15.0 The Overall Curriculum Structure

Based on the Basic Structure of syllabus preparation and total credit hours requirement to obtain the eligibility for an undergraduate certificate, the committee formulated the below overall curriculum structure to be followed by the respective universities with their dignitaries and capacities:

A. Language, History and Cultures

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
1	English Language, History and Cultures	1	Communicative English	1	1	1 x 3 = 3	1 x 1 = 1 Or 1 x 1.5 = 1.5	7 or 7.5	**Compulsory Course:** English-1(Theory) English-1 (Lab) Bengali-1
		2	Technical Writing and Presentation						
		3	Developing English Skills						
		4	Business Communications						
		---	etc.						
2	Bangla Language, History and Cultures	5	Functional Bangla Language	1	-	1 x 3 = 3	-		
		6	Bangladesh Studies: History and Cult						
		---	etc.						

B. General Education

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
1	Science and Humanities	1	Engineering Economics	3	-	3 x 3 = 9	-	18	
		2	Sociology						
		3	Financial and Managerial Accounting						
		4	Political Science						
		5	Environment and Society						
		6	Human Resource Development						
		7	Social Inequality and Planning						
		8	Professional Ethics and Environmental Protection						
		9	International Relations						
		10	Corporate and Legal Affairs						
		11	Civilizations and Cultures of South Asia						
		---	etc.						

2	Business operations, strategies and Managements	12	Service Operational Management	3	-	3 x 3 = 9	-		
		13	Entrepreneurship: Innovation and Commercialization						
		14	Business Strategy Management						
		15	Information System Management						
		16	System Planning and Management						
		17	System Auditing and Maintenance						
		----	etc.						

C. Basic Science and Engineering

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
1	Basic Science and Engineering	1	Physics	4	3	4 x 3 = 12	3 x 1 = 3 or 3 x 1.5 = 4.5	15 or 16.5	
		2	Chemistry						
		3	Electrical Engineering						
		4	Electronics						
		5	Digital Electronics and Pulse Techniques						
		6	Electrical Drives and Instrumentations						
		7	Engineering Drawing						
		8	Mechanical Engineering, etc.						
		---	etc.						

D. Mathematics

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
1	Mathematics	1	Applied Mathematics	4	-	4 x 3 = 12	-	12	
		2	Differential and Integral Calculus						
		3	Statistics and Queuing Theory						
		4	Complex Variables						
		5	Vector Analysis						
		6	Differential Equations						
		7	Coordinate Geometry						
		8	Linear Algebra						
		9	Numerical Methods						
		---	etc.						

E. Computer Science and Engineering Core Courses

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
1	Programming Languages	1	Structured Programming Languages	4	4	4 x 3 = 12	4 x 1 = 4 or 4 x 1.5 = 6	71 or 78	
		2	Object Oriented Programming Languages						
		3	Markup and Scripting Languages						
		4	Java Programming						
		5	Mobile Application Development, etc.						
		---	etc.						
2	Theory, Logic and Algorithms	1	Discrete Mathematics	3	2	3 x 3 = 9	2 x 1 = 2 or 2 x 1.5 = 3		
		2	Data Structures and Algorithms						
		3	Automata Theory and Compiler						
		4	Artificial Intelligence						
		5	Multimedia Technology and Applications						
		6	Computer Graphics						
		----	etc.						
3	Software System	1	Database Management System	7	3	7 x 3 = 21	3 x 1 = 3 Or 3 x 1.5 = 4.5		
		2	Operating System						
		3	Software Engineering						
		4	System Analysis and Design						
		5	Computer and Cyber Security						
		6	Software Architecture and Design						
		7	Software Development Management						
		8	Software Testing and Quality Assurance						
		9	Software Integration and Maintenance						
		10	Software Project Management						
		---	etc.						
4	Hardware System Design and Engineering	1	Digital Logic Design	3	3	3 x 3 = 9	3 x 1 = 3 or 3 x 1.5 = 4.5		
		2	Computer Architecture						
		3	Microprocessor and Assembly Programming						
		4	System Configuration and Performance Evaluation						
		---	etc.						
5.	Communication and Networking	1	Theory of Communications	2	2	2 x 3 = 6	2 x 1 = 2 or 2 x 1.5 = 3		
		2	Information and Control Theory						
		3	Computer Networking						
		4	Data communication						
		5	Switching and routing						
		---	etc.						

F. Elective Courses

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
1	Theoretical Computer Science	1	Mathematical Analysis for Computer Science	4	-	4 x 3 = 12		12	Courses listed under Theory, Logics and Algorithms may be shifted to this group, if not offered as a core courses.
		2	Graph Theory						
		3	Computational Geometry						
		4	Parallel Algorithms						
		5	Simulation and Modelling						
		---	etc.						
2	Communication and Networking	1	Cellular and Wireless Communications						Courses listed under Communication and Networking may be shifted to this group, if not offered as a core courses.
		2	Cloud Computing						
		3	Network Management and Administration						
		4	Digital Signal Processing						
		---	etc.						
3	Software System and Development	1	Distributed Systems						Courses listed under (i) Software System; and (ii) Programming Languages may be shifted to this group, if not offered as a core courses.
		2	Usability Auditing and Testing						
		3	Distributed System Management						
		4	Query Language and optimization						
		5	Computational Software Engineering						
		6	Enterprise Resource Planning						
		7	System Maintenance and Compliances						
		8	Distributed Database Management System						
		9	Database Management and Administration						
		---	etc.						
4	Hardware and Embedded System	1	Human Machine Interaction						Courses listed under Hardware System Design and Engineering may be shifted to this group, if not offered as a core courses.
		2	Digital System Design						
		3	Embedded Systems						
		4	Robotics						
		5	IoT						
		6	Microprocessor Interfacing						
		7	VLSI						
		8	Quantum Computing						
		---	etc.						

SL#	Basic Discipline/ Category	SL#	Courses	Minimum Taking Courses		Credit Hours		Total CH	Remarks
				Theory	Lab	Theory	Lab		
5	Cyber Security	1	Web Application Security						
		2	Ethical Hacking and System Security						
		3	Cryptography and Cryptanalysis						
		4	Digital Forensics and Incident Response						
		5	Blockchain and Distributed security						
		6	Software Security						
		7	Network Security						
		8	Cloud security						
		---	etc.						
6	Artificial Intelligence and Data Science	1	Machine Learning						
		2	Pattern Recognition						
		3	Bioinformatics						
		4	Digital Image and Video Processing						
		5	Natural Language Processing						
		6	Computer Forensics						
		7	Machine Vision and Motion Analysis						
		---	etc.						
7	Data Science	1	Data and Web Mining						
		2	Big Data Analytics						
		3	Complex Data Visualization						
		4	Data Science and Applications						
		5	Blockchain and Cryptocurrencies						
		---	etc.						
8	ICT	1	Enterprise Systems: Concepts and Practice						
		2	Electronic Business						
		3	Business Analytics						
		4	ICT for Development						
		5	IT Audit: Concepts and Practice						
		---	etc.						

Courses listed under General Education may be shifted to this group, if not offered as a core courses.

16.0 Justification for the addition/update/change/modification

As per the ICT Policy 2018, the guideline for university syllabus preparation should be updated on every two-year interval. Therefore, the existing guideline requires updates since it was issued in 2017. Besides that, ICT learning and fields are becoming broader with frequent modernization and advancement of technology like 4IR technology, digital intervention, social media platform, e-commerce, etc. So, new contents/courses come to the front every time. Currently, the ICT industry is dominating the world business domain. It has become an ultimate solution for every business sector to integrate with. Therefore, the ICT professionals are now required to have more dynamism to understand the application of ICT with the integration of proper IT Management and Strategy.

Under the above context, a short justification for addition/update/change/modification is noted in the table below:

Existing Syllabus Structure as of 11 Dec 2017				New Syllabus Structure				Justification/ Remarks based on Existing Syllabus Structure
Discipline/Category		Sl	Existing Courses under GL	Discipline/Category		Sl	Courses	
Broad	Basic			Broad	Basic			
A	B	C	D	E	F	G	H	I (Sl refer from "C")
Language	Language	1	Composition, writing and Communication in English	Languages, History and Cultures	English Language, History and Cultures	1	Communicative English	Simplify of Sl-1
		2	Functional Bengali Language, etc			2	Technical Writing and Presentation	Update of Sl-1
General Education	Social Science	3	Engineering Economics			3	Developing English Skills	Update of Sl-1
		4	Sociology			4	Business Communications	Same of Sl-15
		5	Financial and Managerial Accounting			---	etc	
		6	Political Science		Bangla Language, History and Cultures	5	Functional Bengali Language	Same of Sl-2
		7	Environment and Society			6	Bangladesh Studies: History and Culture.	Update of Sl-10
		8	Introduction to Human Development			---	etc	
		9	Social Inequality and Planning, etc	General Education	Science and Humanities	1	Engineering Economics	Same of Sl-3
	Arts and Humanities	10	Bangladesh Studies (History of Independence)			2	Sociology	Same of Sl-4
		11	Professional Ethics and Environmental Protection			3	Financial and Managerial Accounting	Same of Sl-5
		12	International Relations			4	Political Science	Same of Sl-6
		13	World Civilization Cultures of South Asia			5	Environment and Society	Same of Sl-7
		14	History of South Asia, etc.			6	Human Resource Development	Update of Sl-8
	Business	15	Business Communications			7	Social Inequality and Planning	Same of Sl-9
		16	Industrial and Operational Management			8	Professional Ethics and Environmental Protection	Same of Sl-11
		17	Technology Entrepreneurship			9	International Relations	Same of Sl-12
		18	Business management, etc.			10	Corporate and Legal Affairs	Addition
Basic Sciences	Physics	19	Physics I			11	Civilizations and Cultures of South Asia, etc.	Simplify of Sl-13
		20	Physics II			----	etc	

	Chemistry	22	Chemistry		Business operations, Strategies and Managements	12	Service Operational Management	Update of SI-16
Mathematics	Mathematics	23	Math I			13	Entrepreneurship: Innovation and Commercialization	Update of SI-17
		24	Math II			14	Business Strategy Management	Update of SI-18
		25	Math III			15	Information System Management	Addition
		26	Math IV			16	System Planning and Management	Addition
Other Engineering	a. Electronics & Electrical Engineering	27	Introduction to electrical engineering			17	System Auditing and Maintenance, etc.	Addition
		28	Electronic devices and circuits & pulse techniques				etc	
		29	Electrical drives and instrumentation	Basic Science and Engineering	Basic Science and Engineering	1	Physics	Simplify of SI-19 & 20
	B. Engineering Drawing	30	Engineering drawing, etc.			2	Chemistry	Same of SI-22
Computer Science and Engineering Core	Programming	~~31~~	~~Introduction to Computing~~			3	Electrical Engineering	Simplify of SI-27
		32	Structured Programming			4	Electronics	Addition
		33	Object Oriented Programming			5	Digital Electronics and Pulse Techniques	Update of SI-28
		34	Web Programming			6	Electrical Drives and Instrumentations	Same of SI-29
		35	Mobile Programming. etc.			7	Engineering Drawing	Same of SI-30
	Hardware Systems	36	Digital Logic Design			8	Mechanical Engineering, etc.	Addition
		37	Computer Architecture			----	etc	
		38	Microprocessors & Microcontrollers, etc.	Mathematics	Mathematics	1	Applied Mathematics	Addition
	Logics and Algorithms	39	Discrete Mathematics			2	Differential and Integral Calculus	Specify as per Outline
		40	Data Structures			3	Statistics and Queuing Theory	Addition
		41	Algorithms			4	Complex Variables	Specify as per Outline
	Systems	42	Computer and Cyber Security			5	Vector Analysis	Specify as per Outline
		43	Database			6	Differential Equations	Specify as per Outline
		44	Operating System			7	Coordinate Geometry	Specify as per Outline
		45	Networking, etc.			8	Linear Algebra	Specify as per Outline
	Software Systems and Engineering	46	Software Engineering			9	Numerical Methods, etc.	Addition
		47	Information System and Design, etc.			----	etc	
	Project & Thesis	48	Project and Thesis	Computer Science	Programming Languages	1	Structured Programming Languages	Specify of SI-32
Tech	Theory	49	Mathematical Analysis for Computer Science			2	Object Oriented Programming Languages	Specify of SI-33

		50	Graph Theory			3	Markup and Scripting Languages	Addition
		51	Algorithm Engineering. Compiler			4	Java Programming	Addition
		52	Computational Geometry			5	Mobile Application Development, etc.	Same of SI-70
		53	Computer Graphics, etc.			----	etc	
	Communications	54	Data Communication		Theory, Logic and Algorithms	1	Discrete Mathematics	Same of SI-39
		55	Wireless and Cellular Communication, etc.			2	Data Structures and Algorithms	Merging SI-40-41
	Systems	56	Distributed Systems			3	Automata Theory and Compiler	Addition
		57	Simulation and Modelling			4	Artificial Intelligence	Same of SI-58
		58	Artificial Intelligence			5	Multimedia Technology and Applications	Addition
		59	Computer Graphics and Animation			6	Computer Graphics	Same of SI-53
		60	Cloud Computing, etc-			----	etc	
	Data Science	61	Artificial Intelligence (Same of 58)		Software System	1	Database Management System	Addition
		62	Machine Learning			2	Operating System	Same of SI-44
		63	Data Mining			3	Software Engineering	Same of SI-46
		64	Bioinformatics			4	System Analysis and Design	Addition
		65	Digital Image Processing			5	Computer and Cyber Security	Same of SI-42
		66	Big Data and Analytics, etc.			6	Software Architecture and Design	Update of SI-68
	Software Engineering	67	Human Computer Interaction			7	Software Development Management	Addition
		68	Software Architecture			8	Software Testing and Quality Assurance	Same of SI-69
		69	Software Testing and Quality Assurance			9	Software Integration and Maintenance	Addition
		70	Mobile Application Development, etc.			10	Software Project Management	Addition
	Hardware	71	Digital System design			----	etc	
		72	Embedded Systems		Hardware System Design and Engineering	1	Digital Logic Design	Same of SI-36
		73	Robotics			2	Computer Architecture	Same of SI-37
		74	Interfacing			3	Microprocessor and Assembly Programming	Addition
		75	VLSI, etc.			4	System Configuration and Performance Evaluation	Addition
	ICT	76	Concepts and Practice			----	etc	
		77	Enterprise Systems		Communication and Networking	1	Theory of Communications	Addition
		78	Web Application Security			2	Information and Control Theory	Addition
		79	Electronic Business			3	Networking	Same of SI-45
		80	Visualizing Complex Information			4	Data communication	Same of SI-54
		81	Mobile Web Development and Usability Testing, etc.			5	Switching and routing	Addition

						----	etc	
					Theoretical Computer Science	1	Mathematical Analysis for Computer Science	Same of SI-49
						2	Graph Theory	Same of SI-50
						3	Computational Geometry	Same of SI-52
						4	Parallel Algorithms	Addition
						5	Simulation and Modelling	Same of SI-57
						----	etc	
					Communication and Networking	1	Cellular and Wireless Communications	Same of SI-55
						2	Cloud Computing	Same of SI-60
						3	Network Management and Administration	Addition
						4	Digital Signal Processing	Addition
						----	etc	
				Elective Courses	Software System and Development	1	Distributed Systems	Same of SI-56
						2	Usability Auditing and Testing	Addition
						3	Distributed System Management	Addition
						4	Query Language and optimization	Addition
						5	Computational Software Engineering	Addition
						6	Enterprise Resource Planning	Addition
						7	System Maintenance and Compliances	Addition
						8	Distributed Database Management System	Addition
						9	Database Management and Administration	Addition
						----	etc	
					Hardware and Embedded System	1	Human Machine Interaction	Update of SI-67
						2	Digital System Design	Same of SI-71
						3	Embedded Systems	Same of SI-72
						4	Robotics	Same of SI-72
						5	IoT	Addition
						6	Microprocessor Interfacing	Update of SI-74
						7	VLSI	Same of SI-75
						8	Quantum Computing	Addition
						----	etc	

					Cyber Security	1	Web Application Security	Same of SI-78
						2	Ethical Hacking and System Security	Addition
						3	Cryptography and Cryptanalysis	Addition
						4	Digital Forensics and Incident Response	Addition
						5	Blockchain and Distributed security	Addition
						6	Software Security	Addition
						7	Network Security	Addition
						8	Cloud security	Addition
						----	etc	
					Artificial Intelligence and Data Science	1	Machine Learning	Same of SI-62
						2	Pattern Recognition	Addition
						3	Bioinformatics	Same of SI-64
						4	Digital Image and Video Processing	Update of SI-65
						5	Natural Language Processing	Addition
						6	Computer Forensics	Addition
						7	Machine Vision and Motion Analysis	Addition
						----	etc	
					Data Science	1	Data and Web Mining	Update of SI-63
						2	Big Data Analytics	Same of SI-66
						3	Complex Data Visualization	Addition
						4	Data Science and Applications	Addition
						5	Blockchain and Cryptocurrencies	Addition
						----	etc	
					ICT	1	Enterprise Systems: Concepts and Practice	Update of SI-76 & 77
						2	Electronic Business	Same of SI-79
						3	Business Analytics	Addition
						4	ICT for Development	
						5	IT Audit: Concepts and Practice	Addition
						----	etc	Addition

Defining Filled Colour Matching and Justification Remarks in "I" Column

- Matching Colour between A, B, and E, F: The matching colour shows the similarity in Broad and Basic Category/Discipline to shift, update, and specify the courses more appropriately.
- Black Colour Font Text: It means full similarity between the Existing Syllabus Structure as of 11 Dec 2017 and the New Syllabus Structure.
- Red Colour Font Text: Changes like addition, update, merges are shown with red colour font.
- Same as: It is representing the full similarity between Broad and Basic Category/Discipline.
- Update: This is representing any kind of update, modification or change in the course title etc. considering the advancement of the global curriculum/practice between Broad and Basic Category/Discipline.
- Merging: It is representing any kind of merging among the courses of the Existing Syllabus Structure as of 11 Dec 2017.
- Simplify: It is representing the simplicity of the course title considering the current practices.
- Specify: It is specifying the courses instructed in the remark's column of the outline.

17.0 Adaptation Strategy with Modified Guideline

The standard of the university curriculum depends on the willingness, ability and capacity of the universities though UGC urges the universities to practice curriculum of international standards and industry-recognized. The universities are always trying to attract aspirants with quality education and adequate resources. So, the most standard syllabus with capable faculties are prerequisites for ensuring the quality of education.

The universities have been experiencing that the CSE/IT related undergraduate programs are the most popular courses in Bangladesh and globally from the last couple of decades. Information Technology is becoming the leading driving force in business processes and structures, social services with evolving technological advancement and research and innovation. The employment rate regarding this skillset has been increasing dramatically both locally and globally. Bangladesh is also trying to take a leading position in this IT industry both locally and globally. So, demand for skilled candidates to cope with the 4th Industrial Revolution and digital intervention has increased too. A large number of students are also studying CSE/IT related subjects in different universities. So, the universities should take the highest care of this fact keeping updated their academic curriculum regularly.

UGC is very much inspired to issue the new “Guideline for Preparing Standard Curriculum of B.Sc in CSE/IT/ICE/ICT (Modified)” for guiding the universities to update their curriculum. So, the below strategies may be undertaken by the universities to update/modify the existing syllabus:

- Setting a principle that commits the best quality education-provider.
- Fixing the goal with vision, mission and objective.
- Aligning the curriculum in line with the principle and vision, mission, and objective
- Putting the best efforts to strengthen the capacity for quality implementation.
- Maintaining the basic outline/structure of the guideline to prepare the syllabus and course design.
- Maintaining and guiding students to select the courses in a balanced manner Technology-IT Strategy-IT Management (for example-Technology-60%, IT Strategy-20% and IT Management-20%)
- Guiding students to choose the courses which have demands and applicable in the industry.
- Inspiring to take the project work considering the industrial solutions/demands.

18.0 Recommendations

This is highly recommended to follow the guideline for preparing the CSE/IT related course curriculum by all the universities. Some of the recommendations are listed below to ensure the implementation of the guideline:

- Upload this guideline on the university website as UGC prescribed guideline for preparing/updating syllabus.
- Put a note about the percentage of compliance about the university approved syllabus.
- Train-up the faculties with the latest industrial and academic changes continuously.
- Guide the students in selecting courses in line with his career objective and industrial demand.
- Emphasize learning the minimum level of IT Strategy and IT Management to ensure the application of obtained knowledge and practices.
- Motivate the students to take part in National Skill Certification Exam on ICT (ITEE-FE) organized by BD-ITEC, BCC.
- Motivate the students to grow the competency level as per international standard.
- Maintain strong liaison with UGC, ICTD and related industry.

19.0 Conclusions

The UGC is hopeful to receive positive feedback from all the stakeholders. UGC's mode of work is always collaborative and supportive to all its stakeholders. UGC has always been receiving a very positive response from the universities to implement any initiatives taken by UGC. Therefore, now it has become easier to work with the universities for ensuring quality higher education in Bangladesh.

This is always fascinating for the UGC to work with the renowned faculty members from the leading universities, ICT Division, JICA and BCC to update/modify the existing guideline for preparing the CSE/IT related curriculum of the universities. The updated/modified guideline is dynamic with desired courses/contents. It deals with the students' capacity building as well as industry demands. The guideline is prepared to ensure the right kind of skills and knowledge, increase job opportunities and enhance research and innovation capacity.

UGC strongly believes that all the universities will come forward to standardize the course-curriculum for achieving the university objective and goals through ensuring quality education and qualified human resources development.

UGC hopes that all the universities will prioritize the guideline to help build Bangladesh as a developed and knowledge-based country.

20.0 List of Appendixes

Appendix-i: Previous Guideline

Guideline for preparing standard curriculum of B S in Computer Science and Engineering

Submitted by

Standard syllabus guideline making committee

1

Introduction

An engineering program must be carefully crafted to prepare engineering students for immediate entry into the workplace or to pursue advanced graduate study. Much of our youth's future success depends on the quality of the education they receive. Therefore, the demands for quality standards in higher education are increasing. To ensure that an academic program is meeting certain standards necessary to produce graduates who are ready to enter their professions, UGC has decided to prepare curriculum guidelines. Curriculum needs to be aligned with national and international professional association guidelines and also to be accredited by reputable standards. For example engineering curricula of universities in USA are prepared meeting criteria set by Accreditation Board for Engineering and Technology (ABET). UGC has prepared curriculum design guidelines meeting international standards.

Department offering a program on BS in Computer Science and Engineering/Computer Engineering/Computer Science should have Educational Objectives based on the mission of the department and the perceived needs of the stakeholders. The mission statement should have a preamble followed by declarations of four interconnected commitments: to students, to faculty, to alumni, and to the industries. The program must have documented student outcomes. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. The curriculum must support attainment of the student outcomes and must include:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) the recognition of the need for, and an ability to engage in life-long learning
(j) knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Program outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program. Program outcomes must foster attainment of program educational

objectives. There must be an assessment and evaluation process that periodically documents and demonstrates the degree to which the program outcomes are attained.

To prepare students to meet their career objectives, the Computer Science and Engineering (and other related subject areas) curriculum is suggested to be composed of three stages of education. During the first two years, emphasis should be placed upon establishing competence in mathematics, basic sciences, engineering sciences, and fundamental computer science and engineering topics.

The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

(a) one year of a combination of mathematics and basic sciences (some with experimental experience) appropriate to the discipline. The program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; and knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

I. Categories of Courses:

Type	Credit Hours (in percentage of total credit hours)	Remarks
Language & General Education	12-15%	Compulsory: English – one course Bengali – one course
Basic Science	8-10%	Compulsory: Physics – one course & Lab Chemistry – one course
Mathematics	8-10%	Topics: differential and integral calculus, probability and statistics, complex variables, vector analysis, differential equations, coordinate geometry, linear algebra, etc.
Other Engineering	8-10%	Introduction to electrical engineering, Electronic devices and circuits & pulse techniques, Electrical drives and instrumentation, Engineering drawing, etc.
Core Subjects	40-50%	Areas to Cover: Programming, Hardware Systems, Logics and Algorithms, Network Systems, Software Systems and Engineering, Computer and System Security, etc
Elective Subjects	12-15%	Focus Areas: Computing Theory Communications and Networking Systems Data Science Software Engineering Hardware ICT

4

2. Minimum Credit Hours Requirement for Awarding Degree

Program	Minimum Credit hour requirement for degree	
	Bi-Semester	
	15 weeks + 60 minutes of classroom(excluding final exam week)	14 weeks + 50 minutes of classroom
B. Sc in CSE/CE/CS/ICT	120	154

3. A Rough Guideline

The details of the subjects and a rough guideline of credit hours from each category are listed below. Note that a University has the flexibility in choosing different subjects based on the credit hours limits depicted in the previous table.

3.1 Language

Type	Description	No of Courses (minimum)	Semester Credit Hours (minimum)	Remarks
Language	Composition, writing and Communication in English, Functional Bengali Language, etc.	3T	English 3+2 Bangla: 2	
Total semester credit hours = 7				

3.2 General Education

Type	Description	No of Courses (minimum)	Semester Credit hrs. (minimum)	Remarks
Social Science	Engineering Economics, Sociology, Financial and Managerial Accounting, Political Science, Environment and Society, Introduction to Human Development, Social Inequality and Planning, etc.	2T	3x2 =6	Compulsory: Bangladesh Studies (History of Independence), Professional Ethics and Environmental Protection.
Arts and Humanities	Bangladesh Studies (History of Independence), Professional Ethics and Environmental Protection, and International Relations, World Civilization Cultures of South Asia, History of South Asia, etc.	3T	3x2 = 6	
Business	Business Communications, Industrial and Operational Management, Technology Entrepreneurship, business management, etc.	1T	3x1 = 3	
Total semester credit hours = 15				

6

3.3 Basic Sciences

Type	Description	No of Courses (minimum)	Semester Credit Hours (minimum)	Remarks
Physics	Physics I Physics II Topics: mechanics, Waves and Oscillations, electricity and magnetism, light and thermodynamics, modern and quantum physics, etc.	1T 1T +1L	3x1 =3 3x1+1x1 = 4	T- Theory L- Laboratory
Chemistry	Chemistry Topics: Inorganic and Quantitate Analysis, etc.	1T +1L	3x1+1x1 = 4	
Total semester credit Hours = 11				

3.4 Mathematics

Type	Description	No of Courses (minimum)	Semester Credit Hours (minimum)	Remarks
Mathematics	Math – I Math-II Math- III Math – IV Topics: differential and integral calculus, probability and statistics, complex variables, vector analysis, differential equations, coordinate geometry, linear algebra, etc.	4T	3x4=12	T- Theory L- Laboratory
Total semester credit Hours = 12				

7

3.5 Other Engineering

Type	Description	No of Courses (minimum)	Semester Credit Hours (minimum)	Remarks
a. Electronics and Electrical Engineering b. Engineering Drawing	Introduction to electrical engineering, Electronic devices and circuits & pulse techniques, Electrical drives and instrumentation, Engineering drawing, etc.	2T+2L 1T+1L	3x2 = 6 1.5x2=3 2	T- Theory L- Laboratory
Total semester credit Hours = 11				

3.6 Computer Science and Engineering Core

Type	Description	No of Courses (minimum)	Semester Credit Hours (minimum)	Remarks
Programming	Introduction to Computing, Structured Programming, Object Oriented Programming, Web Programming, and Mobile Programming, etc.	4T + 4L	3x4+1.5x4 = 18	

8

Hardware Systems	Digital Logic Design, Computer Architecture, and Microprocessors & Microcontrollers, etc.	3T+2L	3x3+1x2=11	
Logics and Algorithms	Discrete Mathematics, Data Structures, Algorithms	3T +2L	3x3+1x2=11	
Systems	Computer and Cyber Security, Database, Operating System, Networking, etc.	4T+3L	3x4+1x3 = 15	
Software Systems and Engineering	Software Engineering, Information System and Design, etc.	2T + 2L	3x2+1x2=8	Software Engineering is compulsory
Others Project/Thesis	Project and Thesis		6	
Total semester credit Hours = 69				

3.7 Technical Electives

At least four courses should be taken. Requirement for major courses is mentioned in the table.

Type	Recommended Areas	Semester Credit Hours (minimum)		Remarks
		Major	Minor	
Technical Electives	Theory: Mathematical Analysis for Computer Science, Graph Theory, Algorithm Engineering, Compiler, Computational Geometry, Computer Graphics, etc. Communications: Data Communication, Wireless and Cellular Communication, etc. Systems: Distributed Systems, Simulation & Modeling, Artificial Intelligence, Computer Graphics, Cloud Computing, etc. Data Science: Artificial Intelligence, Machine Learning, Data Mining, Bioinformatics, Digital Image Processing, Big Data and Analytics, etc. Software Engineering: Human Computer Interaction, Software Architecture, Software Testing and Quality Assurance, Mobile Application Development, etc. Hardware: Digital System design, Embedded Systems, Robotics, Interfacing, VLSI, etc. ICT: Enterprise Systems: Concepts and Practice, Web Application Security, Electronic Business, Visualizing Complex Information, Mobile Web Development and Usability Testing, etc.	3T 3x3=9	2T 3x2=6	Different Branches (At least four courses should be taken.) a. **Computer Engineering:** at least 2 courses from Hardware and 1 course from systems. b. **Computer Science and Engineering:** any courses from any branch. c. **Computer Science:** at least 3 courses from Theory d. **Data Science:** at least 3 courses from data science e. **Software Engineering:** at least two courses from Software Engineering. And 1 course from ICT. f. **Information and Communication Technology:** at least three courses from ICT.
Total semester credit Hours = 15				

The total credit hour in the guideline above is 140. Some core courses may be shifted to elective courses to satisfy other credit hours requirement less than 140.

17.01.17

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Appendix-ii: ITEE FE Syllabus

(Table of Content Page Only. Web link for detail: http://bditec.gov.bd/wp-content/uploads/2018/01/Syllabus-FE-Exam.pdf)

■ Information Technology Engineers Examination

Fundamental Information Technology Engineer Examination

(Level 2)

Syllabus

— Details of Knowledge and Skills Required for the Information Technology Engineers Examination —

Version 4.0

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CONTENTS

◆STRATEGY◆

Appendix-iii: Series of Carried Activities

Sl.	Date	Carried Activities	Approaches
1	07 Jul 2019	BCC Inssued letter to UGC with Memo No: 56.00.0000.036.08.006.19-128 Date: 07 Jul 2019	Requested to take necessary steps to include ITEE syllabus contents in the CSE/IT curriculum at the university level.
2	31 Jul 2019	Courtesy Meeting with Professor Dr. Md. Sazzad Hossain, Member, UGC Memo: Mlemo:JiCA ITEE Project/BCC/UGCG ／ 2019/17 Date: 01 Aug 2021	Discussed University Curriculum and our Project activities.
3	08 Aug 2019	ICT Division Issued letter to UGC Memo No: 56.00.0000.032.99.031.18-116 Date: 08 Aug 2019	Requested for inclusion of ITEE syllabus contents in the CSE/IT curriculum at universities.
4	02 Sep 2019	Follow-up Meeting with Professor Dr. Md. Sazzad Hossain, Member, UGC Date:	Requested to arrange a workshop with all universities and related professionals for sharing the importance of ITEE curriculum.
5	12 Sep 2019	Meeting with all directors of UGC	Discussion about workshop planning.
6	23 Oct 2019	Meeting with all directors of UGC	Finalize the workshop arrangement.
7	05 Nov 2019	Meeting with all directors of UGC	Follow-up preparation activities for workshop.
8	13 Nov 2019	Organized Workshop on Skills Development of ICT Engineers on IT Engineers Exam targeting Japanese Market	To realize about ITEE FE syllabus coueses and contents and update university syllabus.
9	12 Dec 2019	UGC issued letter to all universities to include the courses and contents from ITEE FE Syllabus, Memo No: UGC/IMCT/ICT/102/2019/10217, Date: 12 Dec 2019	ITEE FE Syllabus was shared with all universities

10	25 Feb 2020	BCC issued letter to UGC Memo No: 56.01.0000.036.08.006.19-353 Date: 25 Feb 2020	Requested to make guideline about how ITEE FE Syllabus could be included.
11	22 Apr 2021	ICT Division Issued Letter to UGC Memo No: 56.01.0000.000.99.001.21-1 Date: 22 April 2021	Requested to make guideline about how ITEE FE Syllabus could be included.
12	07 Jun 2021	UGC Form a 09 member's Committee for developing guideline to prepare CSE/IT related course-curriculum Memo No: 37.01.0000.114.99.001.19.13 Date: 07 Jun 2021	Reviewed the International standard and ITEE FE syllabus to modify and update the existing guideline.
13	15 Jun 2021	1st Meeting of the committee, Minutes Memo No: 37.01.0000.114.99.001.19.23 Date: 18 Jul 2021	Discussed purpose, learned about the gap courses, open discussion and work plan formulation.
14	11 Jul 2021	2nd Meeting of the committee, Minutes Memo No: 37.01.0000.114.99.001.19.28 Date: 04 Aug 2021	Reviewed the Current Guideline and ITEE FE Syllabus comparing to international standard.
15	26 Jul 2021	3rd Meeting of the committee, Minutes Memo No: 37.01.0000.114.99.001.19.30 Date: 17 Aug 2021	Discussed a proposed guideline for addition, modification, deletation, etc.
16	08 Aug 2021	4th Meeting of the committee, Minutes Memo No: 37.01.0000.114.99.001.19.32 Date: 06 Sep 2021	Discussed the corrected version of the guideline.
17	08 Sep 2021	5th Meeting of the committee, Minutes Memo No: 37.01.0000.114.99.001.19.38 Date: 28 Sep 2021	Finalized the guideline and planned to distribute from UGC officially.

Appendix-iv: Gap Analysis

Gap Analysis of CSE/IT Related Syllabus in comparison between existing UGC GL, International Standard and ITEE FE Syllabus

Objective: 1. To revise and update the existing guideline
2. To promote universities to bring update in the existing syllabus

Syllabus to be follow under existing UGC Guideline as of 11 Dec 2017				Courses as per International Standard (listed only the non-included courses of UGC GL)	Remarks	Courses under ITEE FE Syllabus					UGC GL Existence (Yes/No)	Col-C Sl	Gap Courses from Int. Standard and ITEE FE Syllabus
Type		Existing Courses under GL				FIELD	MAJOR CATEGORY	MIDDLE CATEGORY	MINOR CATEGORY				
Major Field	Fields												
a	b	c		d	e	f	g	h	i		j	k	l
Language & General Education	Language	1	Composition, writing and Communication in English	Communicative English	Update	TECHNOLOGY	BASIC THEORY	BASIC THEORY	1	Discrete mathematics	Yes	39	Communicative English
				Technical Writing and Presentation	Update				2	Applied mathematics			Technical Writing and Presentation
				Developing English Skills	Update				3	Theory of information			Developing English Skills
		2	Functional Bengali Language, etc						4	Theory of communications			
				Bangladesh Studies: History and Culture, etc.	Addition				5	Theory of measurement and control			Bangladesh Studies: History and Culture, etc.
	Social Science	3	Engineering Economics					ALGORITHM AND PROGRAMMING	1	Data Structures	Yes	40	
		4	Sociology						2	Algorithm	Yes	41	
		5	Financial and Managerial Accounting						3	Programming	Yes	32-35	
		6	Political Science						4	Programming languages	Yes	32-35	
		7	Environment and Society						5	Other languages			
		8	Introduction to Human Development	Human Resource Development	Update		COMPUTER SYSTEM	COMPUTER COMPONENT	1	Processor	Yes	37,38	Human Resource Development
		9	Social Inequality and Planning, etc						2	Memory	Yes	37,38	
				Corporate and Legal Affairs	Addition				3	Bus	Yes	37,38	Corporate and Leaga Affairs
	Arts and Humanities	10	Bangladesh Studies (History of Independence)						4	Input/output interface	Yes	37,38	
		11	Professional Ethics and Environmental Protection						5	Input/output device	Yes	37,38	
		12	International Relations					SYSTEM COMPONENT	1	System configuration			
		13	World Civilization Cultures of South Asia						2	System evaluation indexes			
		14	History of South Asia, etc.					SOFTWARE	1	Operating system	Yes, but all in one 3 credits course, therefore, these contents not in details	44	
	Business	15	Business Communications						2	Middleware			
		16	Industrial and Operational Management	Service Operational Management	Update				3	Filesystem			Service Operational Management
		17	Technology Entrepreneurship	Entrepreneurship: Innovation and Commercialization	Update				4	Development tools			Entrepreneurship: Innovation and Commercialization
		18	Business management, etc.						5	Open source software			
				Business Strategy Management	Addition		TECHNOLOGY ELEMENT	HARDWARE	1	Hardware	Yes	36,37,38	Business Strategy Management
				Information System Management	Addition			HUMAN INTERFACE	1	Human interface technology	Yes but not all the components covered by a 3 credits course	47	Information System Management
				System Planning and Management	Addition				2	Interface design			System Planning and Management
				System Auditing and Maintenance, etc.	Addition			MULTIMEDIA	1	Multimedia technology			System Auditing and Maintenance, etc.
	Physics	19	Physics I						2	Multimedia application			

Syllabus to be follow under existing UGC Guideline as of 11 Dec 2017				Courses as per International Standard (listed only the non-included courses of UGC GL)	Remarks	Courses under ITEE FE Syllabus						UGC GL Existence (Yes/No)	Col-C Sl	Gap Courses from Int. Standard and ITEE FE Syllabus
Type		Existing Courses under GL				FIELD	MAJOR CATEGORY	MIDDLE CATEGORY	MINOR CATEGORY					
Major Field	Fields													
a	b	c		d	e	f	g	h	i			j	k	l
Basic Sciences		20	Physics II Topics:Mechanics, Waves and Oscillations, electricity and magnetism, light and thermodlmamics, modern and quanfum physics. etc.					DATABASE	1	Database architecture	Yes, but all in one 3 credits course, therefore, these contents not in details	43	
	Chemistry	22	Chemistry Topics: Inorganic and Quantitate Analysis, etc.						2	Database design			
Mathematics	Mathematics Topics: Differential and integral calculus, probability and statistics, complex variables, vector analysis, differential equations, coordinate geometry, linear algebra. etc.	23	Math I						3	Data manipulation			
		24	Math II						4	Transaction processing			
		25	Math III						5	Database application			
		26	Math IV					NETWORK	1	Network architecture	Yes	45 and 54	
				Applied Mathematics	Addition				2	Data communication and control			Applied Mathematics
				Numerical Methods, etc.	Addition				3	Communications protocols			Numerical Methods, etc
Other Engineering	a. Electronics & Electrical Engineering	27	Introduction to electrical engineering						4	Network management			
		28	Electronic devices and circuits & pulse techniques	Electronics	Update				5	Network application			Electronics
				Digital Electronics and Pulse Techniques	Update			SECURITY	1	Information security			Digital Electronics and Pulse Techniques
		29	Electrical drives and instrumentation						2	Information security management			
	B. Engineering Drawing	30	Engineering drawing, etc.						3	Security technology evaluation			
				Mechanical Engineering, etc.	Addition				4	Information security measures			Mechanical Engineering, etc.
Computer Science and Engineering Core	Programming	31	Introduction to Computing						5	Security implementation technology			
		32	Structured Programming	Structured Programming Languages	Update		DEVELOPMENT TECHNOLOGY	SYSTEM DEVELOPMENT TECHNOLOGY	1	System requirements definition	Yes, but all in one 3 credits course, therefore, these contents not in details	46	Structured Programming Languages
		33	Object Oriented Programming	Object Oriented Programming Languages	Update				2	Systems architecture design			Object Oriented Programming Languages
		34	Web Programming						3	Software requirements definition			
		35	Mobile Programming. etc.	Mobile Application Development	Update				4	Software architecture design and software detailed design			Mobile Application Development
				Markup and Scripting Languages	Addition				5	Software construction			Markup and Scripting Languages
				Java Programming	Addition				6	Software integration and software qualification tests			Java Programming
	Hardware Systems	36	Digital Logic Design						7	System integration and system qualification tests			
		37	Computer Architecture						8	Installation			
		38	Microprocessors & Microcontrollers, etc.	Microprocessor and Assembly Programming	Update				9	Acceptance support			Microprocessor and Assembly Programming
	Logics and Algorithms	39	Discrete Mathematics						10	Maintenance and disposal			
		40	Data Structures	Data Structures and Algorithms	Update			SOFTWARE DEVELOPMENT MANAGEMENT TECHNIQUES	1	Development process and methods			Data Structures and Algorithms
		41	Algorithms						2	Intellectual property application management			
				Automata Theory and Compiler Design	Addition				3	Development environment management			Automata Theory and Compiler
				Artificial Intelligence	Addition				4	Configuration management and change control			Artificial Intelligence
				Multimedia Technology and Applications	Addition	MANAGEMENT	PROJECT MANAGEMENT	PROJECT MANAGEMENT	1	Project management			Multimedia Technology and Applications

Syllabus to be follow under existing UGC Guideline as of 11 Dec 2017				Courses as per International Standard (listed only the non-included courses of UGC GL)	Remarks	Courses under ITEE FE Syllabus					UGC GL Existence (Yes/No)	Col-C SI	Gap Courses from Int. Standard and ITEE FE Syllabus
Type		Existing Courses under GL				FIELD	MAJOR CATEGORY	MIDDLE CATEGORY	MINOR CATEGORY				
Major Field	Fields												
a	b	c		d	e	f	g	h	i		j	k	l
	Systems	42	Computer and Cyber Security						2	Project integration management			
		43	Database	Database Management System	Update				3	Project stakeholder management			Database Management System
		44	Operating System						4	Project scope management			
		45	Networking, etc.						5	Project resource management			
				System Analysis and Design	Addition				6	Project time management			System Analysis and Design
				System Configuration and Performance Evaluation	Addition				7	Project cost management			System Configuration and Performance Evaluation
	Software Systems and Engineering	46	Software Engineering						8	Project risk management			
		47	Information System and Design, etc.						9	Project quality management			
				Software Architecture and Design	Addition				10	Project procurement management			Software Architecture and Design
				Software Development Management	Addition				11	Project communications management			Software Development Management
				Software Integration and Maintenance	Addition		SERVICE MANAGEMENT	SERVICE MANAGEMENT	1	Service management			Software Integration and Maintenance
				Software Project Management	Addition				2	Service design and transition			Software Project Management
	Project & Thesis	48	Project and Thesis						3	Service management processes			
Technical Electives	Theory	49	Mathematical Analysis for Computer Science						4	Service operation			
		50	Graph Theory						5	Facility management			
		51	Algorithm Engineering. Compiler					SYSTEM AUDIT	1	System audit			
		52	Computational Geometry						2	Internal control			
		53	Computer Graphics, etc.			STRATEGY	SYSTEM STRATEGY	SYSTEM STRATEGY	1	Information systems strategy			
				Parallel Algorithms	Addition				2	Business process			Parallel Algorithms
	Communications	54	Data Communication						3	Solution business			
		55	Wireless and Cellular Communication, etc.						4	System utilization promotion and evaluation			
				Theory of Communications	Addition			SYSTEM PLANNING	1	Computerization planning			Theory of Communications
				Information and Control Theory	Addition				2	Requirement's definition			Information and Control Theory
				Modern Networking	Addition				3	Procurement planning and implementation			Networking
				Switching and Routing	Addition		BUSINESS STRATEGY	BUSINESS STRATEGY MANAGEMENT	1	Business strategy techniques			switching and routing
				Network Management and Administration	Addition				2	Marketing			Network Management and Administration
				Digital Signal Processing	Addition				3	Business strategy and goal/evaluation			Digital Signal Processing
	Systems	56	Distributed Systems						4	Business management system			
				Distributed System Management	Addition			TECNOLOGICAL STRATEGY MANAGEMENT	1	Planning of technology development strategy			Distributed System Management
		57	Simulation & Modeling						2	Technology development plan			
		58	Artificial Intelligence					BUSINESS INDUSTRY	1	Business system			
		59	Computer Graphics and Animation						2	Engineering system			
		60	Cloud Computing, etc-						3	e-business			
	Data Science	61	Artificial Intelligence						4	Consumer appliances			
		62	Machine Learning						5	Industrial devices			

Syllabus to be follow under existing UGC Guideline as of 11 Dec 2017				Courses as per International Standard (listed only the non-included courses of UGC GL)	Remarks	Courses under ITEE FE Syllabus					UGC GL Existence (Yes/No)	CoI-C SI	Gap Courses from Int. Standard and ITEE FE Syllabus
Type		Existing Courses under GL				FIELD	MAJOR CATEGORY	MIDDLE CATEGORY	MINOR CATEGORY				
Major Field	Fields												
a	b	c		d	e	f	g	h	i		j	k	l
		63	Data Mining	Data and Web Mining	Update		CORPORATE AND LEGAL AFFAIRS	CORPORATE ACTIVITIES	1	Management and organization theory			Data and Web Mining
		64	Bioinformatics						2	OR and IE			
		65	Digital Image Processing	Digital Image and Video Processing	Update				3	Accounting and financial affairs			Digital Image and Video Processing
		66	Big Data and Analytics, etc.					LEGAL AFFAIRS	1	Intellectual property rights			
				Complex Data Visualization	Addition				2	Laws on security			Complex Data Visualization
				Data Science and Applications	Addition				3	Laws on labor and transaction			Data Science and Applications
				Blockchain and Cryptocurrencies	Addition				4	Other laws, guidelines, and engineer ethics			Blockchain and Cryptocurrencies
	Software Engineering	67	Human Computer Interaction						5	Standardization			
		68	Software Architecture										
		69	Software Testing and Quality Assurance										
		70	Mobile Application Development, etc.										
				Usability Auditing and Testing	Addition								Usability Auditing and Testing
				Query Language and optimization	Addition								Query Language and optimization
				Computational Software Engineering	Addition								Computational Software Engineering
				Enterprise Resource Planning	Addition								Enterprise Resource Planning
				System Maintenance and Compliances	Addition								System Maintenance and Compliances
				Distributed Database Management System	Addition								Distributed Database Management System
				Database Management and Administration	Addition								Database Management and Administration
	Hardware	71	Digital System design										
		72	Embedded Systems										
		73	Robotics										
		74	Interfacing	Microprocessor & Interfacing	Update								Microprocessor Interfacing
		75	VLSI, etc.										
				Human Computer Interaction	Addition								Human Machine Interaction
				IoT	Addition								IoT
				Quantum Computing	Addition								Quantum Computing
	ICT	76	Concepts and Practice										
		77	Enterprise Systems										
		78	Web Application Security										
		79	Electronic Business										
		80	Visualizing Complex Information										
		81	Mobile Web Development and Usability Testing, etc.										
				Ethical Hacking and System Security	Addition								Ethical Hacking and System Security
				Cryptography and Cryptanalysis	Addition								Cryptography and Cryptanalysis

Syllabus to be follow under existing UGC Guideline as of 11 Dec 2017				Courses as per International Standard (listed only the non-included courses of UGC GL)	Remarks	Courses under ITEE FE Syllabus					UGC GL Existence (Yes/No)	Col-C Sl	Gap Courses from Int. Standard and ITEE FE Syllabus
Type		Existing Courses under GL				FIELD	MAJOR CATEGORY	MIDDLE CATEGORY	MINOR CATEGORY				
Major Field	Fields												
a	b	c		d	e	f	g	h	i		j	k	l
				Digital Forensics and Incident Response	Addition								Digital Forensics and Incident Response
				Blockchain and Distributed security	Addition								Blockchain and Distributed security
				Software Security	Addition								Software Security
				Network Security	Addition								Network Security
				Cloud security	Addition								Cloud security
				Machine Learning	Addition								Machine Learning
				Pattern Recognition	Addition								Pattern Recognition
				Natural Language Processing	Addition								Natural Language Processing
				Digital Forensics	Addition								Computer Forensics
				Machine Vision and Motion Analysis	Addition								Machine Vision and Motion Analysis
				Enterprise Systems: Concepts and Practice	Addition								Enterprise Systems: Concepts and Practice
				Electronic Business	Addition								Electronic Business
				Business Analytics	Addition								Business Analytics
				Cloud Computing	Addition								Cloud Computing
				ICT for Development	Addition								ICT for Development
				IT Audit: Concepts and Practice	Addition								IT Audit: Concepts and Practice