented by those students with the best results. With the entrance regulations thus determined by the government the peers found the admission requirements for all programmes suitable and well-defined.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

The peers appreciate the additional material presented by the HEI. Especially the translated curriculum structure facilitates their understanding of the content and structure of the degree programmes under review. Notwithstanding, they still consider it important that the differentiation of the general learning outcomes of both programmes should be more specified on the programme websites or other places accessible to interested stakeholders. Therefore, the peers consider the criterion to be partly fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Report
- Curriculum for Software Engineering
- Curriculum for Information Technology
- Module Descriptions
- Audit discussions

Preliminary assessment and analysis of the peers:

<u>All study programmes under review</u> are divided into modules which comprise a sum of teaching and learning. The panel found the structure of the modules in general to be adequate and manageable. The only problem with the modularized structure refers to the bachelor thesis. For the peers it was not clear from the beginning that the Bachelor theses are not only prepared in the context of the three-credit-hour-course "Bachelor thesis", but also in two other courses consisting of an internship and a research class. Thus, in total, the whole bachelor thesis comprises not three but seven credit hours. In order to avoid misunderstandings the peers see the need to clearly reflect the Bachelor Thesis within the modularization.

As described above, the curricula offer a great variety of electives, leaving sufficient options for the students to set individual and flexible focus on certain specializations. Furthermore, the curricula are constantly being revised and adapted to the changing demands from future employers although, as indicated above, the demand in Mongolia is manifold. In general, the peers were convinced, that the programme structures allow for an individual yet goal-oriented order of study in the designated time.

During the one-site-visit the peers learned that many courses encompass practical approaches that provide students with the necessary experience required for working in industry. This aspect should be also be clearly outlined in the module descriptions (see criterion 5.1)

International mobility is of growing importance to the National University of Mongolia. The panel was pleased to see that a majority of the students plans to go abroad while some others have already done so. The University has many co-operations on a global scale, especially partnerships with Korean and Japanese universities are important. The peers were convinced that recognition of competences and achievements acquired at other universities is flexibly dealt with and that students are well informed about the procedure. In general, students and examination board stipulate a learning agreement indicating which courses will be attended abroad and could be recognized by the NUM afterwards.

Criterion 2.2 Work load and credits

Evidence:

- Self-Assessment Report
- Curriculum for Software Engineering
- Curriculum for Information Technology

- Module Descriptions
- Audit discussions

Preliminary assessment and analysis of the peers:

The peers learned during their on-site visit as well as from the self-assessment report that work load in Mongolia is calculated along credit hours, one credit hour being equivalent to 44 and 48 time hours, depending on the type of exercise. Most modules consist of two or three credit hours, students usually take about 15 credit hours every semester or 30 per year with a total of 120 credit hours during the degree programme. The number of credits is more or less equally distributed throughout the semesters although it is important to the University that the exact workload is open to individual wishes of the students. Thus the minimum of credit hours per semester is 6 while the maximum is 21, offering the possibility to finish studies not within eight but also in seven semesters if desired. The courses taken are being registered by the internal SiSi-programme thus guaranteeing that the students fulfil at least the minimum of their workload. In the discussion with the students they also expressed their general satisfaction with the workload and its equal distribution.

Criterion 2.3 Teaching methodology

Evidence:

- Self-Assessment Report
- Audit discussions

Preliminary assessment and analysis of the peers:

It has already been outlined that teaching in both programmes includes many practical approaches which was welcomed by the peers. In general, teaching includes lectures, classroom exercises, tutorials, group exercises, laboratory work, group and individual projects as well as seminars. From the discussion with the teaching staff it became apparent that the teaching methodology includes modern didactical approaches and technological innovations. Materials for all modules are being presented via SiSi to the students where also details about the schedule, assignments, etc. are made accessible. Several staff members explained to the panel how they involved practical approaches and real-life project work into their courses in order to keep up student enthusiasm. The peers liked how the teaching staff emphasized industry co-operations in order to prepare their students to normal work cycles, project management and industry demand.

In sum, the peers were convinced that the teaching methodology applied in the programmes under review is adequate and ensures the learning progress of all students.

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Report
- Audit Discussions
- On-site-visit

Preliminary assessment and analysis of the peers:

The panel had a very good impression from the offers related to support and assistance of the students. Each year the new students are being assigned to one student advisor who takes care of the group and is the first and foremost contact for all problems and issues concerning University life. They are especially of importance when it comes to choosing courses for the next semester, define specializations, etc. In general, the peers gained the impression of a very familiar atmosphere at the Department; students and teaching staff work closely together and follow an "open-door" policy. Concerning international exchange there is also in international office available to the students which many of them had already contacted and considered to be very helpful. Consequently, the peers deem the support and assistance offered to the students as suitable for a successful study progress.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

The HEI did not further comment on the peers' description assenting to their analysis. In conclusion, the peers maintain that it is important that the full volume of the Bachelor thesis is reflected in the modularized structure of the programmes, thus considering this criterion to be partly fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self-Assessment Report
- Module Descriptions
- Audit discussions

Preliminary assessment and analysis of the peers:

Each course-content in the reviewed study programmes is reflected in exams which are distributed in two examination periods each semester, the midterm and the final period. The exams are usually taken in the form of a written test while alternative examination forms such as homeworks, quizzes, project works and presentations are used as additional tasks. The dates of the exams are scheduled in advance at the beginning of each year while the type of the exam is announced to the students at the beginning of each semester. To the peers the high amount of exams including two exams per course per semester and additional presentations or project works seemed very abundant but the discussion with the students revealed that they preferred this high number of smaller exams over a reduced number of larger exams.

Concerning re-sits the peers understood that a repetition of one exam is not possible. Students have to re-take the whole course. While this at first seems harsh it makes sense taking into account that students would have to fail several examinations forms in one course in order not to pass it. Of the 100% of the course points usually 10% result from mid-term exam, 40% result from final exam while another 50% result from additional tasks such as self assessment work report, course participation etc. In order to fail the course students need to have less than 60% which means that even a very low result in one of the exams would still allow the student to pass the course. In this construction to the peers it seemed plausible since to fail a course would signify that the student failed in a variety of examinations and should better repeat the whole content.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

The HEI did not further comment on the peers' assessment since they all agreed this criterion to be completely fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:
- Self-Assessment Report
- Audit Discussions

Preliminary assessment and analysis of the peers:

On the basis of the information given about the staff of both programmes in the self-assessment report the peers gained the impression that generally sufficient teachers are available in order to sustain the two programmes during the accreditation period. At the moment the student-teacher-ration is given 15:1. However, a critical point in the assessment of the peers was the still limited number of teaching staff with a PhD. Although the peers learned that the political aim of the NUM as well as the faculty is to increase the number of PhD-lecturers to more than 80% in 2024, the actual number of lecturers with a PhD was not very high although this would be important for the further qualitative development of the programmes. The peers emphasized that they did not question the general qualification of the staff members but that an adequate percentage of lecturers with a PhD degree should be aimed for. The numbers and information offered in the documents could help only little to clarify this aspect since many of the lecturers with PhD listed appear to be only retired professors that offer one course per semester while from several others listed as PhD candidates it was not apparent when or if their PhD would ever be completed. This is especially concerning since the peers learned during the discussions that to make a PhD in Mongolia parallel to the teaching responsibilities and other research activities appears to be very difficult. Hence, the large majority of the lecturers with PhD made their PhD in foreign countries. While this is generally nothing to criticize it means that they are not present at the NUM for years to teach but are listed as employees of the NUM due to contracts that binds them to return after the completion of their PhD and teach for at least five years. While all these measures were not of concern for the peers they concluded two things. First, it is necessary to provide a matrix of teachers and teaching responsibilities for the two respective programmes outlining who teaches which courses resulting in which workload for each lecturer. To get an overall view of the lecturers' workload the matrix should include also teaching obligations of the lecturers in other study programmes. This would allow an assessment of whether the teaching load is equally distributed as well as of how many of the major and core courses are actually given by lecturers holding a PhD. Secondly, the peers considered it necessary to design a development plan with concrete measures indicating how the number of lecturers with a PhD will be increased, especially in the major courses.

Criterion 4.2 Staff development

Evidence:

- Self-Assessment Report
- Audit Discussions

- On-site-visit

Preliminary assessment and analysis of the peers:

The offers concerning staff development were assessed to be very positive by the panel. Regularly workshops subject-specific as well as didactical are offered to the teaching staff and many partake in these courses. Further, young lecturers are being tutored by more experienced mentors who discuss teaching methods with them and try to improve classes. Additionally, interested lecturers meet regularly and informally to discuss didactical issues and visit each others' courses for mutual evaluation. The lecturers also express their contentment with international opportunities such as Erasmus+ and Erasmus mundus allowing them to go abroad and learn from didactical experiences in other countries. Concerning research the NUM offers the possibility to take one semester off in order to finish research projects such as the PhD or to do research in other countries with full payment. This can also be extended up to a year but then without payment. This regulation was positively approved by the peers although it appeared that only few of the lecturers made use of this offer shying away from administrative tasks and the fear not to be able to present sufficient progress at the end of the semester. One indicator for this is that the overall number of publications of the lecturers is quite limited. Consequently, the peers encourage the lecturers to make use of this existing opportunity especially in the context of the above-mentioned scarcity of lecturers with PhD degree.

Criterion 4.3 Funds and equipment

Evidence:

- Self-Assessment Report
- Audit Discussions
- On-site-visit

Preliminary assessment and analysis of the peers:

The peers found that the funding and the equipment of the programmes were adequate although this was not clear from the self-assessment report in advance. The funding of the programmes is based by 90% on the student fees, only a small amount of funding is coming from government resources. From the discussions with the programme coordinators the peers learned that this is currently changing but due to the in times turbulent political circumstances in Mongolia it cannot be certain. Therefore, the financial coverage of the programmes through student fees might also be a reassuring factor. While from the self-assessment report the peers knew only of three laboratories, all pure computer rooms, the

reality presented was quite different. In fact, many courses from both programmes include laboratory sessions in a great variety of specialized laboratories although they do not genuinely pertain to the Department. Hence, the presentation in the SAR resulted from a misunderstanding. During the on-site-visit it became clear that especially in the newly built library there are modern laboratories also used by the two degree programmes. Consequently, the peers ask for a revised list of laboratories including all the laboratories actually used and indicating in which courses which laboratories are being frequented (see also criterion 5.1). Notwithstanding, considering the fact that computer science programmes strongly rely on internationally published research results, the number of professional English publications (books as well as journals) in the library should be further increased. Additionally, in discussion with the students some points were mentioned which could be confirmed during the visit of the premises. The students asked for more work rooms in the buildings apart from the lecture rooms. These can only be used if no classes are given and the open spaces in the building appeared to be very limited. Complementary to this request, students asked for high-speed internet throughout the building which, of course, would be a necessary requirement for students' rooms so that they can do their work on their private laptops anywhere in the faculty.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

The peers could improve their understanding the teaching workload and the relation of capacities and courses from the additional documents presented by the NUM. Nevertheless, they still maintain, that for the future the NUM needs to present a development plan indicating how the number of PhD-Graduates among the teaching staff can be continually increased. Consequently, the peers consider this criterion to be partly fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Module Descriptions

Preliminary assessment and analysis of the peers:
The panel found the module descriptions to be in very good order and especially the described learning outcomes to be up-to-date with international standards. Each description offers detailed information about the course outline, its content, the lecturer, distribution

of workload and the composition of the final grade. Thus, the peers criticized only some minor aspects. In the descriptions not only the number of exams should be indicated, but also the examinations forms such as oral, written, alternative, etc. Further, it was considered helpful if the descriptions gave information about the aspects of practical work that form part of the module and also in which laboratories this practical work will be done. Since the peers learned during their on-site-visit that the University offers a variety of well-equipped laboratories which are only partly used by the respective degree programmes this would be a helpful indicator to the practical quality of the courses. Also, the peers lamented that apparently not all descriptions included a list of used or recommended literature for the course. However, apart from these points the panel was satisfied with the descriptions and considered them a helpful asset to all stakeholders.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Self-Assessment Report

Preliminary assessment and analysis of the peers:
In the self-assessment report the HEI claimed that all students receive a Diploma Supplement together with their final Diploma. This was again confirmed during the on-site-visit. But since these documents could not yet be presented in English translation it was requested by the panel that the university does so in the aftermath of the visit.

Criterion 5.3Relevant rules

Evidence:

- Regulations for examination, admission, etc. are added to the Self-Assessment Report
- Audit discussions

Preliminary assessment and analysis of the peers:
The peers realized that regulations for all important aspects of student life and the respective degree programmes have been issued by the HEI and are accessible to the students either through the University website or via the online platform SiSi. During the discussion with the students, they made sure that all participants knew perfectly well where to find any regulations, whom to contact, what are their rights and their duties. It might only be considerable to strengthen the presence of English documents such as module descriptions

on the website (most regulations are already presented in English) in order to enhance the programmes' international visibility.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

With the additional documents handed in by the NUM Diploma Supplements in English language were presented to the peers including all required information. In its comment on the report the HEI agreed with the assessment of the peers including the required revision of some of the module descriptions. Consequently, the criterion is assessed to be partly fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:
- Self-Assessment Report
- Audit discussions

Preliminary assessment and analysis of the peers:

From the self- assessment report as well as the discussions during the on-site-visit the peers got a very good impression of quality management system in operation at the NUM and in the respective programmes. An online evaluation of each course is mandatory; students have to take it before being allowed to register for the examinations. The results of the evaluations are being reported by the department to the university level together with propositions about possible changes and improvements. Further, the department checks the average distribution of grades for each course on the SiSi network; if irregularities are being detected the lecturers are contacted and the reasons for the deviations are discussed. If the pedagogical or didactical improvement is considered necessary lecturers have to attend courses at the university's teaching training centre.

During the discussions it also became clear that after turbulent political times the NUM has recently started to reform its general concept of quality management introducing evaluations of students, graduates and employers. The peers welcome this overall approach and support the NUM's endeavour to centralize certain aspects of its quality management procedures. Apart from this, it also became clear that in the respective degree programmes

lecturers, programme co-ordinators, employers and students are in very close contact with each other, discussing openly critical issues and asking for feedback. Since the number of students is limited the panel got the impression of a very familiar atmosphere. Lecturers meet on a regular basis to discuss student feedback and proposed improvements if criticism is expressed. In conclusion, the panel was convinced that a variety of quality management measures are being implemented and that critique can be expressed by all stakeholders at any time. Thus, they were positive that the quality management at NUM is adequate and aiming at an on-going improvement of the programmes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

The peers consider the criterion to be completely fulfilled.

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

D 1.Matrix of teachers and teaching responsibilities for the two respective programmes. To get an overall view of the lecturers' workload the matrix should include also teaching obligations of the lecturers in other study programmes.

D 2.Results of the latest alumni survey

D 3. Present a translated study plan demonstrating which courses should be taken in which semester

D 4. List of all laboratories which are commonly used in the course of programme modules indicating in which courses they are used

D 5. Diploma Supplements in English language

D 6. A homogenized structure and outline of the courses/curricula of the two programmes along the Body of knowledge

E Comment of the Higher Education Institution (14.11.2017)

The institution provided a short statement as well as the following additional documents:

- A homogenized structure and outline of the courses/curricula of the two programmes along the Body of knowledge
- Teacher Workload Report
- Alumni Survey
- Translated Study Plan
- List of Labs
- Diploma Supplements

The following quotes the comment of the institution:

„ We have gone through the Accreditation Report carefully. It appears that the peers, who visited us onsite, and the peers, who worked on the report we sent, understood the two program implementation processes and our university system very well. I totally agree with the assessment and analysis of the peers.

Though, we have the most reputation nationally and well recognized nationwide, we came to know our weaknesses and improvements during this process we worked with the peers. We will be continually improving our programs under the national and international standards and guidelines for quality assurance in the higher education area even after the accreditation process is finished."

F Summary: Peer recommendations

Taking into account the additional information and the comments given by the HEI the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Software Engineering	With requirements for one year	Euro-Inf	30.09.2023
Ba Information Technology	With requirements for one year	Euro-Inf	30.09.2023

Requirements

A 1. (ASIIN 4.1) Present a development plan approved by the Dean indicating by which concrete measures such as financial and time management the number of PhD-Graduates among the teaching staff will be significantly increased in the accreditation period.

A 2. (ASIIN 1.1) Specify the general learning outcomes in order to clearly outline the differences between both degree programmes.

A 3. (ASIIN 5.1) Rewrite the module descriptions so as to include information about the examination forms, teaching methods and practical work included as well as the laboratories in which this is performed. Further, lists of required or recommended reading should be included.

A 4. (ASIIN 2.1) Ensure, that the full volume of the Bachelor thesis is clearly reflected in the modularized structure.

Recommendations

E 1. (ASIIN 1.3) It is recommended to strengthen contents of innovative technologies such as Big Data as well as communication skills of the students.

E 2. (ASIIN 4.3) It is recommended to enlarge the workroom for students' self-directed individual and group work and improve the availability of high-speed internet.

E 3. (ASIIN 4.3) The number of professional English publications (books as well as journals) in the library should be further increased.

G Comment of the Technical Committee 04- Informatics (21.11.2017)

Analysis and assessment concerning the award of the ASIIN label:
The Technical Committee discusses the procedure and generally agrees with the peers' assessment. However, it proposes slight modifications in some of the requirements in order to make especially requirement A1 better understable.

Analysis and assessment concerning the award of the Euro-Inf® Label:
The Technical Committee agrees that the described learning outcomes do comply with the SSC of the Technical Committee 04 – Informatics.

The Technical Committee 04 recommends to award the following labels:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Software Engineering	With requirements for one year	Euro-Inf	30.09.2023
Ba Information Technology	With requirements for one year	Euro-Inf	30.09.2023

Requirements

A 1. (ASIIN 4.1) Present a development plan approved by the Dean indicating by which concrete measures such as financial and time management the number of PhD-Graduates among the teaching staff will be significantly increased in the accreditation period and outlining in which time-steps such an increase will be achieved.

A 2. (ASIIN 1.1)Specify the general learning outcomes in order to clearly outline the differences between both degree programmes.

A 3. (ASIIN 5.1) Rewrite the module descriptions so as to include information about the examination forms, teaching methods and practical work included as well as the laboratories in which this is performed. Further, lists of required or recommended reading should be included.

A 4. (ASIIN 2.1) Ensure, that the full volume of the Bachelor thesis is clearly reflected in the modularized structure and indicated as such in the Diploma Supplement.

Recommendations

E 1.   (ASIIN 1.3)It is recommended to strengthen contents of innovative technologies such as Big Data as well as communication skills of the students.

E 2.   (ASIIN 4.3)It is recommended to enlarge the <mark>students'</mark> workroom and group work and improve the availability of high-speed internet.

E 3.   (ASIIN 4.3) The number of professional English publications (books as well as journals) in the library should be further increased.

H Decision of the Accreditation Commission (08.12.2017)

Analysis and assessment concerning the award of the ASIIN label:
The Accreditation Committee discusses the procedure and generally agrees with the peers' and the Technical Committee's assessment apart from a few minor modifications concerning the wording of requirement 4.

Analysis and assessment concerning the award of the Euro-Inf® Label:
The Accreditation Committee agrees that the described learning outcomes do comply with the SSC of the Technical Committee 04 – Informatics.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Software Engineering	With requirements for one year	Euro-Inf	30.09.2023
Ba Information Technology	With requirements for one year	Euro-Inf	30.09.2023

Requirements

A 1. (ASIIN 4.1) Present a development plan approved by the Dean indicating by which concrete measures such as financial and time management the number of PhD-Graduates among the teaching staff will be significantly increased in the accreditation period and outlining in which steps such an increase will be achieved.

A 2. (ASIIN 1.1) Specify the general learning outcomes in order to clearly outline the differences between both degree programmes.

A 3. (ASIIN 5.1) Rewrite the module descriptions so as to include information about the examination forms, teaching methods and practical work included as well as the laboratories in which this is performed. Further, lists of required or recommended reading should be included.

A 4. (ASIIN 2.1) Ensure, that all study units related to the Bachelor module are clearly reflected in the modularized structure and indicated accordingly in the Diploma Supplement.

Recommendations

E 1. (ASIIN 1.3) It is recommended to strengthen contents of innovative technologies such as Big Data as well as communication skills of the students.

E 2. (ASIIN 4.3) It is recommended to enlarge the students' workroom and group work and improve the availability of high-speed internet.

E 3. (ASIIN 4.3) The number of professional English publications (books as well as journals) in the library should be further increased.

I Fulfillment of Requirements

Analysis of the peers and the Technical Committee

Requirements

For all degree programmes

A 1. (ASIIN 4.1) Present a development plan approved by the Dean indicating by which concrete measures such as financial and time management the number of PhD-Graduates among the teaching staff will be significantly increased in the accreditation period and outlining in which steps such an increase will be achieved.

Initial Treatment	
Peers	partly fulfilled (1) /fulfilled (1) Justification: The number of PhD-Graduates is apparently increasing following the agreed strategic plan 2016-2022. However, the provided document "Staff Development Plan" shows no significant difference between years 2017 and 2018.
TC 04	not (completely) fulfilled Vote: unanimous Justification: The TC agrees with the critical assessment of one peer.

A 2. (ASIIN 1.1) Specify the general learning outcomes in order to clearly outline the differences between both degree programmes.

Initial Treatment	
Peers	partly fulfilled (1) / fulfilled (1) Justification: The provided material on this issue is partly confusing and requires quite an amount of interpretation from the side of the reader/evaluator. Several graphics are provided which still show a large amount of overlap between the 2 programmes (e.g. Fig. 5), other data (e.g. table 1) is okay. But in summary, one wishes to see a clear difference between the 2 programmes. In addition, the wording in provided file (D6) is much too unspecific: example: *In the horizontal and vertical dimensions together, someone who cares about making things work for people and is more interested in devices than organizations will be interested in the lower-right, while someone who wants to develop new theories about*

	how information affects organizations will be interested in the upper-left, and so on.
TC 04	not (completely) fulfilled Vote: unanimous Justification: The TC agrees with the critical assessment of one peer.

A 3.   (ASIIN 5.1) Rewrite the module descriptions so as to include information about the examination forms, teaching methods and practical work included as well as the laboratories in which this is performed. Further, lists of required or recommended reading should be included.

Initial Treatment	
Peers	fulfilled Justification: Clear information, e.g. detailed description of labs, is provided
TC 04	fulfilled Vote: unanimous Justification: The TC agrees with the assessment of the peers.

A 4.   (ASIIN 2.1) Ensure, that all study units related to the Bachelor module are clearly reflected in the modularized structure and indicated accordingly in the Diploma Supplement.

Initial Treatment	
Peers	partly fulfilled (1) / fulfilled (1) Justification: The provided Diploma Supplements (files D5a and D5b) do not show a relational grade. This needs to be added. The rest is okay.
TC 04	not (completely) fulfilled Vote: unanimous Justification: The TC agrees with the critical assessment of one peer.

Decision of the Accreditation Commission (07.12.2018)

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Software Engineering	Requirement 1, 2 and 4 not fulfilled	Euro-Inf®	6 months prolongation

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Information Technology	Requirement 1, 2 and 4 not fulfilled	Euro-Inf®	6 months prolongation

Decision of the Accreditation Committee (28.06.2019)

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Software Engineering	All requirements fulfilled	Euro-Inf®	30.09.2023
Ba Information Technology	All requirements fulfilled	Euro-Inf®	30.09.2023

Appendix: Programme Learning Outcomes and Curricula

According to Self-Assessment-Report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme <u>Software Engineering</u>:

"Program outcomes

Program Educational Objectives of SE graduates are listed:

PEO-1:Basics Concepts - Design, analyze, develop, maintain and formulate various software systems differed by their complexities and abstractions starting with modules and individual components of software and eventually whole system architecture.

PEO-2: Practical Skills - Identify and estimate SE problems, produce robust products that meet customers' needs and have intellectual and analytical skills to do SE projects for various industries.

PEO-3: Professional Ethics - A professional who is an active member of a software development team, efficient and responsible for professional ethics and personal ethics.

PEO-4: Get Promotion - Develop their technical skills, do researches, learn continuously and have an aptitude to excel in their personal businesses and works.

Program Learning Outcomes:

PLO-1.SE knowledge: - Ability to use SE fundamentals and knowledge of software development life cycle to make a software design and carry out the development based on a solution.

PLO-2.Problem analysis: - Analyze complex problems and identify customer needs and document them.

PLO-3. Estimation and finding solutions:-Ability to find and estimate software solutions for various problems in society.

PLO-4.Using software tools: - Ability to use appropriate tools, skills and methods such as software development and CASE tools.

PLO-5. Administrative skills: - Use management skills such as resource, time, scope and work order management in dealing with quality assurance standards.

PLO-6.Team work: - Ability to function effectively, actively and creatively in a team or individually.

PLO-7.Ethics: - Ability to fulfill social, ethic and legal duties.

PLO-8. Communication: - Good communication skill in exchanging their ideas in speech and written forms.

PLO-9. Data analysis: - Use scientific and engineering methods to solve complex problems in engineering (researching, making tests and a test framework and analyzing test data and drawing accurate conclusion).

PLO-10. Lifelong learning: - Habit and desire to develop and update their skills and knowledge."

The following **curriculum** is presented:

No		Index	Coursenames	Cre-dith-	Semester
A.GENERALEDUCATIONCOURSES				30	
1	1		A1.Elective:Natural sciences courses	6	I,II
2	2		A2.Elective:Social sciences courses	3	I,II
3	3		A3.Elective:Humanities courses	3	I,II
4	4		A4.Elective:Civic education courses	3	I,II
5	5		A5.Elective:Research methodology courses	3	I,II
6	6		A6.Elective:Speech and writing proficiency courses	3	I,II
7	7		A7.Elective:English and other language courses	6	I,II
8	8		A8.Elective:Physical Training, Health Education courses	3	I,II
NOTE: Students are permitted to choose their major after collecting 30 credit hours from each section of general education according to the requirement specified in the curriculum. (Courses in Appendix 1 must be selected and "Fundamentals of Computation" is recommended for those who are in this curriculum.)					
B.CORE				21	
B1.MANDATORYCOURSES				6	
9	1	MATH180	EngineeringMathematics*	3	II,III
10	2	PHYS180	EngineeringPhysics	3	II,III
B2.ELLECTIVECOURSES				15	
11	1	MATH183	OrdinaryDifferentialequations	3	II,III
12	2	APMA280	ProbabilityandRandomProcesses	3	II,III
13	3	MATH181	MultivariableCalculus	3	II,III
14	4	MATH182	MathematicalLogicandDiscreteMathematics	3	II,III
15	5	APMA201	AppliedMathematics	3	II,III
16	6	CSII200	BasicsofAlgorithms*	3	II,III
17	7	CSII201	ProgrammingLanguageC*	3	II,III

18	8	CSII202	Databasefundamentals*	3	II,III
19	9	CSII203	BasicsofInternetTechnology*	3	II,III
20	10	CSII204	ProgrammingMethodology	3	II,III
21	11	EENG201	EngineeringElectromagnetics	3	II,III
22	12	EENG202	FundamentalsofElectronics	3	II,III
23	13	EENG203	ElectricCircuits	3	II,III
24	14	ENGI201	MechanicalEngineering	3	II,III
25	15	ENGI200	EngineeringGraphics	3	II,III
26	16	ENGI202	EngineeringThermodynamics	3	II,III
27	17	ACHE201	AppliedChemistry	3	II,III
28	18	FORS200	IntroductiontoForestScience	3	II,III
29	19	ENVI200	EnvironmentalScience	3	II,III

*Note:*ProbabilityandStatisticsrequiresEngineeringMathematics;Programmingin C,IntroductiontoArtificialIntelligence,OperationAnalysis(mathprogramming),Algorithmdesignandanalysis,Object-OrientedProgrammingandComputergraphicsrequireIntroductiontoAlgorithms;Object-OrientedProgrammingandDataStructurerequireProgramminginC;IntroductiontoArtificialIntelligenceandOperationAnalysis(mathprogramming)requireDiscreteMathematicsandLogics;DatabaseSystemsandSoftwareProjectrequiresIntroductiontoDatabase;SoftwareProjectrequiresObject-OrientedSystemDesigntobetaken.*

C.MAJORPROGRAMMECOURSES				54	
C1.REQUIREDCORECOURSES				**48**	
30	1	ICSI204	ComputerStructureandAssemblyLanguage	3	IV
31	2	ICSI205	FoundationofInformationSystems	2	IV
32	3	ICSI208	IntroductiontoNetwork	2	IV
33	4	ICSI201	ObjectOrientedProgramming	3	V
34	5	ICSI202	DataStructures	3	V
35	6	ICSI203	ProbabilityandStatistics	3	V
36	7	ICSI207	TheoryofOperatingSystems	3	V
37	8	ICSI402	SoftwareConstruction	3	V
38	9	ICSI206	VisualProgramming	3	VI
39	10	ICSI301	WebProgramming	3	VI
40	11	ICSI302	DatabaseProgramming	3	VI
41	12	ICSI303	SoftwareRequirementsAnalysis	2	VI
42	13	ICSI304	SoftwareEngineeringDesignandArchitecture	3	VII
43	14	ICSI403	SoftwareQualityandTesting	3	VII
44	15	INTE400	Internship(PracticalTraininginIndustry)**	2	VII
45	16	ICSI401	MobileApplicationDevelopment	3	VIII
46	17	ICSI405	SoftwareProjectManagement	2	VIII
47	18	THES400	BachelorThesis	3	VIII
C2.ELECTIVECOURSES				5	
48	1	ICSI431	NetworkProgramming	3	V
49	2	ICSI434	IntroductiontoOperationsResearch(Math-programming)	3	V

50	3	ICSI305	DataCommunication	3	V
51	4	ICSI438	SoftwareProjectDocumentation	2	V
52	5	ICSI435	E-Development	2	VI
53	6	ICSI310	FoundationofBioinformatics	3	VI
54	7	ICSI432	FundamentalsofComputerGraphics	3	VI
55	8	ICSI433	NumericalMathematics/Methods	3	VII
56	9	ICSI404	IssuesonInformationandSocialInformation	2	VII
57	10	ICSI430	ArtificialIntelligence	2	VII
58	11	ICSI441	JavaTechnology	3	VII
59	12	ICSI437	ServiceOrientedArchitecture	3	VIII
60	13	ICSI439	CyberSecurity	2	VIII
61	14	ICSI440	HumanComputerInteraction	2	VIII
62	15	ICSI436	SoftwareEngineeringEconomics	2	VIII

Note:
Thelistofelectivecorecoursesisrenewedeveryyeardependin-gonthenumbersofstudentsinthecurriculum,thecoursesofferedbythelecturers,andfeasibilityandpreparationofthecourses.*Internshipsmustbedoneintheorganizationdirectlyrelatedtotheir-

D.FREEELECTIVECOURSES	**15**

NOTE:D-AllthecoursessuggestedbyNUM.Totalofelectiveandfreeelectivecoursesmustbeatleast15credith-ours.Thesecredithoursmaybeusedwhenthestudentisearningdoublemajoror-studyinginmasterintegratedprogrammes.Coursesmustbestudiedaccordingtothecourserequirementssincesomecoursesarerelatedtoothers.

TOTALCREDITS	**120**

According to Self-Assessment-Report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Information Technology:

"Expected knowledge:

- Plan, administer and manage IT resources of an organization or an individual.

- Estimate and explain IT upgrade and new IT trends in an organization.

- Install and present appropriate IT solutions for an organization or an individual to achieve their goal.

- Have a clear understanding of a science and mathematics behind IT and take part in them if necessary.

- Have a broad understanding of their stance and a specific commitment to society.

Expected skills:

- Utilize mathematical and computational knowledge of their specialty.

- Analyze a problem and determine the appropriate computational requirements for the problem.

- Estimate, design and install the appropriate software, components, processes and computer systems for a specific requirement.

- Collaborate efficiently in a team to achieve a common goal.

- Take responsibility for professional, ethical, legal, security related and social problems.

- Understand best solutions and standards, and their usages.

- Assist to produce an efficient project plan."

-

The following **curriculum** is presented:

No		Index	Coursenames	Cre-dith-	Semester
A.GENERALEDUCATIONCOURSES				30	
1	1		A1.Elective:Naturalsciencescourses	6	I,II
2	2		A2.Elective:Socialsciencescourses	3	I,II
3	3		A3.Elective:Humanitiescourses	3	I,II
4	4		A4.Elective:Civiceducationcourses	3	I,II
5	5		A5.Elective:Researchmethodologycourses	3	I,II
6	6		A6.Elective:Speechandwritingproficien-cycourses	3	I,II
7	7		A7.Elective:Englishandotherlanguagecourses	6	I,II
8	8		A8.Elective:PhysicalTraining,HealthEducation-courses	3	I,II
NOTE:Studentsarepermittedtochoosetheirmajoraftercollecting30credithoursfromeachsectionofgeneraleducationaccordingtotherequirementspecifiedinthecurriculum.(CoursesinAppendix1mustbeselectedand"FundamentalsofComputation"isrecommendedforthosewhoareinthiscurriculum.)					
B.CORE				21	
B1.MANDATORYCOURSES				6	
9	1	MATH180	EngineeringMathematics*	3	II,III
10	2	PHYS180	EngineeringPhysics	3	II,III
B2.ELLECTIVECOURSES				15	
11	1	MATH183	OrdinaryDifferentialequations	3	II,III
12	2	APMA280	ProbabilityandRandomProcesses	3	II,III
13	3	MATH181	MultivariableCalculus	3	II,III
14	4	MATH182	MathematicalLogicandDiscreteMathematics	3	II,III
15	5	APMA201	AppliedMathematics	3	II,III
16	6	CSII200	BasicsofAlgorithms*	3	II,III
17	7	CSII201	ProgrammingLanguageC*	3	II,III
18	8	CSII202	Databasefundamentals*	3	II,III

19	9	CSII203	BasicsofInternetTechnology*	3	II,III
20	10	CSII204	ProgrammingMethodology	3	II,III
21	11	EENG201	EngineeringElectromagnetics	3	II,III
22	12	EENG202	FundamentalsofElectronics	3	II,III
23	13	EENG203	ElectricCircuits	3	II,III
24	14	ENGI201	MechanicalEngineering	3	II,III
25	15	ENGI200	EngineeringGraphics	3	II,III
26	16	ENGI202	EngineeringThermodynamics	3	II,III
27	17	ACHE201	AppliedChemistry	3	II,III
28	18	FORS200	IntroductiontoForestScience	3	II,III
29	19	ENVI200	EnvironmentalScience	3	II,III

Note:ProbabilityandStatisticsrequiresEngineeringMathematics;ProgrammingLanguageCrequiresBasicsofAlgorithms;ObjectOrientedProgramming,DataStructuresandJavaTechnologyrequireProgrammingLanguageC;DatabaseSystemsrequiresIntroductiontoDatabase;Windowsprogrammingrequires ObjectOrientedProgramming;MobileApplicationDevelopmentrequiresTheoryofOperationSystemstobetaken.*

C.MAJORPROGRAMMECOURSES				54	
C1.REQUIREDCORECOURSES				**48**	
30	1	ICSI208	IntroductiontoNetwork	2	III
31	2	ICSI200	SpecialTopicsinInformationTechnology	3	IV
32	3	ICSI207	TheoryofOperatingSystems	3	IV
33	4	ICSI211	PlatformTechnologies	3	IV
34	5	ICSI201	ObjectOrientedProgramming	3	V
35	6	ICSI202	DataStructures	3	V
36	7	ICSI203	ProbabilityandStatistics	3	V
37	8	ICSI301	WebProgramming	3	V
38	9	ICSI311	Databasesystems	3	VI
39	10	ICSI315	WindowsProgramming	3	VI
40	11	ICSI441	JavaTechnology	3	VI
41	12	ICSI440	HumanComputerInteraction	2	VII
42	13	ICSI448	InformationSecurity	3	VII
43	14	INTE400	Internship(PracticalTraininginIndustry)**	2	VII
44	15	ICSI314	SystemIntegrationandArchitecture	3	VIII
45	16	ICSI448	SystemAdministrationandMaintenance	3	VIII
46	17	THES400	BachelorThesis	3	VIII
C2.ELECTIVECOURSES				**6**	
47	1	ICSI310	FoundationofBioinformatics	3	VI
48	2	ICSI488	IntroductiontoSoftwareEngineering	3	VI
49	3	ICSI302	DatabaseProgramming	3	VI
50	4	ICSI381	DataStructureandCProgramming-LanguageProject/DataStructureandAlgorith-	2	VI

51	5	ICSI382	ScriptProgramming	3	VI
52	6	ICSI206	VisualProgramming	3	VI
53	7	ICSI401	MobileApplicationDevelopment	3	VI
54	8	ICSI489	WebProject	2	VII
55	9	ICSI210	SystemAnalysisandDesign	3	VII
56	10	ICSI496	WebProgramming(Advanced)	3	VII
57	11	ICSI481	ComputerNetworkProgramming	3	VII
58	12	ICSI404	IssuesonInformationandSocialInformation	2	VII
59	13	ICSI495	GameProgramming	3	VII
60	14	ICSI498	AssemblyLanguageProgramming	3	VII
61	15	ICSI499	DigitalImageProcessing	3	VII
62	16	ICSI487	SocialIssuesandProfessionalPractice	3	VIII
63	17	ICSI463	SystemProgramming	3	VIII
64	18	ECEN461	IntroductiontoComputerNetworkSecurity	3	VIII
65	19	ICSI380	IntroductiontoPatternRecognition	3	VIII
66	20	ICSI409	EnterpriseArchitecture	2	VIII
67	21	ICSI491	E-Commerce	3	VIII
68	22	ICSI383	InformationTechnologyManagement	3	VIII

Note:
Thelistofelectivecorecoursesisrenewedeveryyeardependin-gonthenumbersofstudentsinthecurriculum,thecoursesofferedbythelecturers,andfeasibilityandpreparationofthecourses.
*Internshipsmustbedoneintheorganizationdirectlyrelatedtotheir-

D.FREEELECTIVECOURSES	**15**

NOTE:D-AllthecoursessuggestedbyNUM.Totalofelectiveandfreeelectivecoursesmustbeatleast15cre-dithours.Thesecredithoursmaybeusedwhenthestudentisearningdoublemajoror-studyinginmasterintegratedprogrammes.Coursesmustbestudiedaccordingtothecourserequirementssincesomecoursesarerelatedtoothers.

TOTALCREDITS	**120**