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বিশ্ববিদ্যালয় মঞ্জুরী কমিশন



Guideline for Preparing Standard Curriculum of B.Sc. in CSE/IT/ICE/ICT (Modified)

University Grants Commission of Bangladesh

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Name of the Author

University Grants Commission of Bangladesh

UGC Bhaban, Plot# E-18/A, Agargaon Administrative Area, Sher-e-Bangla Nagar, Dhaka-1207.

Phone: 88-02-58160100, 88-02-58160208, Fax: 88-02-58160202, 88-02-58160206

Email: info@ugc.gov.bd, website: www.ugc.gov.bd



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Editorial Panel

1. Professor Dr. Md. Sazzad Hossain, Member, UGC
2. Mohammad Maksudur Rahman Bhuiyan, Director (Additional Charge), IMCT Division, UGC

Final Scrutiny of the Draft Guideline, Materialization and Distribution by

Probir Chandra Das, Assistant Secretary, UGC

Draft Compilation: Hasan Ahmed Sharif, HR & GA Expert, ITEE Project, JICA

Coordination and Facilitation by

1. Engr. Md. Golam Sarwar, Project Director, The Project for Skill's Development of ICT Engineers Targeting Japanese Market, Bangladesh Computer Council (BCC)
2. Akihiro SHOJI, JICA Expert, ITEE Project, JICA
3. Ms. Nushrat Sharita, Sr. Assistant Director, IMCT Division, UGC
4. Hasan Ahmed Sharif, HR & GA Expert, ITEE Project, JICA

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UGC Bhaban, Plot# E-18/A, Agargaon Administrative Area, Sher-e-Bangla Nagar, Dhaka-1207.

Tel: 88-02-58160100, 88-02-58160208, Fax: 88-02-58160202, 88-02-58160206

Email: info@ugc.gov.bd

www.ugc.gov.bd

Guideline Development Committee
for
Preparing Standard Curriculum of B.Sc. in CSE/IT/ICE/ICT
as per International Standard and ITEE Syllabus

The Members of the Committee



Professor Dr. Md. Sazzad Hossain
Member, UGC
and Convener of the Committee



Professor Dr. Mohammad
Mahfuzul Islam, P. Eng,
Vice Chancellor, Canadian
University of Bangladesh and
Member of the Committee



Dr. Md. Ekramul Hamid
Professor, Department of CSE
and Dean, Faculty of
Engineering, University of
Rajshahi and Member of the
Committee



Dr. Md. Mamun-or-Rashid
Professor, Department of CSE,
University of Dhaka and
Member of the Committee



Dr. Mohammad Nurul Huda
Professor, Department of
CSE, United International
University, Dhaka and
Member of the Committee



Dr. M Shamim Kaiser
Professor, Institute of Information
Technology, Jahangirnagar
University and Member of the
Committee



Dr. Farhana Sarker
Assistant Professor,
Department of CSE, University
of Liberal Arts Bangladesh and
Member of the Committee



Mohammad Maksudur

Rahman Bhuiyan, Director
(Additional Charge), IMCT
Division, UGC and Member
of the Committee



Nushrat Sharita

Sr. Assistant Director
IMCT Division, UGC
and Member Secretary
of the Committee

List of Abbreviations

| | |
|------------|--|
| ABET | - Accreditation Board for Engineering and Technology |
| AI | - Artificial Intelligence |
| BCC | - Bangladesh Computer Council |
| BDITEC | - Bangladesh Information Technology Engineers Examination Center |
| B.Sc. | - Bachelor of Science |
| CS | - Computer Software |
| CE | - Computer Engineer |
| CSE | - Computer Science and Engineering |
| ICE | - Information and Communication Engineering |
| ICTD | - Information and Communication Technology Division |
| ICT | - Information and Communication Technology |
| IT | - Information Technology |
| IoT | - Internet of Things |
| JICA | - Japan International Cooperation Agency |
| ICT | - Information and Communication Technology |
| ITEE | - Information Technology Engineers Examination |
| ITES | - Information Technology Enabled Services |
| FE | - Fundamental Information Technology Engineer Examination |
| ITPEC | - Information Technology Professionals Examination Council |
| IPA, Japan | - Information-technology Promotion Agency, Japan |
| PP2041 | - Perspective Plan 2041 |
| UGC | - University Grants Commission of Bangladesh |
| 4IR | - 4 th Industrial Revolution |

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Professor Dr. Kazi Shahidullah

Chairman

University Grants Commission of Bangladesh

Message

Today's in-demand skills for the present job market is vastly different from what was required five or ten years ago. We are observing that the skill requirements for jobs have been changing rapidly with the application of new technologies in business and industrial sectors. As the technological breakthroughs are becoming a reality for millions of workers and companies, the tasks performed by humans and those by machines are also undergoing major transformation. If managed wisely, these transformations could lead to a new era of good work, good jobs and improved quality of life. But if managed poorly, it could widen skills gaps and thus put lives of millions at risk. We all agree to the fact that skilled manpower is the most important tool in building a self-reliant, poverty and unemployment-free Bangladesh. Bangladesh has achieved a consistent and impressive track record of economic growth over the last thirteen years. The current pace of economic growth needs to be accelerated even further to turn Bangladesh into a prosperous, developed and resourceful country by the year 2041. Bangladesh has now more people of working age than ever before. About 66 percent of the population of our country are aged between 15 and 64 years. By 2030, the population of this age group would rise to 70 percent and then it would start declining. This opportunity may not repeat for any nation.

We have to transform our huge young population into human capital to face the challenges and future demands of job markets. The higher educational institutions of the country will have to play a pivotal role to produce skilled graduates to meet the current and future manpower demands of industries and business organizations. Our universities are producing IT graduates. But the grim picture is that when they are sitting for the ITEE exam, their passing rate is only 10-15%. This poor passing out rate indicates that our academic curriculums are not updated enough to meet the skill demand of IT industries. Our academic curricula need to be urgently updated to keep with the needs of the global IT establishments. This will help us to create huge employment opportunities for our graduates in the IT industries of many developed countries including Japan. The universities of our country should update and modernize their syllabus in line with the ITEE syllabus so that our graduates can pass easily the ITEE exam. I believe the new syllabus changes should be incorporated in courses related to computer sciences and information technology to help our graduates get lucrative jobs abroad, especially in Japan. Widely accepted in the Asian region, I hope the international ITEE certification will give Bangladeshi students access to jobs in many foreign countries.



Dr. Md Abdul Mannan, PAA
Executive Director
Bangladesh Computer Council

Message

Bangladesh Computer Council (BCC) is a statutory body of the Government, established for development of the ICT sector of Bangladesh. BCC has been actively contributing in realizing Digital Bangladesh and Vision 2041.

ICT has been taken as one of the main driving technologies in our national development by the Honorable Prime Minister Sheikh Hasina when she envisioned for Digital Bangladesh in 2008. The architect of Digital Bangladesh Mr. Sajeeb Wazed, Honorable ICT Affairs Adviser to the Honorable Prime Minister has guided the country to materialize “Digital Bangladesh”. Honorable State Minister of ICT, Mr. Zunaid Ahmed Palak, MP is leading ICT Division with relentless effort to attain the national goal.

Human resource is the main resource of Bangladesh which needs to be nurtured to achieve the vision of 2041. Skilled ICT graduates and professionals are necessary for sustainable development and to leverage the 4th Industrial Revolution (4IR). Now, the country is taking various measures to develop skilled IT professionals for meeting the need of domestic and overseas markets. To elevate the standards of the country’s ICT human resources and to make them globally competitive, Government of Bangladesh introduced Information Technology Engineers Examination (ITEE) in 2013.

BCC is conducting ITEE exam which is administered by the Information-technology Promotion Agency (IPA), Japan since 2013. It is found that there is a gap in the CSE-related curriculum in universities and in the syllabus of the ITEE exam. I am very happy to know that Guideline Formulation Committee formed by UGC has addressed the issue to minimize the gap. I strongly believe that the guideline prepared by the committee will enhance the quality of our ICT graduates.

I am highly pleased to see this progress with the able leadership and guidance of UGC. This is our great pleasure that BCC is having the opportunity to be actively involved with this initiative. We are also thankful to Japan International Cooperation Agency (JICA) for addressing and cooperating with this issue and playing an important role to ensure quality ICT Human Resource of Bangladesh.



Yuho Hayakawa
Chief Representative,
JICA Bangladesh Office

Message

On behalf of Japan International Cooperation Agency, I would like to congratulate and appreciate the team of “The Project for Skills Development of ICT Engineers Targeting Japanese Market” for taking the initiative and successfully publishing this excellent piece of document, “Guideline for Preparing Standard Curriculum of BSc in CSE/IT/ICE/ICT”.

ICT has entered throughout all our lives to the point. This project, implemented by Bangladesh Computer Council (BCC) of ICT Division under the Ministry of Posts, Telecommunications and Information Technology aims to develop skilled IT Engineers targeting Japanese Market and at the same time to enhance the capacity of BCC to better manage Information Technology Engineers Exam (ITEE).

This guideline demonstrates excellent standard, showcases the joint efforts of BCC, ICT Division and University Grant Commission, inspiring the universities to update their CSE/IT-related curriculum in line with this CSE/IT Syllabus preparation guideline. I believe this guideline will be functioning as an effective tool to bring CSE/IT syllabus to an international standard and hence contribute to produce qualified and skilled graduates with appropriate knowledge.

With the strong leadership and commitment of ICT Division, JICA is proud of continuous work together with BCC and its associates, enhancing the human resource development of ICT sector through better management of ITEE and training of IT engineers targeting Japan and global markets. I believe the development of ICT Sector is getting more and more important, which will be one of the key factors in achieving the “SDGs (Sustainable Development Goals)” as well as Vision 2041 of Bangladesh.

Finally, I wish to express my sincere gratitude again to the officials concerned of the Government of Bangladesh and University Grants Commission for their sincere efforts to produce this valuable document, which I believe will become the reference for future activities to improve the ICT sector in Bangladesh.



Professor Dr. Md. Sazzad Hossain
Member, UGC
and
Convener, Guideline Development
Committee for Preparing Standard
Curriculum of BSc in CSE/IT/ICE/ICT

Acknowledgement

Since inception, the University Grants Commission of Bangladesh (UGC) has always been focusing on sharing thoughts on research, emerging science and engineering aspects. This contributes to the goal of our honorable Prime Minister Sheikh Hasina's technologically enlightened Digital Bangladesh i.e. Vision 2041. It is high time we developed an Innovative Education Ecosystem (IEE) in the country facilitating the implementation strategy of the Fourth Industrial Revolution (4IR). In this digital era and the 4th industrial revolution, it is impossible to think about national development without enriching knowledge, research, and innovation. The covid-19 pandemic situation has shown the importance of digital intervention in our social and business solutions.

The national growth or development of any country depends largely on skilled professionals and knowledge depth. It is undeniable that we are living in the world of connectivity in which digitalization is predominant. To keep pace with the shift from traditional industry to an economy based on information and communications technology (ICT), universities are the most dependable platform of proper human resource development. This is the crucial transition period for any prospective student to enter into professional life. We must equip the students with adequate knowledge and in-demand skills from this platform.

And to ensure adequate knowledge and skill acquirement from the universities, the role of standard curriculum is unavoidable. In this point of view, this is important to choose the right academic programs, especially those changing very fast and frequently. Apart from this, CSE/IT related curriculum is difficult to maintain updates with the professional or industrial demand due to the dramatic continuous innovation in digital services and technologies. Currently, IT knowledge, skills, and technology are essential for any kind of business, social or public service. So, to cope with the continuous improvement in all sectors through IT knowledge, skills and technology, it is important to keep the CSE/IT curriculum with the most updated and internationally compatible standard.

I am thankful to University Grants Commission of Bangladesh (UGC) for forming and approving the "Guideline Development Committee for Preparing Standard Curriculum of B.Sc. in CSE/IT/ICE/ICT as per International Standard and ITEE Syllabus" in an immediate response to the ICT division.

It is a matter of happiness to work for such kind of initiative with a dynamic team involvement. We are very much thankful to the ICT division for approaching and cooperating with this initiative. BCC and JICA were also very much concerned about the progress of this work. To help us materialize the task, BCC and JICA dedicatedly carried out a part of activities of “The Project for Skills Development of ICT Engineers Targeting Japanese Market” with their workforce. Engineer Md. Golam Sarwar, Project Director and Mr. Akihiro Shoji have continuously maintained communication with UGC and adhered to the progress of this work. They put their continuous effort since July 2019 and did a wonderful workshop on “Skill Development of ICT Engineers on IT Engineers Exam (ITEE) Targeting Japanese Market” to address the importance of curriculum updates. Later they have also visited several universities to this issue. In this course of work, they have received feedback about the necessity of proper guidelines from UGC.

As a result of continuous effort, UGC formed a very dynamic nine-member committee named “Guideline Development Committee for Preparing Standard Curriculum of BSc in CSE/IT/ICE/ICT as per International Standard and ITEE Syllabus” which was also facilitated by this project. Six members of the committee with a long academic course management experience and diverse knowledge about the latest changes appropriate for the standard curriculum development were selected from the renowned universities of Bangladesh.

I am truly honoured to chair the committee. All the members of the committee have done great jobs with their inputs and knowledge. Professor Dr. Mohammad Mahfuzul Islam, P. Eng, Vice-Chancellor, Canadian University of Bangladesh and Member of the Committee deserves thanks for his commendable support and brainstorming work to develop this guideline. It was a great team work. I also would like to convey appreciations to Mr. Yukinobu Miyamoto, Professor, Kobe Institute of Computing, Kobe, Japan for sharing his knowledge and experience in Bangladesh to enlighten us with the current situation of the university curriculum in Bangladesh and finding out prevailing gaps.

I would like to express my sincere thanks to Mr. Zunaid Ahmed Palak MP, Honorable State Minister, ICT Division, Mr. N M Zeaul Alam PAA, Senior Secretary, ICT Division, Mr. Parthapratim Deb, Executive Director, BCC for their support and cooperation. I feel also very much blessed to receive enormous flexibility and encouragement from Professor Dr. Kazi Shahid-ullah, Chairman, University Grants Commission of Bangladesh.

Finally, I am truly happy to see the outcome of this committee and very much hopeful about the good acceptance of the guideline by all the universities. UGC is always ready to encourage all the universities to update their CSE/IT-related curriculum in line with the CSE/IT Syllabus preparation guideline to help our graduates with the right skills and knowledge.

Again, I do like to congratulate all my fellow team members with a big thanks for their beautiful work.



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1.0 Executive Summary

By Presidential Order No. 10 of 15 February 1973, Father of the Nation Bangabandhu Sheikh Mujibur Rahman founded the Bangladesh University Grants Commission (UGC) with the objective of building a productive and prosperous nation through higher education and research. On 16 December 1972, the first Victory Day, with implicit consent, the law came into force. Since inception the UGC has been working to facilitate and guide the universities to achieve excellence in higher education and innovative research for sustainable socio-economic development and building a knowledge-based economy through promoting good governance and management at the higher education institutions in Bangladesh.

Now the UGC is working broadly availing the scope of work in partnership with many other government and private institutions for the academic development of our country. UGC is motivated by the initiatives and support received from the ICT Division, BCC and JICA regarding the project “The Project for Skills Development of ICT Engineers Targeting Japanese Market”. We have worked collaboratively with renowned academic professionals from the leading public and private universities of Bangladesh to prepare a Guideline for the Standard Curriculum of BSc in CSE/IT/ICE/ICT.

The guideline is an outstanding, resourceful and proper outline for making a standard syllabus meeting the national and international standard. There is a clear instruction on the broader disciplines with a balanced allocation of credit hours for the undergraduate programs in CSE/IT. The disciplines include Languages, History and Cultures, General Education, Basic Science and Engineering, Mathematics, Computer Science and Engineering Core and Elective Courses. Thus, it ensures the ideal combination of inputs regarding the knowledge and skills requirements to study and practice in the CSE/IT related undergraduate programs. The outline is carefully designed and recommends the curriculum so that the students can gather in-demand knowledge and skills and never feel overburdened. Besides, there are topics to study our national culture, history and language with core courses.

The syllabus is thoughtfully addressed and listed with the varieties of courses for each discipline. The courses covered are well justified with the program in the context of global and international standards. All the courses are closely related to the programs with a variety of selection options to furnish target-oriented and enjoyable academic program individually. All the contemporary courses with basic and essential fields are also included in the program with a futuristic vision and mission to meet the learners’ individual, national and international quest. The syllabus covers the needful courses for professional career development locally and internationally. The syllabus pays special attention to the industry focusing knowledge and skill requirements. As a whole, the syllabus is modelled considering the total competency level for undergraduate students of the CSE/IT program. It also consists of the required courses from the ITEE FE syllabus to enhance the

success of passing rate in this exam conducted by BCC. BCC is experiencing a significant success rate of ITEE FE passers in career development both locally and internationally. But the passing rate is not up to the expected level comparing to that of the other countries; though a large number of CSE/IT students' complete graduation from Bangladesh every year.

All the updated and latest courses for the core areas are included considering the emerging situation of 4IR and Digital and Social Media Intervention in every sector. Most modern updated courses on Computer Languages, Software Development and Engineering, Research and Innovation, Business and Entrepreneurial Development, IT Strategy, and IT Management are addressed properly in this syllabus. Newest courses on technology and innovation are also chosen carefully. All these contemporary inclusion and modification works have been done sophisticatedly and methodically by performing gap analysis. Comparing to the international standard and ITEE FE syllabus to identify the missing courses in our existing guideline or current practice at the universities in Bangladesh, the guideline is prepared. So, the syllabus is highly focused on the quality human resource development of Bangladesh.

Bangladesh started its journey with a new vision to become digital Bangladesh by 2021 which is no more a vision but a reality now. Bangladesh is moving to reach an upper-middle-income country by 2030 and high-income country by 2041 with a knowledge-based society. So, to reach the goals it is a crying need to ensure quality human resource development. Human resource development for the ICT sector is more important than any other sectors because of the rapid inclusion of 4IR in all areas of life and earth. The syllabus is aligned nicely with Country Perspective Plan 2041, the 8th Five Year Plan, and ICT Policy-2018. There is a mandatory guidance for the universities to update the university curriculum every two years considering the international and industrial context to secure enough employment opportunities and entrepreneurship development. This syllabus will help the universities in this regard as well as ensure quality human resources development.

The guideline deals with the clarifications and justifications in detail about the need for updating the existing guideline. It shows the importance of collaborative efforts between industry-academia-public to ensure the right kind of human resources development with proper knowledge, skill and ability. The guideline preparing committee considered the Covid-19 situation and how the ICT sector plays the leading role to face this pandemic situation. There are justifications for changing the existing curriculum at universities and recommendations for better implementation and development.

This guideline will work as an essential tool for all the universities to prepare their CSE/IT related curriculum compatible with international standard and industry demand. The University Grants Commission of Bangladesh (UGC) expects a great success of this curriculum and encourages the universities to adopt the guideline for updating their CSE/IT related course curriculum without delay.

2.0 Vision

Helping Bangladeshi ICT Human Resources lead locally and globally and contribute to build a developed Bangladesh by 2041.

3.0 Mission

Ensuring the universities to update their CSE/IT curriculum as per the guideline.

4.0 Objective

1. To incorporate the latest courses of Technology, IT Strategy and IT Management highly applicable for ICT related courses.
2. Support to formulate the university curriculum in a balanced manner between academic knowledge and business requirements.

5.0 Purpose

1. To make the guideline industry focused, business oriented and application based.
2. To make the CSE/IT curriculum as per global and international standard.
3. To promote IT based business and increase competency for employment opportunity.

6.0 Goal

1. Produce quality human resources with required skill and knowledge.
2. Help Bangladeshi ICT businesses grow with sustainability and competency.
3. Maximize the holding positions in local and global ICT industry by Bangladeshi ICT human resources.

7.0 Introduction

The University Grants Commission of Bangladesh has taken the initiative to modify the existing Guideline for the preparation of Standard Curriculum for BSc in CSE/IT/ICE/ICT with the inclusion of the latest courses, contents addressing the disruption of the 4th Industrial Revolution and time-demanding courses as per internationally standard academic curriculum. The guideline also deals with a rearrangement of credit allocation keeping the same order and structure of existing guidelines.

The guideline is modified in line with the international standard for curriculum development of undergraduate courses in CSE/IT/ICE/ICT. It incorporates some gap courses from the Fundamental Information Technology Engineers Examination syllabus, which is a yardstick to measure IT knowledge and skill.

The modified version of this guideline mainly emphasizes on how to align with the existing curriculum considering present and future industrial demand and professional skill requirements. The guideline has focused on the inclusion of some latest courses and updates of some existing courses in the field of programming and algorithm, system and software development & management, networking, data science, software engineering and a wide range of various additional subjects that are most highly demandable for career development. In addition to this, the guideline also addresses some IT Strategy and IT Management courses aiming to learn applied knowledge in the latest IT industry. System Planning & Auditing, Service Strategy & Management, Corporate & Legal Affairs with some more IT business-related courses are the notable inclusion in this guideline.

A team of renowned CSE faculties from leading public and private universities and UGC professionals has dedicated their professional expertise and support under the leadership and guidance of Professor Dr. Md. Sazzad Hossain, Member, UGC and Convener of the Committee to make this guideline more effective and professional.

UGC is very much hopeful that all the universities will show their best effort to the maximum adaptation of this modified guideline to make their curriculum most competitive and updated.

8.0 Background

The background is required to explain in broader perspective under different contexts and references to understand deeply the necessity of updating the curriculum for the undergraduate studies in ICT/CSE disciplines. Therefore, the detailed explanation is given below for clear understanding:

8.1 4IR and Digital Disruption in 21st Century/Current Situation:

In the era of the 21st century 4th Industrial Revolution has been impacting almost everywhere in education, business, operation and overall lifestyle around the globe. The 4th industrial revolution is transforming all spheres of life with emerging innovations and digital disruptions. They are 5G internet, 6th sense technology, 3D printing, Internet of Things (IoT), Artificial Intelligence (AI), Blockchain, Big Data, Robotics, Cloud Computing, Bio and Nanotechnology, Virtual and Augmented Reality, etc. Therefore, the knowledge and skill requirements are also changing swiftly for professional and business growth and entrepreneurship development. Nowadays, intervention and integration with digital innovation is the crucial factor for continuing with success in every mode for product development, service introduction and improvement, process simplification or improvement and new business model development. So, human resources development depends on the right kind of knowledge and important skills to adapt to the time of digital disruption. Undoubtedly, universities are the platform to produce the right human resources and IT human resources are becoming an essential part of every sector of our life and operation. In this context, IT is a must have skill for effective application & utilization to become an IT professional.

8.2 Current Practices in the Universities in Bangladesh:

Currently about 115 universities out of 154 universities in Bangladesh are offering the undergraduate programs in IT-related courses with different degree names based on individual course design. Most universities offer a very common undergraduate program namely Bachelor of Science in CSE/IT/ICE/ICT (B.Sc. in CSE) for 4 years of studies. Besides, a range of 4 years courses are also offered in various names like B.Sc. in Software Engineering, B.Sc. in Information, Communication and Technology with different features in course curriculum. Almost all the courses range from 140-160 credits hours and take 8-12 semesters in 4 years program. The university can design its curriculum in line with the basic compliance of the Guideline for Preparing Standard Curriculum for B.Sc in Computer Science and Engineering issued in 2017. All the universities design syllabuses individually to address the current situation incorporating with latest courses. The reality is that many of the universities are unable to maintain the global standard in their curriculum in comparison to the changing industrial demand and nature of knowledge required for becoming an IT professional due to the continuous advancement of technology and knowledge development.

8.3 Previous Guideline for Preparing Standard Curriculum for BSc in Computer Science and Engineering:

The previous guideline was issued by UGC in 2017 and formulated at best during that period by a professional committee for making standard committee. The guideline was prepared to align with the national and international professional association and accredited by reputable standards. The guideline was a keen focus to develop interconnection skills between students, faculties, alumni, and industries and directed to ensure at least 11 basic outcomes like mathematics, science & engineering knowledge, design and analyze data, system, process, problem-solving, communication, socio-economic impact across the globe, contemporary issues etc. with proper assessment and evaluation process periodically. The guideline consists of six categories of courses- (i) Language and General Education (ii) Basic Science (iii) Mathematics (iv) Other Engineering (v) Core Subjects and (vi) Elective Subjects with meeting the criteria set by the Accreditation Board for Engineering and Technology (ABET). In this context, the guideline gives direction to follow the program in three stages. The first stage covers one year study in combination of mathematics and basic sciences as appropriate to the discipline, in the second stage it needs one and half years' studies on engineering topics and the rest of the period goes with study about general education including technical contents consistent with the degree offered. The total curriculum has been designed with six types of studies showing the percentage of credit allocation and suitable subjects or contents indication. A detailed sample structure of the syllabus is outlined in the guideline for making it easy to understand by all stakeholders. This is annexed herewith in the reference: **Annexure- i** .

8.4 Perspective Plan of Bangladesh 2021-2041:

After the successful implementation of vision 2021 Bangladesh is now focusing on becoming a developed country by 2041 and articulated a 20-year perspective plan titling with "Making Vision 2041 a Reality". This plan converts the vision 2041 into a development strategy with policies and programs. There are clear directions to cope with the rapid transformation shifts in agriculture, trade and industry, education and healthcare, transportation and communication and the way of work and business models. The government is committed to playing a leading role in creating an adaptive national system for the whole of society regarding planning, adaptation, action & learning through collaboration among policymakers, private sector representatives, academia, skill development organizations and development partners.

As per the strategy and policy under Chapter-5 it is stated "Human Development through Quality Education and Harnessing the Demographic Dividend and Chapter-9: Creating an Innovation Economy for Bangladesh through Fostering

ICT and Scientific Research of PP2041 there is no other alternate to re-organize the academic curriculum of IT-related studies in the linkage of industry-academia.”

8.5 Five-Year Plan:

Under the Sector-11 it says “Education and Training, Chapter-11: Education Sector Development Strategy is highly indicated to make market-oriented curriculum and strengthening of UGC and under the Sector-12: Digital Bangladesh and Information Communication Technology, Chapter-12: Leveraging Digital Bangladesh and ICT Strategy for Higher Growth entails the importance of increasing the ICT facilities for all sector.”

8.6 ICT Policy 2018:

“National Information and Communication Technology Policy 2018” was approved on 15 November 2018 with a clear vision to reach a knowledge-based developed country by the year 2041. A set of strategic areas are identified to progress with specific objectives for the implementation of the policy. There are instructions to Secondary and Higher Education Division and UGC to implement the Strategic Issue 4.3 and update the curriculum to generate employment, ensure the cooperation between academic institutions and ICT industry- (1) to do update the ICT curriculum for university-level reviewing the standardization in every 2 years intervals to ensure more effectiveness (4.3.3, Page-45), (2) to prepare feasible course & curriculum to develop with updated knowledge and skill aligning with the local and global ICT based demand to ensure the supply of ICT human resource at the higher rate for the prospective ICT industry of the country (4.3.2, Page-45). Moreover that under the Strategic Issue 4.1 Inclusion and regular update of IT studies from primary level to all academic level & line it is instructed to Secondary & Higher Studies Division, Technical & Madrasa Education Division, Primary & Mass Education Ministry, NCTB, ICTD and UGC to ensure regular update of ICT curriculum in every academic level to ensure the skilled human resources development and to construct a knowledge-based society with caring the skill demand in the local, global market and for 4th Industrial Revolution (4.1.1, Page-40). These instructions are given to ensure the overall objective no-4: Education, Research and Innovation (Objective No-4, Page-40).

8.7 Current International Standard:

Developing curriculum guidelines for CSE/IT/ICE/ICT has become challenging due to the rapidly changing evolution and expansion of knowledge and application levels. Association of Computer Machinery (ACM) and IEEE Computer Society have a long history of sponsoring an effort to establish international curriculum standards for the undergraduate program on a roughly 10-year cycle. Accreditation Board for Engineering and Technology (ABET) has also set some criteria for accrediting the Engineering Technology program to understand that the program has met required standards to prepare graduates and enter the critical STEM fields in the global workforce. Therefore, the current international standard for developing curriculum is more focused on competency, transforming knowledge-based learning to competency-based learning and expanding courses with the latest technological advancement.

Industry: The industry requires employees having specific knowledge at relevant knowledge levels and several key dispositions. Courses in the curriculum should be appropriate for the professional skills in education as well as in workplace. The industry hires graduates and internships. So, the input of industrial demand should be focused on the curriculum guidelines.

The global IT industry is growing faster than other industries. The current supply of potential human resources for the global IT/ITES industry is not enough at all and it requires more in terms of quality and quantity. Nowadays, the skilled human resources in IT/ITES are not only the requirement of IT/ITES industry but also demanded by other industries.

The IT industry of Bangladesh is growing fast and facilitates to be the leading entity economically in near future. So, there is awaiting a huge employment opportunity in the local IT industry also.

Besides these factors, the global and local IT industry is evolving with the latest technological advancement and the creation and integration of innovative products and services.

8.8 Linkage with ITEE and CSE/IT related Curriculum in Bangladesh

8.8.1 Information Technology Engineers Examination (ITEE) and ITEE FE Syllabus:

ITEE is an assessment tool of IT human resources by measuring the IT skills and knowledge of IT engineers. Fundamental Information Technology Engineer Examination (FE) is one of the key categories of examination to test IT knowledge and skills.

The examination is conducted under the Information Technology Professional Examination Council (ITPEC) of Information-technology Promotion Agency (IPA), Japan. ITPEC is the organization for a common IT examination in Asian countries. ITPEC includes members from 6 countries (Philippines, Thailand, Vietnam, Myanmar, Mongolia, and Bangladesh). The examination is conducted in English in 6 countries of ITPEC twice a year (April and October), on the same day using the same set of questions to keep the level of the examination equivalent in each country. The questions of the examination are made by the Question-Making Committee of each ITPEC member country in cooperation with the Japanese Question-Making Committee. The examination is highly reliable since it is a national exam in each country and the certificate is issued officially by each government. The unique features of this examination are (i) questions are designed in vendor-neutral stance (ii) applicable in IT human resource development for both Vendors and Users (iii) open an assessment of the ability of IT engineer in the global market and (iv) extensive exam scope with IT and business management.

ITEE FE syllabus represents the knowledge and skills required for the Information Technology Engineers Examination in detail. This is configured like what graduates should learn to solve a problem independently.

The body of knowledge of the ITEE examination is unique and nicely balanced to become potential IT professional or to continue for higher studies or to do research and innovation work. The passers of this exam will be capable to work in a team as IT engineer with skills in the fields of (i) System architecture design and software detailed design (ii) Software programming and software development management (iii) System operation and service management (iv) Analysis/evaluation of information system strategy (v) Proposal for the planning of information system strategy.

| Field | Major Category | | Middle Category |
|------------|----------------|---------------------------|---|
| Technology | 1 | Basic Theory | Basic Theory, Algorithms and Programming |
| | 2 | Computer Systems | Computer Components, System Components, Software, Hardware |
| | 3 | Technical Elements | Human Interfaces, Multimedia, Databases, Networks, Security |
| | 4 | Development Techniques | System Development Techniques, Software Development Management Techniques |
| Management | 5 | Project Management | Project Management |
| | 6 | Service Management | Service Management, System Auditing |
| Strategy | 7 | System Strategy | System Strategy, System Planning |
| | 8 | Management Strategy | Management Strategy, Technology Strategy Management, Business Industry |
| | 9 | Corporate & Legal Affairs | Corporate Activities, Legal Affairs |

8.8.2 An overview of ITEE FE Exam in Bangladesh:

Bangladesh Computer Council (BCC) has been conducting the ITEE FE exam in Bangladesh since October 2013 under the “Capacity Building of ITEE Management Project” to establish ITEE exam and now carry over by “**The Project for Skills Development of ICT Engineers Targeting Japanese Market**” to promote ITEE exam with an extensive scope of works in cooperation with Japan International Cooperation Agency (JICA). Total 242 candidates were passed the examination till the last examination held in October 2019. The passing rate is only 8.16% of the total appeared candidates which is much lower than other ITPEC countries. Only about 50% of the total registered candidates participated in every exam. BCC is trying to improve the situation by taking dedicated projects in cooperation with JICA since the inception of ITEE in Bangladesh to promote, develop, and brand IT professionals of Bangladesh in the local and global industry. The project is also trying to be the leading position among ITPEC countries in the passing rate with at least 40% and above. The project has been done the number of seminars on the importance and impact of ITEE in most of the renowned public and private universities, provide training, organized model exam, commentary session, develop social media platform, youtube channel, availability of resource materials, and the most importantly trained 159 trainers from different universities, government organizations and IT industries. Mr. Yukinobu Miyamoto, Professor, Kobe Institute of Computing, Kobe, Japan, and dedicated Japanese professionals are working for a long time to develop IT Human Resources in Bangladesh from the beginning. Mr. Miyamoto very closely observes and analyses the performances of Bangladeshi examinees and tries to find out the reason behind the low passing rate. The participation and results surprisingly show a very low rate of performance though the students of Bangladesh have enough potential and a large number of students study CSE/IT-related courses. The syllabus of CSE/IT-related undergraduate courses run by universities in Bangladesh deeply focuses on

technology part only where IT Management and IT Strategy are less focused. This is very essential to have the ability to apply, operate, manage and disseminate the excellence of technology through improving the industry and developing the human life cycle and society. So, a very well-balanced knowledge among technology, management and strategy to compete in the global IT industry is a must. This is also determined by the shortage of required courses in the curriculum of CSE/IT related courses to generate skilled IT professionals for the IT industry.

8.9 Joint Effort by UGC-BCC-JICA for Updating Syllabus

After analysing and finding out the concerning issues in the ITEE result and checking CSE syllabus of a few universities, BCC immediately drew the attention of UGC to take measure for inclusion of IT Strategy and IT Management courses from ITEE FE syllabus and latest courses for creating effective IT professional for global market level. The UGC also responded immediately and the following activities have been done jointly:

8.10 Workshop on “Skill Development of ICT Engineers on IT Engineers Exam (ITEE) Targeting Japanese Market”

The workshop was held on 13 November 2019 in participation with a notable number of Vice-Chancellors, Deans of Engineering Faculties and Chairman/Heads of CSE departments. It briefly discussed the importance of the exam to enrich competency level for becoming skilled IT professional. It also addressed the expected disruption of the 4th Industrial Revolution in all sectors and how nicely could balance with the adoption of relevant courses/contents from the ITEE syllabus. Later UGC issued a letter to all the universities to update their syllabus with the inclusion of required courses/contents from the ITEE syllabus to make the curriculum more industry-oriented and to ensure more competent IT human resources development. But while following up with the progress of the UGC’s instruction at the universities, it was realized the requirement for a clear guideline about how to adopt internationally most valuable, updated and necessary courses from the ITEE syllabus and to know how to balance with multiple issues on priority criterion as there was already an existing guideline by UGC.



Mr. Zunaid Ahmed Palak, Honorable State Minister, ICT Division delivering speech as Chief Guest

A glimpse of the Workshop

Mr. N M Zeaul Alam, Sr. Secretary, Ministry of ICTD



Professor Dr. Md. Sazzad Hossain, Member, UGC



Professor Dr. Kazi Shahidullah, Chairman, UGC



A view of the participants from the Universities



8.11 Formation of Guideline Development Committee for Preparing Standard Curriculum of BSc in CSE/IT/ICE/ICT as per International Standard and ITEE Syllabus

At a time, UGC again came forward in response to the official request from BCC and formed a committee (vide memo no- 37.01.0000.114.99.001.19.13 Dated: 07 June 2021) with the experienced and learned professors from leading public and private universities including UGC officials. The committee was headed by an hon'ble member of UGC and worked intensively to update the CSE/IT Syllabus Guideline.

8.12 Portfolio of the Guideline Development Committee for Preparing Standard Curriculum of BSc in CSE/IT/ICE/ICT as per International Standard and ITEE Syllabus

The committee was duly authorized to share, exchange their views, opinion, feedback, open discussion, questioning, reviewing, understanding situations and overall deliberation to input in the guidelines ensuring unanimous agreement of all the members. The Convener guided, supervised, discussed and advised as appropriate in the jurisdiction of UGC rules and regulations considering the interest of national goals and vision. All the committee members are renowned in their respective fields and position. The committee member's age, expertise area, experience, graduation, activeness in a professional organization, representation of

public and private universities, knowledge on rules and regulation, coordination capacity etc. were considered while it was formed. Short portfolio of each member has been given below:



Professor Dr. Md. Sazzad Hossain, Member, UGC and Convener of this Committee is also a Director of Bangladesh Satellite Company Ltd (BSCL). He earned a Ph.D in Electrical and Computer Engineering from Portland State University, Oregon, USA Dr. Sazzad taught several advanced courses, such as Introduction to Quantum Computing, VLSI Design, Artificial Intelligence and Human Robot Interaction. He also lent his teaching and research experiences in many universities and institutes as a visiting faculty/researcher/guest speaker. He has twenty six (26) years of experience in Information Technology. He has served as a consultant to a number of nationally and internationally renowned ICT companies, government agencies and organizations. His research interest includes Quantum computing, quantum algorithms, quantum entanglement, de-coherence, natural computing, fault-tolerant computing, theoretical computer science, Nano Technology, Low Power VLSI Design, Reversible logic, Software Engineering, Internet of Things (IoT), Artificial Intelligence, Robotics, Human Robot Interaction, Renewable Energy and Solar PV Cell. Based on his research findings over 50 papers have been published in peer-reviewed international journals and conference proceedings. He is popular with the readers of science and technology books for his recently published book titled “অদৃশ্য প্রযুক্তি” (Invisible Technology) which caught readers’ attention since its availability. He is also the author of the book named “Programming in C”. He is well known for his visionary write-ups and interviews both in print and electronic media.



Professor Dr. Mohammad Mahfuzul Islam, P. Eng, Vice-Chancellor, Canadian University of Bangladesh and Member of the Committee. He did PhD from Monash University. His research interest topics are Information Security, Network Security, Wireless Network, Artificial Intelligence, Steganography and Computer Forensics. He is also the Chairman of Bangladesh Question Making Committee for ITEE. He

was Head of the Department of CSE and Provost, Shahid Smriti Hall, BUET. He also writes more than 70 articles on various ICT contemporary issues for different world-reputed journals and conferences. He also led the professional ICT-related bodies like as a president of Bangladesh Computer Society and a chairman of Computer Engineering Division, IEB. He served as a Director of Dhaka Electric Supply Company (DESCO) Ltd. He served as the project leader, a consultant, an assessor and a team member in a number of government and non-government projects including Machine Readable Passport, National ID Project, Hi-Tech Driving License Project, Digital Classroom, VAT Automation conceptual model and DNA Lab. He is one of the key inventors of electronic voting machine (EVM) of Bangladesh.



Dr. Md. Ekramul Hamid, Professor, Department of CSE and Dean, Faculty of Engineering, University of Rajshahi and Member of the Committee has done PhD from Japan. He has more than 23 years of experience in the academic profession. Speech Enhancement, Speech Noise Reduction, Speech Feature Extraction, Speech Recognition, Biomedical Signal Processing, Image Processing are his research interest. Besides that, a number of his write-ups were published in various journals.



Professor Mamun received B.S. and M.S. degrees from the University of Dhaka, Bangladesh in 1998 and 1999, respectively. He earned a PhD degree in Wireless Networking from the Department of Computer Engineering, School of Electronics and Information, Kyung Hee University, South Korea in 2008. He was a postdoctoral fellow in the same university during 2008-2009 in the institute of Multimedia Technology. Beside teaching he served as a Technical Support Team Consultant for the Bangladesh Research and Education Network (BdREN), a component of Higher Education Quality Enhancement Project (HEQEP) till 2016. He is also working closely in different ministries, specially, Information and Communication Technology Division to

contribute innovation evaluation and innovation fund policy making. He has made significant contributions as a technical committee member for the National Data Center 4TDC (now BDCCL Bangladesh Data Center Company limited), first Tier IV Data Center in Bangladesh, Smart Metering for Northern Electric Supply Company (NESCO) and many others. He is working as a Professor in the Department of Computer Science and Engineering, University of Dhaka, Bangladesh. His research interests include modelling, analysis and optimization of wireless networking protocols and architectures, wireless sensor networks, wireless mesh networks, Internet of Things (IoT) etc.

Dr. Mohammad Nurul Huda, Professor and MSCSE Director, Dept of CSE, United International University, Dhaka and Member of the Committee

graduated from CSE, BUET and then did PhD from Japan on “Articulatory Feature Extraction for Robust Speech Recognition”. He has over 24 years of academic teaching experience in leading private universities in Bangladesh. His research fields are Machine Learning, Natural Language Processing, Algorithms, Artificial Intelligence, etc and writing on various tech issues regularly in journals. He has more than 150 international research articles in the related fields. Among them more than 78 are SCOPUS indexed articles. Besides, he is working as an honorary senior director, AI & NLP in eGeneration Public Limited Company and as the Vice-President (Academic) in Bangladesh Computer Society (BCS).



Dr. M Shamim Kaiser, Professor, Institute of Information Technology, Jahangirnagar University and Member of the Committee

received Ph. D. degree in Telecommunication Engineering from the Asian Institute of Technology (AIT) Pathumthani, Thailand and worked as a postdoc fellow in the Big data and Cyber Security Lab of Anglia Ruskin University, UK from 2017-2018. His current research interests include Data Analytics, Machine Learning, Wireless Network & Signal processing, Cognitive Radio networks, Big IoT data,



Healthcare, Neuroinformatics, and Cyber Security. He has authored more than 150 Scopus indexed articles in different peer-reviewed journals and conferences.

Dr. Farhana Sarker, Assistant Professor, Department of CSE, University of Liberal Arts Bangladesh and Member of the Committee.



Dr. Sarker received her PhD degree in Computer Science from the University of Southampton, UK. Before her PhD study, she worked as a researcher in the University of Southampton, UK and in King Saud University, Riyadh, Saudi Arabia. She has diversified research background in the area of computer science and engineering. Her current research focuses on health, education, linked data, open data and data science. She published a number of journal and conference papers in renowned journals and conferences. She also has experience in working in software and telecom industry in Bangladesh for around 3 years.

Mohammad Maksudur Rahman Bhuiyan, Director (Additional Charge), IMCT Division, UGC and Member of the Committee,



has been working also in the International Collaboration & Cooperation Section & Cross Border Higher Education of Bangladesh Section at UGC. Currently he is a PhD researcher at University of New England, Australia. He achieved his Master of Information Technology (MIT) degree from University of Queensland, Australia and completed B.Sc in Electrical & Electronic Engineering from CUET, Chittagong. Mr. Maksudur is the author of more than 20 top ranking International Articles, Journals and Conference Proceedings in Engineering, Data and Data Science relevant areas. He earned certification on Google Data Analytics, Google Data Science, Google Project Management and Google Data ICT Cloud Infrastructure. He has 1 ½ years' working experience under Google and ACT Government of Australia.



Nushrat Sharita, Sr. Assistant Director, IMCT Division, UGC and Member Secretary of the Committee

As per the jurisdiction, the committee worked under the following Terms of References :

1. Review of existing syllabus followed by various universities.
2. Review of Internationally followed syllabus and ITEE Syllabus.
3. Comparison status between our existing following syllabus and professional & standard syllabus.
4. Identify the weakness of existing syllabus.
5. Recommendation to formulate professional & standard syllabus.
6. Develop an ideal professional and standard syllabus in line with the incorporation of ITEE syllabus.
7. An overall outline to incorporate the recommended subjects and chapters from ITEE syllabus.
8. Identify the qualification and management of teachers who conduct the classes for the recommended subject and chapters from ITEE syllabus.
9. Others related issues.

8.13 Decisions of the Meetings of Guideline Development Committee for Preparing Standard Curriculum of B.Sc in CSE/IT/ICE/ICT as per International Standard and ITEE Syllabus

The committee reviewed and discussed the existing guideline with the scope of standardization in 5 meetings. After the series of meetings, the committee finally shaped up a structure of the standard syllabus with the inclusion of the latest courses as per the international standard and the ITEE FE syllabus. As a result, the committee formulated a detailed guideline with an unanimous agreement of all the members. So, the table below shows the schedule of meetings and taken decisions:

| Sl | Date & Time | Subject & Ref. | Decisions | Remarks |
|----|-------------------------|---|---|---|
| 1. | 15 Jun 2021; 03:00PM | 1st Meeting. Memo No- 37.01.0000.114. 99.001.19.16 Dated: 14 June 2021 | <ol style="list-style-type: none"> 1.The current syllabus guideline of UGC for CSE/IT related course-curriculum will be shared for review. 2.ITEE syllabus will be shared with the members to review it with their own university curriculum. 3.Faculty members will prepare a draft guideline to incorporate ITEE into the existing university curriculum. | <p>Memo No- 37.01.0000.114.</p> <p>99.001.19.23 Dated: 18 July 2021</p> |
| 2 | 11 Jul 2021; 03:00PM | 2nd Meeting. Memo No- 37.01.0000.114. 99.001.19.26 Dated: 11 July 2021 | <ol style="list-style-type: none"> 1. Advise to review the guideline shared by Professor Dr. Mohammad Mahfuzul Islam, P. Eng, Vice-Chancellor, Canadian University of Bangladesh in light of the possibilities of immediate effects keeping the national policy issues unchanged. 2. Consider the formulation of guideline structure in short so that it would be possible to give instruction to universities promptly. 3. Try to develop a gap analysis between existing curriculum and ITEE and other related syllabuses with broader aspects. 4. Develop the final outputs of this committee within a | <p>Memo No- 37.01.0000.114.</p> <p>99.001.19.28 Dated: 04 Aug 2021</p> |

| | | | | |
|---|-------------------------|---|--|---|
| | | | <p>couple of meetings by July/August 2021.</p> <p>5. Tentative schedule for next meeting is 18/19 July 2021. It would be finalized by the Convener of the Committee.</p> | |
| 3 | 26 Jul 2021; 03:00PM | <p>3rd Meeting.</p> <p>Memo No- 37.01.0000.114. 99.001.19.27 Dated: 29 Jul 2021</p> | <p>1. Prepare a course list from the gap analysis of our existing curriculum with ITEE syllabus.</p> <p>2. Prepare the guideline document to be acceptable by all universities without changing the structural framework of current guideline.</p> <p>3. Include all the study analysis, findings, recommendations with reference documents with a objective to future activities for a greater changes with all other relevant factors for the competitive market.</p> <p>4. Do 1/2 professional discussion meeting among the members to formulate the guideline as per instructions lead by Professor Dr. Mohammad Mahfuzul Islam, P. Eng, Vice-Chancellor, Canadian University of Bangladesh and submit within 2 weeks.</p> | <p>Memo No- 37.01.0000.114. 99.001.19.30 Dated: 17 Aug 2021</p> |

| | | | | |
|---|-------------------------|---|---|---|
| 4 | 08 Aug 2021; 04:00PM | 4th Meeting. Notify by email Dated 07 Aug 2021 | <ol style="list-style-type: none"> 1. Revised draft will be shared with all members before the next meeting to make finalize. 2. Professor Dr. Mohammad Mahfuzul Islam, P. Eng, Vice-Chancellor, Canadian University of Bangladesh will revise the draft as per findings, recommendation and point of consideration. 3. The next meeting will be held withing one week. 4. Ensure the inclusion of introduction, objective, background, findings, recommendations are narrated in the proposed guideline for better implementation. | Memo No-37.01.0000.114. 99.001.19.32 Dated: 06 Sep 2021 |
| 5 | 08 Sep 2021; 03:30PM | 5th Meeting. Memo No-37.01.0000.114. 99.001.19.33 Dated: 07 Sep 2021 | <ol style="list-style-type: none"> 1. The proposed guideline needs to be approved by UGC officially. 2. The printed copy of the guideline should be distributed to all the universities with proper instructions to bring changes to their existing curriculum as per newly approved and issued guideline. 3. Submit the final version of the guideline accumulating all the comments and advise made by the convenor. | Memo No-37.01.0000.114. 99.001.19.38 Dated: 28 Sep 2021 |

| | | | | |
|--|--|--|---|--|
| | | | 4. A nationwide workshop need to be organized to officially launch the newly approved guideline and demonstrate the know-how. | |
|--|--|--|---|--|

8.14 Covid-19

Soon after the workshop, the entire world has been suffering from the Covid-19 pandemic and disrupted all the regular activities of human life. The education sector too is severely affected by Covid-19. But at the same time, this is also great to realize that intervention of advanced IT can solve many of the covid-19 disruptions. Though it was not possible to maintain physical classes or other regular university activities, the online facilities bring the option to run the activities regularly by working/studying from home. All the sectors were forced to adopt to the technological changes to survive in the situation. The covid-19 situation completely indicates the emerging priority and necessity of technological advancement.

Therefore, this is highly required to acquire the appropriate knowledge and learning with application of the lessons learned to cope with the predicted changing situation specifically for the IT discipline.

It is undeniable that the post Covid-19 era has brought us a drastic change in the entire course/practice of life, education, business, professionalism, career, innovation criteria across the globe, geographical location, religion, races, classes and many more. So, we must be prepared accordingly with technological equipment and skilled human resources as well.

9.0 Scope of Work

Preparing this guideline was a massive task for this committee. The work required very deep knowledge about current changes in IT, future scenarios, forecasting demand, advancements and application. The most important thing was to understand the ability and capacity of user institutions and what processes should be offered to acquire. The output of the committee will influence the overall national higher level IT education system and impact considerably to ensure effective human resources development with required skill and knowledge as per the industry demand. So, each member of the committee had to pay maximum dedication and effort to do the work.

Considering the broader scope, all the members actively participated in the meeting and submitted their valuable comments, suggestions, advice, consultation, better directions and recommendations to contribute to developing a guideline for the greater national interest and effective use of all the stakeholders.

Fortunately, 7 members out of 9 are the very active faculties of leading public and private universities of Bangladesh, it becomes easy to review the overall situation of the current CSE syllabus followed by Bangladeshi universities in comparison with the international standard.

Besides that, 4 members are connected with ITEE and have deep insights about the ITEE FE syllabus. This helped make a standard syllabus for our graduates to be competent IT professional as per the current demand of the ITEE.

Moreover, as the committee was headed by an honourable Member and there were one director and additional director from the concerned department of

UGC, it made the task sophisticated integrating all the updates, changes, modifications and revisions in line with the structural syllabus formation of UGC.

Therefore, the expected deliverables of the Guideline will help to prepare Standard Curriculum for B.Sc in CSE/IT/ICE/ICT (Modified) addressing the current situation of the IT industry, internationally followed curriculum and the ITEE contents to generate skilled IT professionals.

10.0 Limitations

It was challenging to prepare the CSE curriculum with a single guideline, as ICT evolves vast areas with continuous changes and innovations. It is never easy to cover all the areas of 4 years undergraduate program in CSE/IT. Under this context, this guideline tried to pursue a balanced curriculum that ensures the right kind of knowledge and lessons required for human resources development, individual career and academic growth and industrial demand. So, this guideline offers enough options to select the course aligning with the ultimate objective of the students.

Despite a lot of technological courses, the committee tried to emphasize on essential IT Business and IT Strategy courses considering the learner's level of gathered knowledge on the application or their entrepreneurship capacity.

It is hoped that the respective ICT faculty members would be able to guide their students to be perfect human resources for serving in diversified capacity either in business or industry.

11.0 Challenges

The beginning of the implementation of the design curriculum as per the new guideline may be a bit challenging due to the inclusion of new or updated courses in the course curriculum. The faculty members will have to spend enough time in study and finding the knowledge resources and reference books for ensuring the effective outcome from the new inclusion/updated syllabus.

There are also possible challenges to select the appropriate courses from the wide range of options with long-term objectives and goals.

12.0 Benefits

The curriculum prepared as per the new guideline will certainly bring enormous benefits for the students, faculties, departments, all sectoral industries specifically for the ICT industry, employment generation and overall significant contribution to the national economic growth despite some limitations and challenges. Some of the identical and expected benefits are stated below:

- ❖ The syllabus will be more dynamic and compatible with international standard.
- ❖ The syllabus will be more focused on the study of the disruption of 4IR technology.
- ❖ The syllabus will be more industry oriented.
- ❖ The syllabus will address how to apply gathered knowledges.
- ❖ The syllabus will ensure quality ICT human resources development.
- ❖ The syllabus will increase the competency of the students for the local and global employment.
- ❖ Students will get enough flexible options to choose their courses more strategically.
- ❖ Students will get the opportunity to learn IT Management and IT Strategy with utilization of technology.
- ❖ More students will be able to pass the ITEE exam.
- ❖ The ICT departments and faculties will be enriched.
- ❖ The other sectoral industry will be benefitted from skill employment.
- ❖ The ICT industry growth rate will be faster and more sustainable.

13.0 Methodology

The existing guideline was reviewed and compared with international standards, syllabuses followed by the leading universities and the ITEE FE syllabus to find out the gap courses or contents. The committee discussed, suggested, guided and recommended to incorporate or update the existing guideline. It was also ensured not to violate the national rules and policy about some compulsory courses and the basic structure of the curriculum design for the national interest.

14.0 Outline/Basic Structure

The outline/basic structure will make it easier to understand the basic structure of the syllabus guideline. The committee paid special attention to the broader discipline/category of the learning fields for the allocation of credit hours, compulsory courses and study topics. So, the table below shows the outline/basic structure of the syllabus guideline:

14.1 Outline/Basic Structure of the Guideline to Prepare CSE/CE/CS/ICT Syllabus

| SL # | Broader Discipline /Category | Tentative Theory (T) and Laboratory (L) Courses | When laboratory/sessional courses are 1.0 CH | | When Laboratory/Sessional Courses are 1.5 CH | |
|--------------|---|---|--|------------|--|------------|
| | | | CH | Percentage | CH | Percentage |
| 1 | Language, History and Cultures | 2T + 1L | 7 | 5.0% | 7.5 | 5% |
| 2 | General Education | 6T | 18 | 12.8% | 18 | 12% |
| 3 | Basic Science and Engineering | 4T + 3L | 15 | 10.6% | 16.5 | 11% |
| 4 | Mathematics | 4T | 12 | 8.5% | 12 | 8% |
| 5 | Computer Science and Engineering core courses | 19T + 14L | 71 | 50.4% | 78 | 52% |
| 6 | Project and Thesis (PT) | - | 6 | 4.3% | 6 | 4% |
| 7 | Elective Courses | 4T | 12 | 8.5% | 12 | 8% |
| Total | | 39T + 18L + 1PT | 141 | - | 150 | - |

14.2 Requirement of Minimum Credit Hours to Award an Undergraduate Certificate

Courses offered in the universities of Bangladesh are of two types: theoretical and sessional or practical. The contact hours of students with teachers for sessional or practical courses are twice compared with the hours spent in theoretical courses. To match with the credit hours defined widely in international domain, the following definition of credits hours should be considered the standard credit hours defined by the UGC: "One credit hour for a theory course is defined as the minimum 1 hour or 60 minutes of class per week when the teaching period is 15 weeks and one credit hour for a sessional or laboratory course is the minimum of 15 weeks class with a 2 hours or 2*60 minutes of class per week." Hence, standard teaching hour (STH) for a 1.00 Credit Theory course shall be 15 weeks * 60 minutes/week, i.e., 900 minutes and for a sessional or practical course, it will be 1800 minutes. For graduation, a student must complete at least 120 Standard Credit Hours including completion of all the core and independent courses included in the syllabus.

Number of weeks in terms of teaching and the class duration varies from university to university. So, for actual calculation to adjust the level of required

knowledge for a student, a multiplying factor (M) shall be defined through dividing STH by actual teaching hour (ATH) as follows:

$$\text{Multiplying Factor (M)} = \frac{\text{Standard Teaching Hour (STH) per Credit Hour}}{\text{Actual Teaching Hour (ATH) per Credit Hour}}$$

A student needs to complete at least $120 * M$ credit hours for graduation. For an instance, if the teaching period excluding vacation and examination in a university is 14 weeks, three classes are taken per week with a class duration of 50 minutes, then

$$M = \frac{\text{STH per week}}{\text{ATH per week}} = \frac{60 \times 15 \times 3}{50 \times 14 \times 3} = 1.2857$$

For completing graduation from this university, a student needs to complete at least $120M = 120 \times 1.2857 \cong 154$ Credit Hours.

| Program | Minimum Credit Hours Requirement for Awarding the Undergraduate Certificate | |
|-----------------------|--|--|
| | Bi-Semester System | |
| | 15 Weeks + 3 classes per week with 60 minutes duration (excluding final exam week) | 14 Weeks + 3 classes per week with 50 minutes duration |
| B.Sc in CSE/CE/CS/ICT | 120 | 154 |

