Technische Universität Berlin

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# Conference Report

International Conference on
Information Technology for Higher Education in Afghanistan
Part IV

November 2008
René Herlitz

## Venue

Ministry of Higher Education
Kabul, Afghanistan

November 3 – 5, 2008

## Organization

 Ministry of Higher Education

 Technical University Berlin

## Financing

 German Academic Exchange Service

Pictures by Melanie Stilz

# Content

## *Background*

Information Technology (IT) offers many opportunities to the Afghan society; most important for Higher Education hereby is the access to worldwide sources of information. The required qualification for adequate use of these technologies result from appropriate IT education. University degrees in Computer Science need to be negotiated in form and content in order to achieve a nationally and internationally acknowledged standard.

In the last six years, the Ministry of Higher Education (MoHE) has been actively promoting the implementation if IT at Afghan universities and achieved many goals in this field. The Technical University Berlin (TU Berlin) has been supporting the MoHE in this field in the last years. Computer Science is currently taught at different public and private universities throughout the country. The syllabus of each university, although approved by the MoHE differs in many aspects. On this account, the MoHE invited to part IV of a series of conferences titled "Information Technology for Higher Education in Afghanistan", which took place on 3$^{rd}$ to 5$^{th}$ of November 2008 in the conference hall of the MoHE. The first three parts of this conference series on different aspects within the topic of IT in higher education which the MoHE conducted with the support of the TU Berlin and financial support by the German Academic Exchange Service (DAAD) were held in 2006 and 2007.

This fourth conference brought together 26 Afghan universities (20 public and 6 private institutes), the MoHE as well as international lecturers to work out a coherent IT curriculum on the basis of the "National IT strategy for Higher Education in Afghanistan". Each of the participating higher education institutions was represented by its president or a deputy as well as its IT advisor. The three days of the conference each had a specified topic:

Day 1: IT Strategy for Higher Education

Day 2: IT Curriculum

Day 3: Outcome and Discussion

## *Day 1: IT Strategy for Higher Education*

In the first conference session strategies towards a sustainable adoption of IT in higher education were presented. The session was moderated by **Prof. M. Osman Babury**, Deputy Minister of Higher Education for Academic Affairs, and **Dr. Nazir Peroz**, head of the Centre of International and Intercultural Communication of TU Berlin.

### *Opening and Welcome*

The conference was opened by **Dr. Azam Dadfar**, Minister of Higher Education. The minister welcomed all participants of the conference and thanked the German Embassy and the German institutions, especially DAAD and TU Berlin for their lasting support and engagement in Afghanistan. He highlighted the importance of IT in the section of higher education, because it is a discipline that affects all other scientific fields. Therefore there is a need to establish faculties of Computer Science at all major Afghan universities, which will give the young talents in Afghanistan a professional perspective.

Words of greeting were addressed by **Dr. Christian Buck**, Deputy Ambassador of the German Embassy in Kabul. Dr. Buck reflected, that when thinking about reconstruction, we often think about bridges, schools, water supply, education – the basic infrastructure. But today's topic, IT, takes it one step further. IT is the cutting edge of higher education and it connects any country to the rest of the world, so through IT Afghanistan can get new opportunities from a globalized world. IT is not only about hardware and technology, it is about software and the software is generated in the heads of people. Dr. Buck reminds that the job of the representatives from universities and the ministry is not only to teach IT, but to develop a national IT strategy. He feels impressed by the leadership of the MoHE and the heads of the universit-

ies in this field and is proud to be partners through Dr. Peroz. Afghanistan is striving to the highest standards and Dr. Buck is pleased that Germany, especially TU Berlin and DAAD are able to help here and is thanking these organizations for their work.

*Keynote speech: National IT Strategy for Higher Education, Prof. M. Osman Babury, Deputy Minister of Higher Education for Academic Affairs*

**Prof. M. Osman Babury** began his presentation of the National IT Strategy for Higher Education by highlighting the vision of facilitating the development of Afghanistan's capital by providing access to quality higher education and enabling the people of Afghanistan to participate and effectively contribute in the development of economic growth and stability of the country. He concretized that until 2020 all Afghan institutes in the higher education sector shall have access to the international knowledge society and adoption of various measures for capacity building shall be applied. Each member of the Afghan institutes of higher education (professors, personnel, students) as well as all employees at the MoHE shall be literate in operating IT systems and their applications. IT shall be implemented professionally for teaching, research and administration. Specific goals within this vision are quality improvement and the establishment of a Quality Assurance System, systemic reform and management improvements, access to higher education, and financing. Prof. Babury points out that in public universities currently there are five departments and one faculty of Computer Science, whereas private institutions can count on six faculties of Computer Science. Overall the biggest challenge is the insufficiently qualified teaching staff, the deficiency of IT infrastructure, and the lack of a coherent IT curriculum.

The National IT Strategy for Higher Education defines an action plan that defines the next steps to take in order to achieve the aforementioned goals, this plan includes:

- establishment and expansion of an efficient infrastructure,
- development of networks integrating all the institutes under higher education,
- establishment of computer centers in each institute of higher education,
- establishment of Computer Science faculties,

- establishment of Computer Science libraries,

- implementation of IT application in education and administration, and

- education through further training.

Strengthening the IT department of the MoHE is necessary for realizing this action plan. The IT department will be supported by an IT board which will be formed in order to develop IT policies and strategies. The IT board will consist of members from Afghan ministries, public and private institutes of higher education, as well as international members from universities and donor organizations. Further parts of the realization of the action plans are the setup of an IT office at each university, the elaboration of a security concept, and a coordinated financial concept.

### *Current situation of IT in Higher Education, Mr. Salim Saay, Head of IT Department, MoHE*



**Mr. Salim Saay** emphasized that his presentation on the current situation of IT in higher education in Afghanistan will look at the educational part as well as the technical part. In IT education there is a differentiation needed between capacity building and teaching Computer Science within a faculty or department. Computer Science Departments currently exist at Kabul University, Kabul Educational University, Kabul Polytechnic University, Nangarhar University, and Sheskh Zayed University. The only public university with a Computer Science Faculty is Herat University. So far, all these universities are teaching different curricula within their Computer Science study programs. These curricula have been developed with the help of TU Berlin, UWC, Merlynd University, Colgate University, Delhi University, and Cisco. In addition to these curricula, the private higher education institutes have implemented their own Computer Science curricula. The need for a standardized national curriculum for Computer Science becomes obvious.

Looking at the capacity building, there have been numerous efforts in the past to train students, lecturers, and administrative staff at the universities. These efforts include the IT Center of Kabul University (ITCK), the Women Computer Center, the Angel centers, the

HEP projects, Cisco projects, and computer training at the MoHE.

Mr. Saay continues to inform about the technical issues regarding IT in higher education, which include secure domains, web filtering, user acceptable policies, a student information system, a concours database, and firewalls. In 2008, the IT department of MoHE has made inventory checks and assessments of available IT infrastructure at all universities.

### Framework for the implementation of IT in the area Higher Education in Afghanistan, Dr. Nazir Peroz, TU Berlin

**Dr. Nazir Peroz** outlined the framework that is necessary to implement IT in the area of higher education in Afghanistan. *Prerequisites* of IT in higher education are a legal framework, which is supported from the political, economic, and societal stakeholders and brought into agreement with the IT strategy of the Ministry of Communication.

Regarding the *political frame*, Afghanistan needs an IT strategy, which coheres to the national needs of Afghanistan. The rights of individuals in the use of IT have to be protected and guaranteed. National measures must be set in accordance to international IT policy.

Within the *economic frame* private initiative have to be strengthened, the setting up of business facilitated and the flexibility of the overall economy towards technical and economical developments enlarged.

The *societal frame* includes the facilitation of a low-cost IT access. The Afghan government on the other hand must ensure to prevail against criminal content and prevent to development of a new kind of criminality. Legislative framework conditions must be established regarding youth protection, copyright, data privacy, etc.

The MoHE will consider *organizational and technical measures* on how the resource demand at each faculty can be determined, the priority of projects can be defined, programs of action can be established, a time schedule can be set up, and measurements within the action plan can be coordinated between donor countries, supporters and recipients.

An important organizational measure consists in the founding of a *CIO* (Chief Information Officer). The tasks of this organization divide into three categories:

- Lead and conduct: Publish project ideas, determine the need of the universities, fill

donors with enthusiasm, and prepare decisions.

- Coordination: Design and organize the project frame, connect interests, mediate between stakeholders, preserve continuity, positively affect the climate, think sustainably.

- Observe and judge: evaluate, monitor quality standards, give feedback, reflect, document.

The *activity fields* of the action plan include the *construction and expansion of an efficient IT infrastructure*. The deployment of productive local computer systems, standardized office and administration software as well as network based communication forms at universities depends on an efficient infrastructural basis, such as power supply, buildings suitable for IT, and personnel that is capable of operating it. For the solution that will be implemented a time frame of three years is considered for the establishment of an extensive power supply that is not dependent on generators, as well as telephone connections, communication channels or broad-band cables.

Another action field is the establishment of *IT centers at the universities*. IT centers form the heart of a university network and make fundamental services and resources available. These services include the *development of an e-mail system*. Furthermore *network connections* within universities, faculties and administrations and with each other must be established. Libraries and buildings with a high percentage of IT supported lectures must be equipped with a wireless network. Internet access must be facilitated. The use of *open source software* should be encouraged.

*IT in administration* can be a promoter of reforms. This will speed up the work flow at all administrative levels, provide access to information, knowledge and processes, raise efficiency through the use of databases and libraries, give everyone access to administration services with lower waiting times, and make decisions faster and more transparent.

University employees have a great demand for *further education*. Education programs must be designed in a way to make university members (professors, lecturers, administrative employees, and students) capable of operating computers, administrate networks, and find solutions for occurring technical problems. Besides the technical knowledge, aspects of *data privacy and data security* need to be taught.

The current lack of qualified IT personnel is based on the insufficient opportunities of education during the years of war. The initiative of the *construction of computer science fac-*

*ulties* should provide this opportunity in an extensive way. The project should be started immediately and until the year 2016 all Afghan universities should have a computer science faculty. A coherent national IT curriculum is necessary at these faculties.

The projects within the action plan must be strategically planned and coordinated by the MoHE and the exchange of information and cooperation between government institutions and the universities must be ensured. The universities will have to learn in a collaborative manner, including joint research projects and the operation and use of shared infrastructure. The cooperation at international level is recommended on department level.

A *steering group* for the coordination of the "Action Plan MoHE 2008-2020" with donor countries, supporters and recipients must be formed in order to provide quality, sustainability, compatibility, security, and bundling of resources.

In respect to the welcoming speech of Minister Dr. Dadfar and the presentation of Deputy Minister Prof. Babury, who both laid out the need of the foundation of Computer Science faculties in the major universities to give the motivated youth a career perspective, Dr. Peroz recommended the following: Regarding the current goals of the MoHE and given the current deficit of qualified personnel, technical equipment, and administrative structures it is necessary to bundle existing resources in order to build up academic structures rapidly. An effective use of the IT strategy plan of the MoHE can be ensured by establishing an independent IT Institute in Kabul. This bundling of resources will ease coordination and give financial advantages. Within this structure efficient and sustainable teachings and research can be established at an internationally acknowledged level. The institute would provide a scientific home for the twelve lecturers from Kabul who are currently studying in a Master program at TU Berlin that is financed by the World Bank and who will push forward the establishment of IT structures in the academic field after completing their studies.

### Development of an IT Curriculum, Dr. Jochen Koubek, Humboldt University Berlin



**Dr. Jochen Koubek**, who has been actively involved in the design of curricula in computer science in Germany, presented the steps that are necessary to take to develop a syllabus for an IT curriculum. He clarified these terms by defining a curriculum as consisting of everything that promotes learners' intellectual, per-

sonal, social and physical development. As well as lessons and extracurricular activities, it includes approaches to teaching, learning and assessment, the quality of relationships within university, and the values embodied in the way the university operates. It provides the framework for a syllabus and should focus on the people it affects. The presented guidelines for developing a syllabus were distilled from guidelines of the Association for Computing Machinery (ACM), the Association for Information Systems (AIS), the Association of Information Technology Professionals (AITP), the Institute of Electrical and Electronics Engineers (IEEE), the German Society of Computer Science (GI), and the International Federation for Information Processing (IFIP).

The most important aspect of syllabus design is that it needs to have a real-world-basis. An outcome focused approach looks first at what the graduates are going to do after their studies, the action fields. The learning fields should be based on these action fields and are described with competencies and content. They are concretized by learning situations which are the result of a didactical reflection of professional, individual and social action fields. Curriculum designers and instructors must think in terms of outcomes, it is not the question what the lecturers could teach, but what the students should learn. Presenting the example of a syllabus from the ACM, Dr. Koubek showed that it not only contains technological competencies, but also analytical and critical thinking, teamwork, organizational and other so called "soft" skills.

One key aspect of syllabus design is, that the underlying and enduring principles of computer science should be emphasized, rather than details of the latest or specific tools. Of course the students will know specific tools, but they are not necessarily taught at university. Apart from university studies of computer science, there is also a need for the training of basic tools and IT skills.

As for syllabus organization it can be summarized that learning certain computer science topics requires maturity, so that these topics should be taught towards the end of the curriculum, while other material should be taught earlier to facilitate gaining that maturity. The granularity levels of design in a syllabus architecture reach from the presentation areas via courses with learning units to a detailed body of knowledge. In the design process ethical, legal, and economic concerns, and the notion of what it means to be a professional, should be raised frequently, since the curriculum is not about technology, but about people, which are designing, constructing, and using technology to help other people. They have to know more than technology, they have to know what the technology they construct is

used for. Curriculum designers must strike an appropriate balance between coverage of material, and flexibility to allow for innovation in order to cope with technological change. Furthermore curriculum designers and instructors must have sufficient relevant knowledge and experience and understand the character of their topic. In order to ensure that students embrace certain important ideas, care must be taken to motivate students by using interesting, concrete and convincing examples. Computer science education today needs to move beyond the lecture format as teamwork and social skills cannot be learned that way: It is therefore important to encourage consideration of a variety of teaching and learning approaches.

Dr. Koubek concludes that in the 21st century Afghanistan has the opportunity to be part of the international scientific society. For achieving this goal it is crucial to have a higher education, comparable to international standards. A computer science curriculum is more than about technology, it is about principles, divided and structured into modules. The design of such a curriculum takes time and effort, but it is an investment in the future which pays of in the years to come.

## Day 2: IT Curriculum Development

The second conference session focused on the development of an IT curriculum. The session was moderated by **Mr. Salim Saay**, of the MoHE, and **Mrs. Melanie Stilz**, of TU Berlin. In the first conference session it was concluded that there is a need for differentiating three types of IT education: training in basic IT skills, training in advanced IT skills for web masters and server or network administrators, and higher education in computer science programs at bachelor level.

### Presentation of IT Curricula

The morning of this second day was dedicated to the presentation of different curricula that are taught or are going to be implemented at six different public and private universities of Afghanistan. The curricula presented can be found in the appendix to this document.



The curriculum of **Kabul University** was presented by **Mr. Tariq Meeran**, Assistant Professor in the Computer Science Department (see appendix 1, p. 19). This department was the first Computer Science department in Afghanistan, established in 1995.

**Dr. Dawlat Khan**, Dean of Computer Science, presented the curricula of the bachelor programs in computer science and in telecommunication from **Bakhtar University** (see appendix 2, p. 21). This private institute of higher education is situated in Kabul.





**Kardan Institute of Higher Education** was represented by **Mr. Irfan Khan**, Dean of Computer Science. Kardan institute is the first private institute of higher education in the country and is based in Kabul. Amongst other study programs it offers a bachelor in computer science and a diploma in information technology (see appendix 3, p. 23).

**Herat University** is the only public university that has established a Computer Science Faculty up to now (see appendix 4, p. 25). **Mr. Mahmood Asgharzada**, Local Manager of the faculty, presented the curriculum taught in Herat with help of lecturers from TU Berlin, which will be replaced by local lecturers that are currently participating in a Master program in computer science in Berlin.

**Mr. Hamdullah Mohib**, Assistant Director of IT, presented the curriculum of the private **American University** in Kabul (see appendix 5, p. 28). At this university it is possible to receive degrees in a study program called "Information Technology and Computer Science".

The sixth presentation of a curriculum was conducted by **Mr. Badam**, head of the IT department of **Nangarhar University** (see appendix 6, p. 29). Nangarhar University has plans to extend its Department of Computer Science to a faculty with departments of networking, software engineering, as well as database in the near future.

Apart from the education in computer science, there is a huge demand for further education of university personnel. A concept for the first type of IT education was presented by **Mr. Tasali**, head of the **IT Center at Kabul University** (ITCK). The **Basis IT Training at Universities** has been successfully conducted by ITCK staff in the last years. Since 2003 ITCK is providing this basic IT training for university members (professors, lecturers, administrative employees, and students). There is a specific syllabus for each of these target groups. Since 2006 the focus of education at ITCK has concentrated on the education of IT administrators for all faculties of Kabul University. This kind of education differs from the more scientific education of Computer Science.

## *Working Groups*

After the presentation of six syllabuses by public and private universities in the morning, the second part of the day was dedicated to address the necessary steps that are taken in order to develop a curriculum. For this purpose the 60 conference participants were divided into three working groups which were independently going through the curriculum development process and thereby identifying the essential elements of a national IT curriculum. All members of one university were together in the same working group. Each working group had about 20 participants.



The first working group was lead by **Dr. Jochen Koubek** (Humboldt University Berlin) and **Mr. Irfan Khan** (Kardan Institute of Higher Education).



The work of the second working group was moderated by **Mr. René Herlitz** (TU Berlin) and **Mr. Hassan Adel-yar** (Kabul University).



The third working group was organized by **Mrs. Melanie Stilz**, **Mrs. Lena Wittke** (both TU Berlin) and **Mr. Salim Saay** (MoHE).

The division into working groups made a clear and structured discussion of the curriculum development process possible. In each working group the same catalog of eight pre-defined questions was answered independently. These eight questions reproduced the curriculum design process:

1. **Resources:** What preliminaries are necessary for teaching computer science at university level?

2. **Action fields:** What are the jobs that computer science graduates are going to

work in in the future?

3. **Competencies:** What competencies are necessary in order to work in the action fields identified in the previous step?

4. **Principles:** What principles of computer science are related to the competencies identified in step 3?

5. **Modules:** How can we group these principles into modules? Which modules cover the intended objectives?

6. **Number of semesters:** How many semesters are needed to cover the identified modules?

7. **Distribution of modules:** How do distribute the chosen modules into the semesters available?

8. **Next steps:** What are the next steps that are necessary for the deployment of the developed curriculum?

In all three working groups the discussions were lively and productive. The results were presented on the following day.

## Day 3: Outcome and Discussion

The aim of the final session of this year's conference on IT in higher education was the presentation of the outcomes and the discussion of the results from the working groups that would lead to a conclusion of the next steps to take. The session was moderated by **Prof. Babury** and **Dr. Peroz**.

### Outcome

**Mr. Salim Saay**, Head of IT Department of MoHE, started the morning session with the presentation of the results from his working group. This working group chose to work on the action fields website design, database development, network administration, and software engineering. The elements that were identified in each step were presented.

The results of the second working group were presented **Mr. Hassan Adelyar**, Computer Science Lecturer at Kabul University. A presentation of the step-by-step process from prerequisites and action fields via competencies and principles to modules was presented. One of the findings of this working group was the consideration that students enter Afghan universities with differing levels of IT literacy, which can be as low as none. In order to encounter this problem, the first semester must be dedicated to teaching the basic prerequisites of Computer Science. In the working group it got clear that curriculum development is an effort that takes several weeks to provide sustainable outcomes. Therefore it was suggested to form a Curriculum Development Team in which representatives of MoHE and the universities work together in the planning of financial resources, a curriculum framework (study and exam regulations), and a syllabus (module definition and descriptions).

Findings of the remaining working group were presented by **Mr. Irfan Khan**, Dean of the Department of Computer Science at Kardan Institute of Higher Education. Again the step-by-step process was shown and the result was similar to the other two working groups. One of the considerations by this working group, was the structuring of the modules into the semesters. It was proposed to start with a pillar based approach in the first four to six semesters and afterwards provide action field orientated modules. Mr. Khan furthermore pointed out that currently there are 25 computer science lecturers in Berlin studying in a Masters program. Since they are going to teach the future curriculum, they should be involved in the development process.

### *Discussion*

During the presentation of the working group results it got clear that a consensus among the participants existed on many aspects of a computer science curriculum. These aspects were summarized by the session moderators.

The action fields identified had in common that they were working on practical issues of computer science. One of the important findings were that the competencies that graduates should have are not only of technical background, but also include general competencies such as social and team skills, interpersonal communication, English language, and the ability of making ethical considerations.

Further it was common understanding that the duration of a Bachelor program in computer science should be eight semesters where the first semester should be reserved for the prerequisites that are needed to study computer science and the eighth semester is mainly being used for preparing the bachelor thesis.

The process of developing a national IT curriculum will involve a major effort in time and personnel. The suggestion of forming a round table for curriculum development was well received it was highlighted as the next step to take subsequent to the conference.

Dr. Peroz welcomed the idea of the second working group of forming a working group for curriculum development. He summarized that action has to be taken quickly in order to

reduce the lack of qualfied personnel and orientate teachings and research on the needs of the country. Three types of education in IT can be differentiated:

1) Basic IT education that teaches the use of the new technologies for everyday work.

2) Higher level IT education for the overall technical, economic, and administrative development of the university. Target groups are IT managers, IT administrators, IT technicians, IT web master, etc.

3) Regular computer science study programs on a high quality level that is adjusted to international standards in order to form and support the young talent in science and research and for the formation of experts for leading roles of the country.

The Afghan universities must aim for an integration into the international scientific community as acknowledged members. The curriculum under development must consider the needs of Afghanistan, the resources available and the education level of the students.

The participants appraised the outcome of the conference as a success. The findings provide a solid starting point for a national curriculum development process for bachelor studies in computer science. The proposed round table needs to be formed quickly while the motivation generated in the conference is still fresh. It should be headed by a representative named by the MoHE. Further participants should be compound by international experts as well as national experts of the major higher education institutions which will implement the curriculum in the future. All members of the round table should have an overview of the field of computer science and be directly related to a department or faculty of computer science at the respective universities. During the selection of round table members the MoHE should propose a time line and a list of expectations for the work of the group.

Prof. Babury appreciated this initiative of forming a round table for developing a national IT curriculum for Afghanistan and assured his support in its establishment.

As was concluded from the conference, the development process of a national curriculum involves the following steps:

- Analysis of the demand of the Afghan labor market and definition of the short, middle, and long term education demand according to the outcome.

- Determination of the personnel, technical, and financial resources necessary for the realization of a coherent curriculum.

- Selection of national and international partner organizations and universities and establishment of a coordinating instance.

- Ascertainment of the measures in an action plan with an according time schedule.

- Definition of study courses and creation of a syllabus for each semester, and description of the content of the individual courses.

- Evaluation of the course content by computer science experts and further development of study structure and content according to the changing demand.

**Dr. Peroz** thanked the MoHE for hosting the conference, the Afghan university representatives for taking the time to join the event, and the German Embassy and DAAD for their support as well as Mrs. Melanie Stilz and Mr. Salim Saay for the preparation and organization of the conference. **Prof. Babury** expressed his thanks towards the representatives of TU Berlin and Humboldt-University Berlin for their input and their continuous support for IT in higher education in Afghanistan. Furthermore he thanked the DAAD for financing such an important event and the university representatives for taking the time to discuss the future of IT in higher education in Afghanistan.

# Appendices – IT Curricula presented on Day 2

## Appendix 1 – Kabul University

Proposed structure:
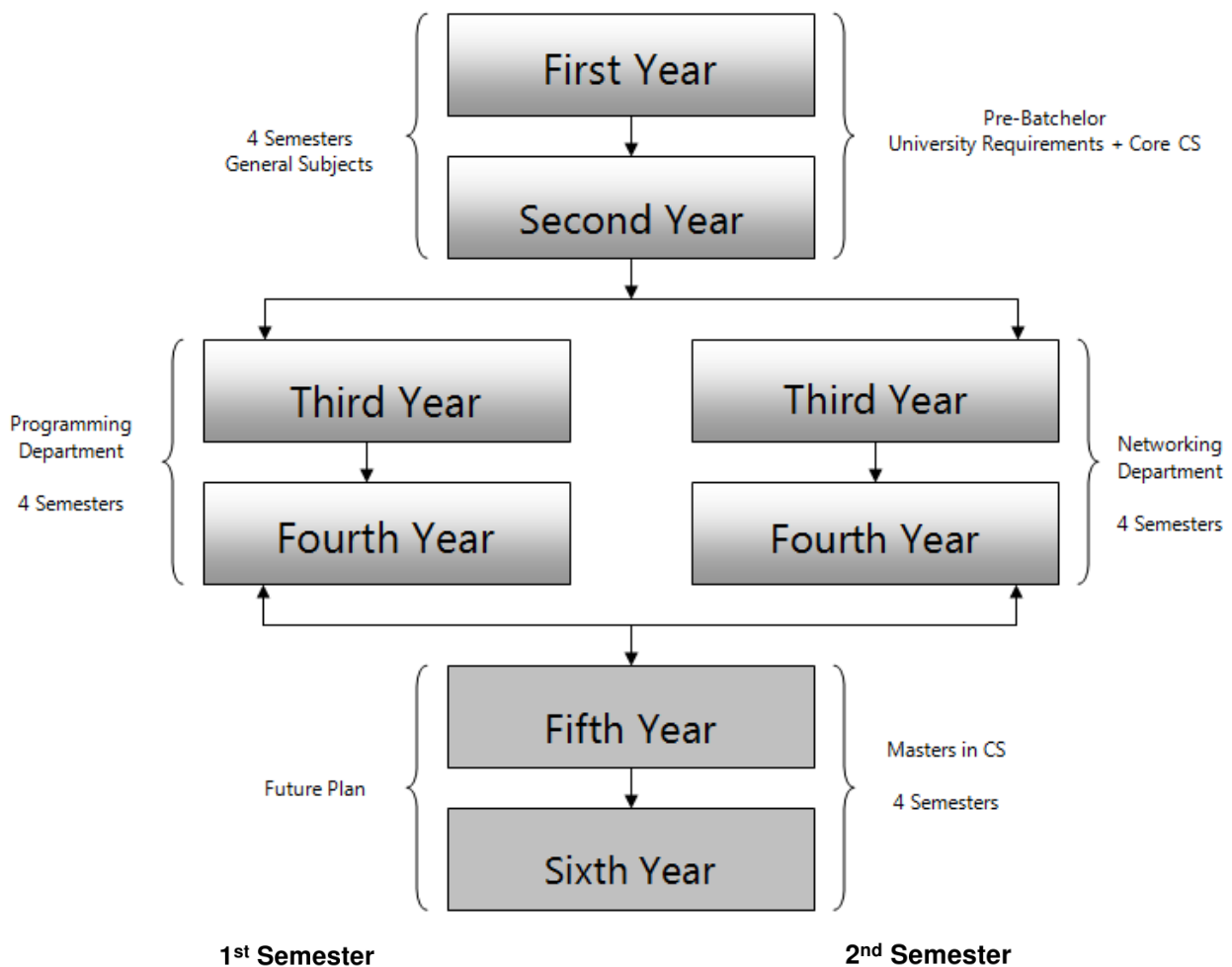


| Course ID | Course Name | Hours L-P* | Marks |
|-----------|-------------|------------|-------|
| CS101 | Introduction to Computers and Networks | 3-0 | 100 |
| | *(Other courses as per common curriculum)* | | |

**1st Semester**

| Course ID | Course Name | Hours L-P* | Marks |
|-----------|-------------|------------|-------|
| CS201 | Introduction to Common Software Tools | 3-0 | 100 |
| | *(Other courses as per common curriculum)* | | |

**2nd Semester**

### 3rd Semester

| Course ID | Course Name | Hours L-P* | Marks |
|---|---|---|---|
| CS301 | Programming and Problem Solving with Computer | 3-0 | 100 |
| CS302 | Computer System Organization | 3-0 | 100 |
| CS303 | Digital Electronics | 3-0 | 100 |
| CS304 | Computer Networks – I | 3-0 | 100 |
| CS305 | Advanced Calculus | 3-0 | 100 |
| CS306 | Lab based on CS301, CS302, CS303, CS304, and Software Tools | 0-8 | 100 |

### 4th Semester

| Course ID | Course Name | Hours L-P* | Marks |
|---|---|---|---|
| CS401 | Data Structures and File Systems | 3-0 | 100 |
| CS402 | Mathematical Foundations of Computer Science | 3-0 | 100 |
| CS403 | Microprocessors and Assembly language Programming | 3-0 | 100 |
| CS404 | Computer Networks – II | 3-0 | 100 |
| CS405 | Algebra | 3-0 | 100 |
| CS406 | Lab based on CS401, CS402, CS403, CS404, and Software Tools | 0-8 | 100 |

### 5th Semester

| Course ID | Course Name | Hours L-P* | Marks |
|---|---|---|---|
| CS501 | Object Oriented Programming | 3-0 | 100 |
| CS502 | Database Systems | 3-0 | 100 |
| CS503 | Analysis and Design of Algorithms | 3-0 | 100 |
| CS504 | Numerical and Scientific Computing | 3-0 | 100 |
| CS505 | Probability Theory | 3-0 | 100 |
| CS506 | Lab based on CS501, CS502, CS504, and Software Tools | 0-8 | 100 |

### 6th Semester

| Course ID | Course Name | Hours L-P* | Marks |
|---|---|---|---|
| CS601 | Operating Systems | 3-0 | 100 |
| CS602 | Software Engineering | 4-0 | 100 |
| CS603 | Principles of Visual Programming | 3-0 | 100 |
| CS604 | Internet and Web Technologies | 3-0 | 100 |
| CS605 | Statistics | 3-0 | 100 |
| CS606 | Lab based on CS601, CS602, CS603, CS604, and Software Tools | 0-8 | 100 |

### 7th Semester

| Course ID | Course Name | Hours L-T-P* | Marks |
|---|---|---|---|
| CS701 | Computer Graphics | 3-0 | 100 |
| CS702 | Theory of Computation | 3-0 | 100 |
| CS703 | Programming Languages and Paradigms | 3-0 | 100 |
| CS704 | Technical Communication | 3-0 | 100 |
| CS705 | Elective – I | 4-0 | 100 |
| CS706 | Lab based on CS701, CS703, CS704, CS705, and Software Tools | 0-8 | 100 |

### 8th Semester

| Course ID | Course Name | Hours L-T-P* | Marks |
|---|---|---|---|
| CS701 | Intelligent Systems | 3-0 | 100 |
| CS702 | Elective – II | 4-0 | 100 |
| CS703 | Elective – III | 4-0 | 100 |
| CS704 | Project | 0-8 | 100 |

## Appendix 2 – Bakhtar University

**SEMESTER-I**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS111 | IT Essentials | 3 |
| BCS112 | Mathematics-I | 3 |
| BCS113 | Probability & Statistics | 3 |
| BCS114 | Functional English | 3 |
| BCS115 | Financial Accounting | 3 |
| BCS116 | Programming Languages -I | 3 |
| **TOTAL SEMESTER CRED HRS** | | **18** |

**SEMESTER-II**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS117 | Programming Languages-II | 3 |
| BCS118 | Mathematics-II | 3 |
| BCS119 | Digital Logic Design | 3 |
| BCS120 | Operating Systems | 3 |
| BCS121 | Technical & Business Writing | 3 |
| BCS122 | Afghanistan Studies/Islamic studies | 3 |
| **TOTAL SEMESTER CRED HRS** | | **18** |

**SEMESTER-III**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS123 | Database-I | 4 |
| BCS124 | Object Oriented   Programming-I | 3 |
| BCS125 | Computer Graphics | 4 |
| BCS126 | Discrete Mathematics | 3 |
| BCS127 | Computer Architecture/Assembly Language | 3 |
| **TOTAL SEMESTER CRED HRS** | | **17** |

**SEMESTER-IV**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS128 | Data Communications & Networking | 3 |
| BCS129 | Data Structures & Algorithms | 4 |
| BCS130 | Analysis of Algorithms | 4 |
| BCS131 | Artificial Intelligence | 3 |
| BCS132 | Advance DBMS | 3 |
| **TOTAL SEMESTER CRED HRS** | | **17** |

**SEMESTER-V**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS133 | Wireless & Mobile Communications | 3 |
| BCS134 | Software Engineering-I | 3 |
| BCS135 | Theory of Automata | 4 |
| BCS136 | Object Oriented Programming-II | 4 |
| BCS137 | Database Administration | 3 |
| TOTAL SEMESTER CRED HRS | | 17 |

**SEMESTER-VI**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS138 | E-Commerce | 4 |
| BCS139 | Web Development | 3 |
| BCS140 | Communication Skills | 3 |
| BCS141 | Visual Programming-I | 4 |
| BCS142 | Multimedia Technologies | 3 |
| TOTAL SEMESTER CRED HRS | | 17 |

**SEMESTER-VII**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS143 | Visual Programming-II | 4 |
| BCS144 | Advanced Networking | 4 |
| BCS145 | Research methodology | 3 |
| BCS146 | Management Information System | 3 |
| BCS147 | Decision Support System | 3 |
| TOTAL SEMESTER CRED HRS | | 17 |

**SEMESTER-VIII**

| Course Code | Course Title | Credit Hours |
|---|---|---|
| BCS148 | Software Engineering-II | 4 |
| BCS149 | System Programming | 4 |
| BCS150 | Research Project | 9 |
| TOTAL SEMESTER CRED HRS | | 17 |

Total Credit Hours are 138. Minimum requirement for BCS (4 Years) are 122 Credit HRS. Further more in each semester Islamic studies is included which is requirement of Higher Education Commission of Afghanistan.

## Appendix 3 – Kardan Institutes of Higher Education

| First Semester | Credits |
|---|---|
| 1. Introduction to Computers | 3 |
| 2. College Algebra | 3 |
| 3. Probability & Statistics | 3 |
| 4. Functional English | 3 |
| 5. Programming Concepts (C++ Basics) | 3 |
| 6. Afghanistan History | 3 |
| | |
| **Second Semester** | **Credits** |
| 7. Programming Language I (C++ Advanced) | 3 |
| 8. Mathematics I (Calculus) | 3 |
| 9. Physics | 3 |
| 10. Data Structure | 3 |
| 11. Digital Logic Design | 3 |
| 12. Islamic Studies | 3 |

| Third Semester | Credits |
|---|---|
| 13. Internet Programming | 3 |
| 14. RDBMS | 3 |
| 15. Mathematics II (Calculus II) | 3 |
| 16. Business Communications | 3 |
| 17 Programming Language III (OOP Via JAVA) | 3 |
| 18. Operating Systems (Linux) | 3 |
| | |
| **Fourth Semester** | **Credits** |
| 19. Computer Organization & Assembly Language | 3 |
| 20. Data Communications & Networking | 3 |
| 21. Database Administration | 3 |
| 22. Electronics | 3 |
| 23. Artificial Intelligence | 3 |
| 24. Discrete Mathematics | 3 |

| Fifth Semester | Credits |
|---|---|
| 25. Programming Language II (Visual C++) | 3 |
| 26. Software Engineering I | 3 |
| 27. Digital Image Processing | 3 |
| 28. Computer Architecture | 3 |
| 29. Compiler Construction | 3 |
| 30. Computer Graphics | 3 |
| | |
| Sixth Semester | Credits |
| 31. ASP.NET | 3 |
| 32. Multimedia Technology | 3 |
| 33. VB.NET (Basic) | 3 |
| 34. Elective I | 3 |
| 35. Elective II | 3 |
| 36. Elective III | 3 |

| Seventh Semester | Credits |
|---|---|
| 37. VB.NET (Advanced) | 3 |
| 38. Numerical Analysis | 3 |
| 39. Elective IV | 3 |
| 40. Elective V | 3 |
| 41. Elective VI | 3 |
| 42. Elective VII | 3 |
| | |
| Eighth Semester | Credits |
| 43. Thesis | 6 |
| 44. Internship | 6 |
| | |

### 1st semester:

- Introduction to Programming I (Intro to Programming, JAVA, ToP, Variable Concepts, Data Types, Control Flow, Concept of Algorithms, data structures, methods, OOP)

- Introduction to Computer Science I (Intro to CS, Comp HW, Data Format and sizes, Internet, Office, Intro to Linux)

- Introduction to Mathematics I (Recover all math fundamentals, Number Systems, set of #, Theory of sets, arithmetic, equations and inequations, functions, intro to Algebra and analysis)

- English I (CS is mainly in English)

- Islamic

### 2nd semester:

- Introduction to Programming II (Continue Java, OOP, Data Structures, Search Algorithms, Practical work (Exercise))
- Introduction to Computer Science II (Intro to CS, Computer Arithmetic and Electronics – HW system Architecture, RISC, CISC, Machine Lang, Boolean Logic, Logic gates, digital circuits (Hamming code, information, redundancy))
- Introduction to Mathematics II (Recover all math fundamentals, Number Systems, set of #, Theory of sets, arithmetic, equations and inequations, functions, intro to Algebra and analysis)
- English II(CS is mainly in English)
- Islamic

### 3rd semester:

- Technical Computer Science I (OS in Focus, deals with mail concepts of modern OSs, File and Process management)

- Computer Science I (Intro to SE, examples are used to show how to identify relevant parts of SW project descriptions, UML to create models of example SW projects)

- Introduction to Mathematics II (main topics inside calculus, Limit of functions, derivates, quotient, chain rule, continuity, mean value theorem, taylor theorem.)

- English III (CS is mainly in English)

- Islamic

### 4th semester:

- Technical Computer Science II (networking system on focus, theory and practice of Computer Network)

- Computer Science II (continue from last semester, SE, UML,)

- Mathematics II (Continue from Last semester)

- English IV

- Islamic

**5<sup>th</sup> semester:**

- Technical Computer Science III (Intro to DB, focus on rational databases, the concept, design and implementation)

- Computer Science III (Shows New way into JAVA, using swing and awt packages (GUI), get overview of SDk)

- Mathematics III (DMs, Combinatorics, theory of computation, and graph theory)

- Management (Intro to how org and management works. Group work for projects in work environments)

- Scientific Writing (Overview, read and interpret, Keywords recognition, different scientific texts)

- Seminar

- Islamic

**6<sup>th</sup> semester:**

- Computer Science in Application: Database

- Computer Science in Application: Networking

- Computer Science in Application: Software Engineering

- Computer Science in Application: CS and Society

- Seminar

- Scientific Writing

- English (optional)

**7<sup>th</sup> semester:**

- Computer Science in Application (Project)

- Computer Science in Application (Project)

- Computer Science in Application (Project)

- Scientific Writing

- Islamic

**8<sup>th</sup> semester:**

- Monograph

- Presentation and Defending

**1**

| Subject | Introduction to programming I | Introduction to Computer Science I | Introduction to Mathematics I | English I | Islamic |
|---|---|---|---|---|---|
| Time | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours | 2 hour |

**2**

| Subject | Introduction to programming II | Introduction to Computer Science II | Introduction to Mathematics II | English II | Islamic |
|---|---|---|---|---|---|
| Time | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours | 2 hours |

**3**

| Subject | Technical Computer Science I | Computer Science I | Introduction to Mathematics III | English III | Islamic |
|---|---|---|---|---|---|
| Time | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours | 2 hours |

**4**

| Subject | Technical Computer Science II | Computer Science II | Mathematics II | English IV | Islamic |
|---|---|---|---|---|---|
| Time | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours | 2 hours |

**5**

| Subjects | Technical Computer Science III | Computer Science III | Mathematics III | Management | Scientific Writing | Seminar | Islamic |
|---|---|---|---|---|---|---|---|
| Time | 2 hours + 2 hours exercise | 2 hours + 2 hours exercise | 2 hours + 2 hours exercise | 4 hours + 2 hours exercise | 2 hours | 2 hours | 2 hours |

**6**

| Subjects | Computer Science in Application: Database | Computer Science in Application: Networking | Computer Science in Application: Software Engineering | Computer Science in Application: CS and Society | Seminar | Scientific Writing | English (optional) |
|---|---|---|---|---|---|---|---|
| Time | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 4 hours + 2 hours exercise | 2 hours | 2 hours | 2 hours |

**7**

| Subjects | Computer Science in Application (Project) | Computer Science in Application (Project) | Computer Science in Application (Project) | Scientific Writing | Islamic |
|---|---|---|---|---|---|
| Time | 6 hours | 6 hours | 6 hours | 2 hours | 2 hours |

**8**

| Subjects | Monograph |
|---|---|
| Time | 4 Months |

*Appendix 5 – American University*

Service Courses Required (not counted in the major credits):
MTH 115 Discrete Mathematical Structures for IT (3)
CS 101 Intro to Computers (3)

## I.  Overview of Courses Required in the IT major:

| | |
|---|---|
| ITCS 115 Introduction to Information Technology (3) | 1st Year |
| ITCS 210 Computer Systems Hardware and Organization (4) | 1st Year |
| ITCS 215 Programming I (4) | 2nd Year |
| ITCS 225 Programming II (4) | 2nd Year |
| ITCS 220 Fundamentals of Networking & Telecomm (4) | 2nd Year |
| ITCS 230 Database Concepts (4) | 2nd Year |
| ITCS 310 Data Structures (4) | 3rd Year |

Plus take any three of the following:

| | |
|---|---|
| ITCS 320 Advanced Networking & Telecomm (4) | 3rd/4th Year |
| ITCS 330 Advanced Database Concepts (3) | 3rd/4th Year |
| ITCS 340 Human-Computer Interaction (3) | 3rd/4th Year |
| ITCS 350 Open-Source Software (3) | 3rd/4th Year |
| ITCS 410 Web Systems and eBusiness (3) | 3rd/4th Year |
| ITCS 420 Information Technology Management (3) | 3rd/4th Year |
| ITCS 430 Artificial Intelligence (3) | 3rd/4th Year |
| ITCS 490 Special / Current Topics in ITCS (3) | 3rd/4th Year |

_____

Total:  10 courses (36 credits)

## II.  Overview of Courses Required in the IT minor:
ITCS 110  Introduction to Information Technology (3)
ITCS 210  Computer Systems Hardware and Organization (4)
ITCS 215  Programming I (4)
ITCS 220  Fundamentals of Networking & Telecomm (4)
ITCS 230  Database Concepts (4)

_____

Total:  5 courses (19 credits)

## Appendix 6 – Nangarhar University

1st semester:

Introduction to Computers
Programming concepts
Calculus- 1
Functional English
Accounting


2nd semester:

Advanced Programming in C
 Discrete Mathematics
 Digital Logic Design
 Statistics
 Calculus-2


3rd semester:

Database-I
 Data Structures
 Object Orientated Programming in C++
 Numerical Analysis
 Business Communication


4th semester:

Database-II
Data Communications
Operating Systems
Software Engineering-I
Electronics - Circuit Theory


5th semester:

Computer Architecture
 Computer Networks-I
 Java Programming
 Software Engineering-II
 Web Programming


6th semester:

Assembly Language programming
 Computer Networks-II
 Visual Programming

E Commerce

7<sup>th</sup> semester:

Automata Theory
 Computer Graphics
 Wireless and mobile Communication
 Technical Report Writing
 Software Project  Concept

8<sup>th</sup> semester:

Compiler Construction
 Software Project Management
 Artificial Intelligence
 Software Project Presentation