

Institute of Information and Communication Technology (IICT)

Information Booklet

Bangladesh University of Engineering and Technology
BUET, Dhaka-1000, Bangladesh

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Preface

Bangladesh University of Engineering and Technology (BUET) is the oldest and leading university in the area of engineering and technology with more than fifty years of international reputation and the Institute of Information and Communication Technology (IICT) is one of the most prestigious institutes of BUET. It was established by the Syndicate of BUET in its 362nd meeting held in June, 2001 by converting the erstwhile Computer Centre. In the present world the importance of promoting and providing facilities for development of skilled manpower in ICT can never be overstated. This branch of education plays a vital role in modernizing and improving the quality of lives of the people on earth. For this purpose IICT is founded to provide a platform for teaching, learning and research in Information and Communication Technology (ICT) that will contribute to industrial and infrastructural development, economic growth and social prosperity. One of its main aims and objectives include offering courses leading to diplomas and degrees in the field of ICT and to initiate, organize and perform studies and research on practical applications of ICT.

This booklet provides general information about this university, its historical background, faculties and teaching departments, University administration etc. Main emphasis of this booklet is to provide the detailed syllabus for the postgraduate courses this institute offers, namely Post-graduate Diploma in Information and Communication Technology and Master's in Information and Communication Technology. I genuinely hope that this booklet will be of much use to the students as well as anybody interested in the activities of IICT.

Dhaka, Bangladesh
October, 2015

Dr. Md. Liakot Ali
Professor & Director
IICT, BUET
Email: liakot@iict.buet.ac.bd

CHAPTER 1: GENERAL INFORMATION

1.1 The University

Bangladesh University of Engineering and Technology (BUET), is the oldest institution for study of Engineering and Architecture in Bangladesh. Today's BUET originated as Survey School at Nalgola in 1876 to train Surveyors for the then Government of Bengal of British India. As the years passed, the Survey School became the *Ahsanullah School of Engineering* offering three-year diploma courses in Civil, Electrical and Technical Engineering. In 1948, the School was upgraded to *Ahsanullah Engineering College* (at its present premise) as a Faculty of Engineering under the University of Dhaka, offering four-year bachelor's degrees in Civil, Electrical, Mechanical, Chemical and Metallurgical Engineering. This action was taken with a view to meet the increasing demand for engineers in the newly independent country and to expand the facilities for quicker advancement of engineering education, in general. In order to create facilities for postgraduate studies and research, in particular, Ahsanullah Engineering College was upgraded to the status of a University giving a new name of *East Pakistan University of Engineering and Technology* in year 1962. After the birth of Bangladesh in 1971, it was renamed as the *Bangladesh University of Engineering and Technology*.

Till today, it has produced around 25,000 graduates in different branches of engineering and has established a good

reputation all over the world for the quality of its graduates; many of whom have excelled in their profession in different parts of the globe. It was able to attract students from countries like India, Nepal, Iran, Jordan, Malaysia, Sri Lanka, Pakistan, Palestine, etc.

BUET campus is now in the heart of the city of Dhaka. It has a compact campus with halls of residence within walking distances from the academic buildings.

1.2 Faculties, Departments and Degrees Offered

The University has sixteen teaching departments under five faculties. Not all of them are degree-offering. Undergraduate courses in the Faculties of Engineering, Civil Engineering, Electrical & Electronic Engineering and Mechanical Engineering extend over four years and lead to B.Sc. Engineering degrees in Civil, Electrical & Electronics, Mechanical, Chemical, Computer Science & Engineering, Materials and Metallurgical Engineering and Naval Architecture & Marine Engineering. In the Faculty of Architecture and Planning, the degree of Bachelor of Architecture is obtained in five years and the degree of Bachelor of Urban & Regional Planning in four years.

Postgraduate studies and research are now among the primary functions of the university. Most of the departments under the different faculties offer M.Sc. Engineering. & M. Engineering., M. Phil degrees and some departments have started Ph.D. courses. Postgraduate degrees in Architecture (M.Arch.) and in Urban and Regional Planning (MURP) are offered by the Faculty of Architecture and Planning. In addition to its own research programs, the university undertakes research programs sponsored by external organizations, viz., UN Organizations, Common-wealth, Bangladesh University

Grants Commission (BUGC), Ministry of Science, Information & Communication Technology (GOB), etc. The expertise of the university teachers and the laboratory facilities of the university are also utilized to solve problems and to provide current engineering and technological knowledge to various organizations of the country. Faculty-wise list of the departments with the status of the degrees offered are given below:

Faculty	Departments	Degree Offering
Architecture & Planning	Dept. of Architecture	PG and UG
	Dept. of Urban and Regional Planning	PG and UG
	Dept. of Humanities	
Civil Engineering	Dept. of Civil Engineering	PG and UG
	Dept. of Water Resources Engineering	PG and UG
Electrical & Electronic Engineering	Dept. of Electrical and Electronic Engineering	PG and UG
	Dept. of Computer Science & Engineering	PG and UG
	Dept. of Biomedical Engineering	PG
Engineering	Dept. of Chemical Engineering	PG and UG

	Dept. Materials & Metallurgical Engineering	PG and UG
	Dept. of Chemistry	PG
	Dept. of Mathematics	PG
	Dept. of Physics	PG
	Dept. of Petroleum & Mineral Resources Engineering	PG
	Dept. of Glass & Ceramic Engineering	PG
Mechanical Engineering	Dept. of Mechanical Engineering	PG and UG
	Dept. of Industrial & Production Engineering	PG and UG
	Dept. of Naval Architecture & Marine Engineering	PG and UG
Institute of Information and Communication Technology		PG
Institute of Water and Flood Management		PG
Accident Research Institute		PG
Institute of Appropriate Technology		PG

1.3 The Central Library

The four storied library building which has a floor space of 19,775 sft stands close to the academic buildings. It is a compact library which has built-in facilities to provide various

services to students, teachers, and researchers and to perform administrative and technical job. The university library is primarily a reference and research library for use of teachers, staff, students, and visiting scholars.

1.4 University Institutes, Centers, Directorates and Link Programs

1.4.1 Institutes and Centers:

1. Institute of Water and Flood Management (IWFM)
2. Institute of Appropriate Technology (IAT)
3. Institute of Information & Communication Technology (IICT)
4. International Training Network Centre (ITN)
5. Accident Research Institute (ARI)
6. BUET-Japan Institute of Disaster Prevention and Urban Safety (BUET-JISPUS)
7. Center for Energy Studies (CES)
8. Center for Environmental & Resource Management (CERM)
9. Center for Biomedical Engineering Research (CBER)

1.4.2 Directorates

1. Directorate of Advisory, Extension & Research Services (DAERS)
2. Directorate of Planning and Development (P&D)
3. Directorate of Students' Welfare (DSW)
4. Directorate of Continuing Education (DCE)

1.4.3 Bureau of Research, Testing & Consultation (BRTC)

1.4.4 Linkage Projects:

1. University of Alberta-BUET Institutional Linkage Project
2. BUET-DUT Linkage Project
3. BUET-University of Exter (UK) Link Program
4. BUET-University of Loughborough (UK) Link Program
5. BUET-University of Leuven Link Program
6. BUET-University of Birmingham Link Program
7. Bangladesh International Training Network Center for Water Supply & Waste Management-ITN

1.5 University Administration

1.5.1 The Chancellor of the University

Md. Abdul Hamid

Honorable President, the Peoples Republic of Bangladesh

1.5.2 The Vice Chancellor

Prof. Khaleda Ekram

1.5.3 The University Syndicate

Chairman: Vice Chancellor, BUET

Members:

1. Dean, Faculty of Civil Engineering, BUET

2. Dean, Faculty of Engineering, BUET
3. Director General, Secondary and Higher Education,
Govt. of Bangladesh
4. Director General, Technical Education, Govt. of
Bangladesh
5. Prof. Dr. Khondoker Bazlul Haque, International
Business Department, University of Dhaka
6. Prof. Dr. Dipal Kanti Das, Dept. of Mechanical
Engineering, BUET
7. Prof. Dr. S.M. Nazrul Islam Dept. of Mechanical
Engineering, BUET
8. Prof. Md. Muhibur Rahman, Director, Center for
Advanced Research in Physical, Chemical,
Biological and Pharmaceutical Science, University
of Dhaka
9. Prof. Dr. Sultana Shafi, Dept. of Physics, University
of Dhaka
10. Prof. Dr. Nasreen Ahmed, Dept of Geography,
University of Dhaka

1.5.4 Deans of Faculties

- | | |
|--|----------------------------------|
| ▪ Dean of Civil Engineering | Prof. Dr. Md. Mazharul
Hoque |
| ▪ Dean of Architecture and
Planning | Prof. Dr. Zebun Nasreen
Ahmed |

- Dean of Electrical and Electronic Engineering Prof. Dr. M. Kaykobad
- Dean of Mechanical Engineering Prof. Dr. Maglub Al Nur
- Dean of Engineering Prof. Dr. Md. Abu Hashan Bhuiyan

1.5.5 University Administration

- Director of Students' Welfare Prof. Dr. Md. Delwar Hossain
- Director, Bureau of Research, Testing & Consultation Prof. Dr. Sk. Sekender Ali
- Director of Planning & Development Prof. Dr. Sarwar Jahan Md. Yasin
- Director of Advisory, Extension & Research Services Prof. Dr. Sheikh Reaz Ahmed
- Registrar Prof. Dr., A. K. M. Masud
- Controller of Examinations Prof. Dr. Md. Abul Kashem Mia
- Comptroller Md. Jashim Uddin Akanda
- Librarian (in-charge) Suraiya Begum
- Superintending Engineer M.M. Abdul Alim

1.5.6 Directors of Institutes & Centers

- Institute of Water and Flood Management Prof. Dr. G M Tarekul Islam
- Institute of Appropriate Technology Prof. Dr. Md. Kamal Uddin
- Institute of Information & Communication Technology Professor Dr. Md. Liakot Ali
- Accident Research Institute Professor Dr. Tanweer Hasan
- BUET-Japan Institute of Disaster Prevention and Urban Safety (BUET-JIDPUS) Dr. Tahmeed M. Al-Hussaini
- Centre for Energy Studies Dr. Md. Ziaur Rahman Khan
- Centre of Continuing Education Dr. Quazi Deen Mohd Khosru
- Centre for Biomedical Engineering Research Prof. Dr. Md. Aynal Haque

1.5.7 Provosts of Residential Halls

- Ahsanullah Hall Professor Dr. Satya Prasad Majumder
- Chattri Hall Professor Dr. Shakila Rahman
- Shahid Smriti Hall Professor Dr. Md. Wahab Khan

- | | |
|------------------------|---------------------------------------|
| ▪ Sher-e-Bangla Hall | Professor Dr. Md.
Mashud Karim |
| ▪ Dr. M.A. Rashid Hall | Professor Dr. Md. Elias |
| ▪ Suhrawardy Hall | Professor Dr. Syed
Ishtiaque Ahmed |
| ▪ Nazrul Islam Hall | Professor Dr. Md. Afsar
Ali |
| ▪ Titumir Hall | Dr. A. K. M. Akther
Hossain |

1.5.8 University Address

Mailing Address:

Bangladesh University of Engineering & Technology (BUET)
Dhaka-1000, Bangladesh

Telephone Numbers:

PABX: 880-2-55167100; 880-2-55167228-57; 880-2-861
4640-44; 880-2-8618344-49

FAX No: 880-2-8613046 ; 880-2-8613026

Website: <http://www.buet.ac.bd>

CHAPTER 2: INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGY (IICT)

The Institute of Information and Communication Technology (IICT) is the youngest institute of Bangladesh University of Engineering and Technology. The Syndicate of BUET had taken the decision on 28th June, 2001 to start the institute and the formal inaugural ceremony of the institute was held on 2nd September, 2001. The syndicate had taken the decision following a decision of the government in order to produce more professionals in IT sector. The erstwhile Computer Center of BUET has been taken as the backbone of the institute and the previous center has been modified accordingly to form the institute. The main objectives of the institute include offering Post Graduate programs in addition to the services as were provided by the erstwhile Computer Center.

The institute is located on 77,472 sq. ft. of space on the sixth and seventh floor of the ECE Building, BUET. Located within the serene environment of BUET, IICT is an ideal place for technology based education. It is easily accessible by major roads from all parts of the city. Its proximity to residential areas, markets, universities, industries and research centers makes it an excellent spot for its members to avail all their necessities.

2.1 Aims and Objectives of IICT

The purpose of the Institute is to provide a platform for teaching, learning and research in information and communication technology (ICT) that will contribute to industrial and infra-structural development, economic growth and prosperity. The aims and objectives of the IICT are:

- To actively pursue advanced research in ICT in order to develop knowledge based products and services;
- To develop ICT facilities in order to create an on-campus environment conducive to enthusiasm, innovation and enterprise, and to nurture innovative ideas and incubate promising initiatives;
- To produce manpower and expertise in ICT by carrying out training in diverse areas for those interested to step in ICT profession as well as those already engaged in the profession: and
- To provide consulting and advisory services to public and private organizations.

To achieve the above aims and objectives, the Institute will perform the following activities under two wings:

1. Academic Wing, and
2. System and Support Wings.

2.1.1 Activities of the Academic Wing

- To offer courses leading to diploma and masters degrees in the field of ICT.
- To initiate, organize and perform studies and research on practical applications of ICT.
- To promote and provide facilities for development of skilled manpower in ICT

- To provide short course and training to interested persons in the field of ICT
- To provide refresher course and training in emerging branches of ICT
- To hold conference, seminar, workshop and other events related to the development of ICT in the country
- To develop linkage and exchange programs with local and overseas organizations: and
- To publish books, journals, monographs, etc.

2.1.2 Activities of the System and Support Wing

- To promote the use of ICT in the university and the country
- To promote multidisciplinary development of computer applications
- To provide training to students, teachers, officers and employees of the university in relevant fields of ICT
- To produce software for indigenous use as well as export
- To plan, install, maintain and develop computer networks within the university and also links to other institutions in the country as well as the Internet
- To provide computing, infra structural and advisory services to students, officers and teachers of the university and
- To provide advice and physical assistance to different departments, institutes and officers of the university in matters related to the purchase, operation, maintenance and development of computer hardware and software.

2.2 Board of Governors

The overall responsibility for administration and management is entrusted on the Board of Governors. The Vice-Chancellor is the chairman of the Board of Governors. The Director and Associate Directors of the institute conduct the overall administration and management on the permission of the Vice-Chancellor. Board of Governors (BOG) consists of the followings:

1. The Vice-Chancellor, Chairman.
2. The Dean, Faculty of Electrical and Electronic Engineering.
3. One Dean from among the remaining faculties nominated by the Syndicate.
4. One reputed personality nominated by the Syndicate.
5. One external member nominated by the Vice-Chancellor from the ICT sector.
6. One external member nominated by the Vice-Chancellor from other sectors.
7. The Director of Administration and Research Services.
8. One Professor of the Institute nominated by the Vice-Chancellor, and
9. The Director of the Institute, who shall also act as Member - Secretary to the BOG.

2.3 List of Personnel of IICT

1. Dr. Md. Liakot Ali, Director and Professor

B.Sc. Engg.(EEE), Bangladesh University of Engineering and Technology; M.Sc. Engg. (Electrical, Electronic and System Engg.), Universiti Kebangsaan Malaysia; Ph.D. (Electronic Engineering), Universiti Putra Malaysia;
Research Interest: VLSI Design and Testing, Microcontroller and Microprocessor.

2. Dr. S. M. Lutful Kabir, Professor [on leave]

B.Sc. Engg.(EEE), Bangladesh University of Engineering and Technology; M.Sc. Engg., BUET; Ph.D., The University of Manchester, U.K.
Research Interest: Computer Applications, Microprocessor and Microcontroller

3. Dr. Md. Saiful Islam, Professor

B. Sc. Engg.(EEE), Bangladesh University of Engineering and Technology; M. Sc. Engg.(CSE), Shanghai University, China; Ph.D. Bangladesh University of Engineering and Technology (BUET)
Research Interest: Software Engineering, Database, Optical Communications

4. Dr. Md. Rubaiyat Hossain Mondal, Assistant Professor

B.Sc. Engg.(EEE), BUET; M.Sc. Engg. (EEE), BUET; Ph.D. Monash University, Australia
Research Interest: OFDM modulation, Wireless communication, Visible light communication, Free space optics

5. Mr. Fazle Elahi Faisal, Assistant Professor [on leave]

B.Sc. Engg. (CSE), BUET, M.Sc. Engg. (CSE), BUET
Research Interest: Computer Network, Artificial Intelligence

6. Dr. Mohammad Shah Alam, Assistant Professor

B.Sc.,Engg(CSE), BUET, M.Sc. Engg.(Graduate Pool of global Information and Telecommunication Studies), Waseda University, Tokyo, Japan, Ph.D.(Graduate Pool of Global Information and Telecommunication Studies), Waseda University, Tokyo, Japan

Research Interest: Wireless Sensor Network, Vehicular Adhoc Network, Cooperative Network, Performance. Analysis RF Technologies, Protocols, Optical Wireless Communication

7. Mrs. Shamim Ara Showkat, Assistant Professor [on leave]

B.Sc.Engg (EEE), BUET; M.Sc. Engg. (Graduate Pool of Global Information and Telecommunication Studies), Waseda University, Tokyo, Japan

Research Interest: Optical Wireless Communication, OFDM, Wireless Sensor Network, Power Transmission

8. Dr. Hossen Asiful Mustafa, Assistant Professor

B.Sc.,Engg(CSE), BUET; M.Engg, University of South Carolina, USA; Ph.D., University of South Carolina, USA

Research Interest: Network Security, Wireless Communication, Mobile Computing

9. Mohammad Imam Hasan Bin Asad, Lecturer

B.Sc. Engg.(EEE), Bangladesh University of Engineering and Technology; MSc, Ulm University, Germany

Research Interest: Digital IC Design, Hardware Security, Neural Network

10. Ms. Shahin Akhter, Lecturer [on leave]

B.Sc. Engg. (EEE), Bangladesh University of Engineering and Technology

Research Interest: Communication, Computer Networks

11. Mr. Rezaul Hoque Akanda, Principal Instrument Engineer

B.Sc. Engg. (EEE), BUET; M.Sc. Engg. (EEE), BUET; EMBA (HRM), NSU; PGDDP (NAPD); CCNAP (Cisco RA-BUET)

Field of Interest: Instrumentation, Networking, Resource & Project Management

12. Mr. Mohammad Delwar Hossain, Senior Programmer

M.Sc (Mathematics), Dhaka University; PG.Dip. (ICT), M.Engg(ICT), Bangladesh University of Engineering and Technology

Field of Interest: Image Analysis, Database, Networking

13. Mr. Joydeb Kumar Sana, Programmer

B.Sc.Engg (CSE), RUET; M.Sc Engg. (CSE), BUET

Field of Interest: Programming, Database

14. Mr. Md. Mahbub Kabir, Assistant Programmer

B.Sc. in (CSE); M.Sc (IT)

Field of Interest: System Administration, Network Administration

15. Mr. Alamgir Hossain Howlader, Administrative Officer

M.Com(Accounting), PGDM, MBA

Field of Interest: Finance and Accounts, Management.

16. Mr. Mir Abu Toraf, Assistant Programmer

B.Sc in (CSE)

Field of Interest: Programming Java, C#, C, C++, Database

17. Mr. Nasir Ahmed Bhuiyan, Assistant Maintenance Engineer.

B.Sc. in (CSE), Daffodil International University

2.4 Research and Academic Committee

There shall be a Research and Academic Committee (RAC) consisting of the following members:

- Director of the institute;
- All Professors, Associate Professors and Lecturers of the Institute;
- Any other teacher from the institute or from outside who offers a course in a term will be member for that term;
- All Associate Directors of the institute;
- One nominee of the Board of Post-Graduate Studies (BPGS) of the Department of Computer Science and Engineering from among its members not below the rank of Associate Professor;
- One nominee of the BPGS of the Department of Electrical and Electronic Engineering from among its members not below the rank of Associate Professor;
- One member nominated by the Vice-Chancellor; and
- One nominee of the Committee for Advanced Studies and Research (CASR) from amongst its members.

The Director of the Institute shall be the chairman of the RAC. One of the members as decided by the committee shall act as Member Secretary.

The term of office of the nominated members shall be two years but they shall continue in office till their successors are nominated.

The function of the RAC shall be as follows:

- To develop the syllabuses and courses for the post-graduate studies;
- To deal with matters related to admission of students;

- To suggest a panel of names of paper setters and examiners in the subject or subjects concerned;
- To identify target groups for training, assess training needs and develop training strategies;
- To prepare annual programme on short course, training and workshop;
- To identify the areas of research on the basis of national need and formulate research plan;
- To review the research proposals submitted by teachers and technical personnel, or select experts for reviewing the proposal, if necessary;
- To recommend the research proposals to the Board Of Governor's (BOG) for its approval;
- To monitor the progress of ongoing research projects;
- To recommend to the BOG for the appointment of exceptionally reputed technical personnel with vast experience as Visiting Fellow in the institute, if it feels that the appointment would help the Research and Human Development activities of the institute, on such terms and conditions as the BOG may decide;
- To do such other things as are assigned or referred to it by the Vice-Chancellor, the BOG, or the Syndicate.

The RAC shall ordinarily meet at least four times a year and report the proceedings to the BOG. The time and place of meeting shall be fixed by the Director of the institute.

The quorum for the meetings of the RAC shall be one-third of members, fractions being counted as one.

At least seven clear days notice shall be given for all ordinary meetings of the RAC and the agenda papers shall be circulated at least twenty four hours before the meeting.

Extraordinary meetings of the committee may be convened with at least one day's notice, only when the nature of the

business to be brought before committee, in the opinion of the chairman, necessitates an immediate action. Every member of the committee resident in Dhaka shall receive a notice of the extraordinary meeting and no business that is not of immediate urgency shall be transacted at the meeting.

The minutes of the meetings shall be circulated among the members within seven days of the meeting and shall be placed before the following ordinary meeting for confirmation.

The Research and Academic Committee (RAC) is responsible for preparing the syllabus, monitoring the progresses of different research projects.

2.5 IICT Resources and Establishments

The institute has a spacious lounge, office, one conference room with video conferencing facility connected via dedicated bandwidth, two lecture theatres, three PC classroom labs, one Net-work lab and one Multimedia lab. All classrooms, labs, and lecture theatres are air-conditioned. The supplied voltages of the computers are maintained at constant level with a centralized volt-age stabilizer as well as by separate voltage stabilizers for each room.

The center extends its services through a good number of computers and peripherals. At present, the center has six network servers including an IBM RS/6000, 12 DELL and one Zenith HX and two Compaq servers. The networking platforms are UNIX (AIX, SCO, SO-LARIS and Linux) Windows NT and Novell Netware. The Institute has also a good number of printers including 21400/800 lpm line printer, two Tally T6100, 3 laser printers and one OMR machine.

The institute has three modern PC class rooms each having PC, multimedia projector with audio visual capabilities. These classrooms are used by the post graduate students of IICT and also by different departments for their undergraduate programs. Besides, the institute has a very modern Network and Communication Laboratory, Multimedia and Graphics Laboratory and Hardware and Embedded System Laboratory.

Besides the class room PCs, the institute has more than 30 PCs and workstations. These are used for different computing purposes. The institute also acts as the Internet Service Provider for the university users. It is offering 24 hours internet connectivity to the BUET students and teachers through BUET's own VSAT. IICT has established two browsing rooms with (25+30) pc's for students. One is situated at IICT premise another one is at 2nd floor of central library building. IICT has built the fiber optic backbone for BUET campus and is now connected to the submarine cable network.

The institute sometimes arranges different short courses for internal and external personnel and students. Most commonly offered courses are object oriented programming like C/C++, Java, C#, Visual Studio .Net, Web programming, E-business, Database management system like ORACLE etc.

The library of the institute has a good collection of books and manuals around 3000 in number, as well as, number of computer related journals.

The normal office hour of the institute is from 8 am to 10 pm throughout the week except Thursday and Friday. However, the institute does operate 24 hours a day and on weekends to meet emergency requirements.

After meeting the internal services as far as practicable within its means, the institute also caters to external requests for

computing services. The institute extends its support to various organizations such as Dhaka Electric Supply Authority, Bangladesh Chemical Industries Corporation, IMED, Jiban Bima Corporation, and different education boards, National University, Dept. of Primary Education of Government of Bangladesh, Bangladesh Telegraph and Telephone Board, Bureau of Man Power, Employment and training (BMET), Bakhraabad Gas Systems Ltd. (BGSL), etc.

CHAPTER 3: SYSTEM AND SUPPORT WING OF IICT

3.1 Introduction

The System and Support Wing of IICT bears the responsibility of operation, maintenance and development of IT infrastructure of the university which has evolved into one of the most essential tools of modern technological education and research. Being congruent with the role of BUET as premier institution of technical education and research in the country, the System and Support Wing of IICT is devoted to incorporate state of the art of technology and knowledge regarding information and communication engineering in the development of infrastructure, enhancement of education and provision of research facilities. The following section illustrates few of the major tasks and achievements of the wing.

3.2 Internet Services, Web and E-mail

The wing facilitates various kinds of internet services which include providing mail-services, hosting and maintenance of the official website of BUET including the web sites of different departments of the university and, making arrangements for internet browsing for the students and teachers of the institution.

3.3 Operation & Maintenance of Campus Network

In order to enhance the educational and research capacity, recently BUET installed optical fiber based campus backbone network. Based on Gigabyte Ethernet technology, the network connects the main functional components of the university including departments, administrative offices, laboratories, libraries, residential halls, and teacher, and staff quarters. Wi-Fi hotspots are available in different areas of the campus and in the residential halls. A dedicated team works 24/7 to maintain the network operations of BUET.

3.4 Computing Facilities for the Students

Through couple of modern and fully equipped classrooms and laboratories, the System and Support Wing of IICT satisfies the educational and computing needs of the faculties, researchers and students of the university. These classrooms are equipped with powerful computers, multi-media projectors, software etc. Also, all the classrooms are provided with intranet and Internet connectivity. There exist facilities for downloading, copying and printing of necessary documents at the laboratories and browsing rooms.

3.5 Students' Browsing Facility

IICT, BUET has established two browsing rooms for students of BUET. One of these browsing rooms is located at IICT premises and the other is in 2nd floor of Central Library Building. Students of the university can use the facilities for academic and research purpose free of cost.

3.6 Research Facilities

Through highly powerful computers, sophisticated equipments and rich software repository, the System and Support Wing of IICT facilitates high quality research work for the students of different departments of BUET as well as the graduate and postgraduate diploma students of the institute.

3.7 Hardware & Software Related Services

With an objective of optimal utilization of the expertise of the institute, the wing provide consulting services to the departments, institutes and offices of the university in connection with procurement, operation and maintenance of the hardware and software. Recently the wing has initiated a project on development of central database for the university with an objective of automating various administrative and academic activities of the university.

3.8 Education Related Services

In addition to providing computing and browsing facilities for the students of BUET, the wing also facilitates extra-curricular activities of the students like teaching and learning of hardware, networking, database software and programming languages through TITAS program. It assists the faculties of institution by proving the facility of Optical Mark Reader (OMR) which is widely used for student evaluation purpose. Also, the wing extends its support for computer related facilities required for various examinations including the admission test of the university.

3.9 Partnership with CodeWitz Project

The System and Support Wing has established a partnership with CodeWitz Project of Tampere Polytechnic University (TPU) of Finland to enhance the programming skill, particularly in C++ and JAVA, of the students of BUET through effective utilization of simulation, animation and visualization tools. The cooperation also provides the opportunity to develop such tools at IICT and share them with other CodeWitz partners.

3.10 Collaboration with Industry, Institutions & Other Universities

The System and Support Wing of IICT has developed a framework for close cooperation for exchange of knowledge and technology with the leading persons in the industry and other institutions and universities through discussion, meeting and seminar.

3.11 Consultancy Services

IICT has evolved into a Center of Excellence for providing high quality consultation services for information and communication related activities. The institute regularly provides the consultation and ancillary services in this regard to the government and private agencies. A list of few major projects, successfully implemented by the institute, is listed below.

- Automation of result processing and recruitment of primary school teachers (2000)

- Automation of Man Power Export processing of Bangladesh (2003)
- Eradication of hazardous child labor project (2003)
- Machine Readable Passport (MRP), Machine Readable Visa (MRV) and National ID Card Project (2004)
- Computerization of Examination System of Bangladesh Technical Education Board (2004)
- Prepaid Energy Meter Project (2004)
- Computerization of Bakhraabad Gas Systems Ltd.(BGSL) (2004)
- Computerization of Jalalabad Gas Transmission and Distribution Systems Ltd. (2005)
- Data Acquisition System of Dhaka Electric Supply Company (DESCO) (2006)
- Establishment of e-Governance in Dhaka Electric Supply Company (DESCO) (2006)
- BUET Institutional Information System (BIIS) (2006)
- Enhancement, Development of Computerized System of Bureau of Manpower and Employment Training (BMET) with necessary Hardware, Software, Sub-system and Module Making (2008)
- Prepaid Gas Meter Design and Development for Titas Gas Transmission and Distribution Ltd. (2010)
- Development of Low-cost Solar based Irrigation Project (2010)
- Manufacture and Design of Electronic Voting Machine (EVM) (2011)
- Online Application System for Admission in National University (2013)
- Development of Management Information System for Karnafuli Gas Distribution Company Limited
- Online College Application System in Xi Class for Education Boards (2015)

CHAPTER 4: ACADEMIC WING OF IICT

4.1 Academic Activities

Academic goal of IICT is to enrich the students by providing the knowledge of modern technology in both course format and in thesis based research format. The courses offered in IICT are updated periodically with the change of science and technologies. The research work is performed with the involvement of teachers who are the best fit for their respective field of study.

4.2 Research Facilities at IICT

Now is an era of Information and Communication Technology (ICT). The dream of the country is poverty reduction and economic growth by creating knowledge driven economy, and society based on ICT. To realize the goal of the Govt., our graduates produced from Universities should have good knowledge in ICT. So it is now essential to establish strong ICT infrastructure in every university of the country and create an environment of teaching, learning and research on ICT. IICT has the following establishments for this purpose:

4.2.1 Access to the Internet

Internet Browsing room has been established in IICT for the students with knowing that present day world cannot only be

perceived by reading books rather by extending oneself through research papers and e books which are available in INTERNET. The Internet facility also provides to the access of 28 international consortiums like American Institute of Physics, IEEE, Optical Society of America, and American Society for civil Engineers, Springer and others.

4.2.2 Laboratory Facility

IICT maintains a number of laboratory facilities which are necessary to support theoretical knowledge with experimental activities. IICT has the following laboratories:

- Communication Laboratory
- Embedded System Laboratory
- Network Laboratory
- Multimedia and Graphics Laboratory
- Hardware Laboratory

4.2.3 Class Room Facility

The Institute has three modern PC class rooms each having PCs, multimedia projectors with audio visual capabilities. These class rooms are used by the post graduate students of IICT and also by different departments for their undergraduate programs. Besides, IICT has two big lecture halls with multimedia facilities where more than 50 students can be accommodated.

4.2.4 Library Facility

IICT is also having a library for the teachers and students. The library not only contains the modern books on information and communication but also maintains a collection of basic conception books which are very rare these days. Along different versatile books, this Library also contains updated journals and research papers on IT related topics.

4.2.5 Seminar/ Workshop

IICT often arranges both national and international seminars where renowned expatriates from different sectors of science comes to give a talk and share knowledge and ideas which is necessary for being updated with modern science. For this reason IICT maintains a Seminar Room inside it with facility of projector based presentation. IICT creates an opportunity for the students and faculties to attend such educative seminar, workshop to raise interest and enthusiasm and gather opinion and feedback from the participants. IICT also participates in different seminar arranged by the other departments/faculties in BUET.

4.2.6 Research Papers/ Journals

IICT always supports and encourages its teachers and students to publish research papers in national and international conferences or journals. The students who take thesis under the teachers are supervised and guided in a proper and directive way which later led to an international research work published as conference paper or journal paper.

4.3 Courses Offered by IICT

Since the establishment on September, 2001, IICT has been running its programmes with great success and dedication. At the beginning there was only Post Graduate Diploma (PG. Dip.) programme in Information and Communication Technology (ICT). But its immediate success encourages the authority to launch for the Master's Program. Currently the following programs are offered:

1. Post Graduate Diploma (PG.Dip.) in Information and Communication Technology (ICT)
No. of seats: 60 (sixty)

2. M.Sc. Engg./M.Engg. in Information and Communication Technology (ICT) No. of seats: 30 (thirty)

4.3.1 Entrance requirements

1. For admission in PG.Dip. (ICT) Programme, a candidate
 - a. must have either B. Sc. Engineering degree from any recognized University.
OR,
Master degree/Four year Bachelor degree in Computer Science, Information Technology, Physics or Mathematics from any recognized University.
 - b. must have a minimum GPA of 3.50 out of 5.00 or a first division or equivalent in any one of S. S. C and H. S. C or in equivalent examinations and must not have a GPA less than 2.00 out of 5.00 or a third division or equivalent in any of the aforementioned examinations.
 - c. must have at least 50% marks or a minimum GPA of 2.50 out of 4.0 or its equivalent in B. Sc. Engg. / Master degree / Four year Bachelor degree.
 - d. For the candidates having degrees from institutions other than BUET, their eligibility for appearing in the admission test will be decided by the equivalence committee of BUET.
2. For admission in M.Sc.Engg. (ICT) / M.Engg. (ICT) Programme, a candidate
 - a. must have Bachelor's degree in Computer Science and Engineering or Electrical and Electronic Engineering or Computer Engineering or Computer Science or In-formation Technology having at least 50% marks or minimum GPA of 2.5 out of 4.0 or its equivalent from any recognized university
OR,

PG. Dip. (ICT) / PG. Dip. (IT) having a minimum GPA of 2.65 out of 4.0 or its equivalent from any recognized university plus B. Sc. Engineering degree or Master's degree / four year Bachelor's degree in Physics or Mathematics.

- b. must have a minimum GPA of 3.50 out of 5.00 or a first division or equivalent in any one of S.S.C. and H.S.C. or in equivalent examinations and must not have a GPA less than 2.00 out of 5.00 or a third division or equivalent in any of the aforementioned examinations.

4.3.2 Credits to be earned for the degrees

For each of the programme, the minimum requirement for the degree is 36 credit hours. There shall be two categories of students, namely, full-time students and part-time students. Students serving in different organizations may be admitted as part-time students with a written consent of the employer. A part-time student may be assigned a maximum of 9 credit hours of courses in any term. Full-time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per term. A full-time student shall not be allowed to be in the employment of any organization (even as part-time employee). However, they may be employed as Teaching/ Research Assistant at the University. If a full time student becomes an employee (full time or part time) of any other organization in the middle of a semester/term, he/she may, with the approval of the Head of the Department / Director of the Institute and his/her Employer, be allowed to continue as a full time student for that semester/term. A student may be allowed to switch from part-time to full-time or vice versa on the recommendation of the respective BPGS/RAC before the commencement of a semester/term.

4.3.3 Application procedure

BUET now uses online application procedure as described below;

Step 1: Submission of Online Application

The facility for the submission of online Application is available through the website of BUET (<http://www.buet.ac.bd>) during the application period.

1. An applicant must fill in electronically the information related to admission (Desired Program, Status of Studentship, etc), his/her personal information (Name, Father's Name, Mother's Name, Date of Birth, Addresses, Gender, Nationality, etc), his/her academic information, his/her experience (if any), names and addresses of two referees.
2. To upload your digital photograph, simply locate your image file by clicking the Browse button. The photograph to be submitted online should be in any of the .JPG, .JPEG, .GIF, .PNG, or .BMP formats, although .JPG format is preferred. Most digital cameras and scanners on the market today utilize this format. If you are in doubt, submit the photo and you will receive a notice if it does not meet the necessary criteria.
3. After filling in all necessary data in the online Application Form on the website, the applicant must electronically submit the Form. The submission of Online Application should be followed by Steps 2 - 5 as stated below.
4. The applicant must also submit the printed copy of the submitted Application Form within the due date. Failure to do this will result in the cancellation of the online application.

Step 2: Printing the Application Form and Stapling Photographs

1. After electronically submitting the Online Application Form on the website, the applicant must download this form (in PDF) and take a print out of the same. The information pertaining to the Photograph, Name in Bangla (Item No. 4 in the Application Form) and Signature will have to be provided by the applicant on the printed Application Form. Two attested copies of recent passport-size color photographs should be stapled at the appropriate place provided in the Form. The name of the applicant must be written on the reverse side of each photograph. Be informed that the hardcopy (automatically generated in PDF format) will not print your photograph.
2. Please note that Serial No. of Application Form will be generated automatically and almost immediately if the online application has been successfully sent. Please take note of this Serial No. of Application Form for future use.
3. If you have completed and submitted the online Application Form but have not downloaded the PDF file for printing it, you can download the PDF file later by entering the Serial No. of Application Form and your Date of Birth through the website of BUET.

Step 3: Attaching All Supporting Documents

1. Documents submitted in support of your application are non-returnable. Please submit only attested and clearly legible photocopies of documents. Original documents should not be submitted. The University will not be responsible for the loss or damage of original documents, if submitted.

2. The printed copy of the completed Application Form together with the following supporting documents must be submitted to the Registrar's Office to complete the application procedure.
 - a. Attested copies of certificates of all public examinations.
 - b. Attested copies of transcripts/ grade-sheets/ mark-sheets of degrees obtained.
 - c. Attested copies of testimonial/ character certificate from the institution last attended.
 - d. Letter of Consent, in prescribed form, from the employer for applicants in part-time or full-time employment.

Step 4: Payment of Application Fee

Non-refundable application fee of Tk. 500/- (Five Hundred) must be paid in cash as application fee at the time of the submission of complete application to Registrar's Office, BUET. Please DO NOT send cash payment by post. The University will not be responsible for any loss of cash payment submitted by post.

Step 5: Submission of the Complete Application

A complete application includes the printed copy of the completed online Application Form as described in Step 2 attached with all necessary supporting documents as described in Step 3. The complete application must be submitted to Registrar's Office, BUET by the application deadline during office hours (9:00 am to 5:00 pm except on Thursdays, Fridays and any other holidays). Failure to submit the same will result in cancellation of your online submission.

Please note that the Application submitted by mail will NOT be accepted.

The Registrar Office will provide “Receipt of Application Form (Applicant's part)” as soon as the complete application is submitted.

Please note that

- Failure to submit the complete application directly to Registrar Office will result in cancellation of your online submission without further notification.
- Application submitted by mail will NOT be accepted.
- Incomplete Application will result in cancellation of the same.
- Wrong or false information provided in the application form will lead to the cancellation of the application
- For any help regarding online application, please contact the Institute of Information and Communication Technology (IICT), 6th Floor, ECE Building (West Palashi), BUET.

4.3.4 Selection procedure

- The applications will be scrutinized by the Institute and a list of eligible candidates will be displayed in the Institutes Notice Board. The candidates will have to appear in tests conducted by the Selection Committee of the institute
- The written test will be held on the date published by the Institute
- On the basis of the result of the written test, a list of preliminarily selected candidates will be published. A practical test of successful candidates in written test will be held. The practical test will be based on computer fundamental.

4.3.5 Admission test

PG.Dip

Written test for the PG. Dip. (ICT) program generally takes place on the month of November, every year. The test will be of multiple choice type and there will be a total of 50 questions. Section wise distribution will be as follows:

Section 1: IQ - 25 questions

Section 2: English - 15 questions

Section 3: Computer Fundamentals - 10 questions

A candidate must pass in each section individually. The pass mark is 40%. There will not be any negative mark for the wrong answers. A practical test (on Computer Fundamental and Programming Skill) is taken for successful candidates in written test.

Master's Degree

A descriptive type written test will be conducted for the Master's admission. The topics that will be covered are as follows:

- Programming Languages
- Computer Networks
- Data Structures and Algorithms
- Database Management System
- Computer Architecture and microprocessors
- Operating systems
- Communication Theory
- Digital Logic Design
- Electrical Circuits
- Electronic Device

The test generally takes place on the month of March and/or September every year. There will be 5 questions in each topic. That is, a student will answer 30 questions (maximum). Each question will be of 10 marks. The duration of the test will be two hours. Details of the admission test may also be found at IICT office or at the website: www.buet.ac.bd/iict.

4.3.6 Fees and Others

The selected candidates have to pay the following amount as described below:

PG. Dip

Particulars	Amount (Taka)
Admission Fee	500/-
Registration Fee	500/-
Course Fee per Credit	500/-
Thesis/Project Fee per Credit	500/-
Caution Money	5000/-
Late Fee (if applicable)	1000/-

Master's Degree

Particulars	Amount (Taka)
Admission Fee	500/-
Registration Fee	500/-
Course Fee per Credit	100/-
Thesis/Project Fee per Credit	100/-
Caution Money	-
Late Fee (if applicable)	1000/-

4.3.7 Timing of the classes

Normally the classes for the programme held from 5 PM during the working days. But under special circumstances, classes may be held at any other time and days.

4.3.8 Tentative calendar for the forthcoming session

Number of terms for PG Diploma and Masters programme will normally be two. The tentative calendar of the terms is as follows:

1st semester - From April to September

2nd semester - From October to March

4.3.9 Allowable duration of the programs

A student must complete the PG Diploma within 4 academic years and Master's within 5 academic years from the date of the first admission in the respective program.

4.4 Research Activities

IICT encourages its students and teachers to research on IT related topics like data structure and algorithm, software engineering, information system design, computer network, database and distributed systems, e-governance, developing teaching and learning methodologies in an academic environment, fuzzy logic systems, machine translation, pattern and speech recognition etc. Students are involved in the research through courses or group activities. Students of M.Sc. Engg. or M. Engg. are bound to take thesis under the course

no. ICT 6000. Teachers are also involved into research either through individual effort or group work. To provide research materials, IICT allows its students to access Internet or library facility. In addition, teachers can access the facility of central library. IICT library and central library have a good number of books and updated journals on IT related topics. IICT is going to publish a research bulletin very soon to encourage its students and teachers to involve into research activities. The bulletin will be published in every 6 months and it will contain writings of its students, teachers as well as external researchers. Moreover IICT regularly arranges talk and seminar on IT related topics to enrich the knowledge of its students. Famous researchers and professionals from home and abroad usually deliver the talks. Recently IICT arranged a very successful international Conference titled as "International Conference on Information and Communication Technology 2007 (ICICT 2007)". The Conference was able to raise huge interest and opinion among its participants. The conference gathered feedback of participants and speakers and came out with some suggestions, which was delivered to the ministry of science and information and communication technology for future implementation.

4.5 Journal Publications (Since 2009)

1. M. R. H. Mondal and Kusha Panta, "Performance analysis of spatial OFDM for pixelated optical wireless systems", Transactions on Emerging Telecommunications Technologies (ETT), ISSN: 2161-3915, DOI: 10.1002/ett.2948, May 2015.
2. M. R. H. Mondal and Jean Armstrong, "Analysis of the effect of vignetting on MIMO optical wireless systems using spatial OFDM", IEEE/OSA Journal of Lightwave Technology (JLT), ISSN: 0733-8724, vol. 32, no. 5, pp. 922-929, March 2014.

3. A.Nawaz, F.S. Hossian, K.M. Grihan, L. Ali, "Biometric authentication scheme for ATM banking system using Energy Efficient AES Processor", Vol.1 (2), Electrical Engineering Research (EER), 2013
4. F. Sharif, L. Ali and N. Roy "Design of a High Throughput and Low Power AES Processor", International Journal of Communication, Academic Publishers, USA , 2012
5. Hossen Mustafa, Xin Zhang, Zhenhua Liu, Wenyuan Xu, Adrian Perrig, "Jamming-Resilient Multipath Routing", IEEE Transactions on Dependable and Secure Computing (TDSC), vol. 9, no. 6, pp. 852-864, Nov.-Dec. 2012.
6. F. Sharif, L. Ali and N. Roy "Design of an Ultra High Speed AES Processor for Next Generation IT Security", International Journal on Computers & Electrical Engineering, Elsevier Science, USA , 2011
7. M. A. Ali and L. Ali, "Design of a High Performance IC test processor chip employing GLFSR technique", Journal of Science, DU, Bangladesh, 2010
8. M. L. Othman, I. Aris, S. M. Abdullah, L. Ali, M. R. Othman, "Rough set based data mining and rule quality measure to hypothesize distance protective relay operation characteristics from relay event report ", International Journal of Electrical power and Energy systems, Elsevier Science, USA, 2010 (ISI journal)
9. M. L. Othman, I. Aris, S. M. Abdullah, L. Ali, M. R. Othman, "Knowledge discovery in distance relay event report: a comparative data mining strategy of rough set theory with decision tree", IEEE Transaction on Power Delivery, Vol. 2(54), pp. 2264-2287, Oct., 2010 (ISI journal)
10. L. Ali, F. Hasan, "Information System Trust and Human-External Protection in Information Combat Environment", Journal of Public Administration Training Centre, Vol. 42. pp. 61-78, March 2010
11. L. Ali, R. Shima, G. Shahab, " Development of an web based educational module for Verilog HDL", International Journal of Industrial and Systems Engineering (IJISE), special issue, April, 2010

12. M. R. Khatun, M. S. Islam and A.N.M. Bazlur Rashid, "Analysis of Dual Core Hexagonal PCF Based Polarization Beam Splitter Computer Engineering and Intelligent Systems, Vol 3, No.3, page 1-9, Sept., 2012.
13. Sher Shermin A. Khan and Md. S. Islam, "Determination of the Best Apodization Function and Grating Length of Linearly Chirped Fiber Bragg Grating for Dispersion Compensation", Journal of Communications, Vol. 7, No.. 11, pp. 840-846, November, 2012.
14. S. R. Sabuj and M. S. Islam, "Performance Analysis of SFBC and Data Conjugate in MIMO-OFDM System over Nakagami Fading Channel", Journal of Communications, Vol. 7, No.. 11, pp. 790-794, November, 2012.
15. M. R. Khatun and M. S. Islam, Propagation Properties and Stress Sensitivity of S-PCF, H-PCF and O-PCF, Journal of Communications, Vol. 7, No. 11, pp. 832-839, November, 2012.
16. M. R. H. Mondal and Satya P. Majumder, "Analytical Performance Evaluation of Space Time Coded MIMO OFDM Systems Impaired by Fading and Timing Jitter", Journal of Communications (JCM), ISSN: 1796-2021, Academy Publisher, Oulu, Finland, vol. 4, issue. 6, July 2009.
17. Mohammad Shah Alam, Shamim Ara Shawkat, Gontaro Kitazumi and Mitsuji Matsumoto, "Performance Evaluation of IrSimple Protocol and Its Efficiency Enhancement with Effective Error Control and Flow Control Schemes", Institute of Image Electronics Engineers of Japan (IEEEJ) Journal on Visual Computing, Devices and Communications, Vol.38, NO.2, March 2009

4.6 Conference Publications (Since 2009)

1. Gorkem Kar, Hossen Mustafa, Yan Wang, Yingying Chen, Wen yuan Xu, Marco Gruteser, and Tam Vu, "Detection of On-Road Vehicles Emanating GPS Interference", 21st ACM Conference on Computer and Communications Security (CCS), November 2014, Scottsdale, Arizona, USA.
2. Hossen Mustafa, and Wen yuan Xu, "CETAD: Detecting Evil Twin Access Point Attacks in Wireless Hotspots", In the Proceedings of IEEE Conference on Communications and Network Security (CNS), October 2014, San Francisco, CA, USA.
3. Hossen Mustafa, Wen yuan Xu, Ahmad-Reza Sadeghi, and Steffen Schulz, "You Can Call But You Can't Hide: Detecting Caller ID Spoofing Attacks", In Proceedings of the 44th IEEE International Conference on Dependable Systems and Networks (DSN), June 2014, Atlanta, USA.
4. L. Ali, M.I. Hasan, M. S. Islam, "Contactless Smart Card Based Prepaid Gas Metering System", International Conference on Industrial Engineering and Operations Management (IEOM), Grand Hyatt Hotel, Bali, Indonesia, January, 2014
5. Shane Clark, Hossen Mustafa, Benjamin Ransford, Jacob Sorber, Kevin Fu, and Wen yuan Xu, "Current Events: Identifying Webpages by Tapping the Electrical Outlet", In Proceedings of the European Symposium on Research in Computer Security (ESORICS), September, 2013, UK.
6. L. Ali and H. Rahman, "Development of a Remote Digital System Laboratory", Proceedings of International Conference on Computer and Information technology (ICCIT), Dhaka, Bangladesh, Dec. 2012
7. L. Ali, M. Alam and R. Rahman, "Development of an RFID based Waste Management System", Proceedings of ICECE, Dhaka, Bangladesh, Dec, 2012
8. L. Ali and U. Kumar, "Design of a double AES Processor, Proceedings of ICECE, Dhaka, Bangladesh, Dec, 2012
9. Ishtiaq Rouf, Hossen Mustafa, Miao Xu, Robert Miller, Wen yuan Xu and Marco Gruteser, "Neighborhood Watch:

- Security and Privacy Analysis of Automatic Meter Reading Systems”, In Proceedings of the 19th ACM Conference on Computer and Communications Security (CCS), October, 2012, Raleigh NC, USA.
10. M. R. H. Mondal and J. Armstrong, "Impact of Linear Misalignment on a Spatial OFDM Based Pixelated System", 18th Asia Pacific Conference on Communications (APCC), South Korea, October 2012.
 11. M. R. H. Mondal and J. Armstrong, "The Effect of Defocus Blur on a Spatial OFDM Optical Wireless Communication System", International Conference on Transparent Optical Networks (ICTON), England, UK, June 2012.
 12. Steffen Schulz, Ahmad-Reza Sadeghi, Maria Zhdanova, Hossen Mustafa, Wenyuan Xu, Vijay Varadharajan, "Tetherway: A Framework for Tethering Camouflage", In Proceedings of the 5th ACM Conference on Wireless Network Security (WiSec), April, 2012, Tucson, Arizona, USA.
 13. F.S. Hossain, L. Ali, "A very Low Power and High Throughput AES Processor", Proceedings of International Conference on Computer and Information technology (ICCIT), Dhaka, Bangladesh, Dec. 2011
 14. M.N.H. Khan, L. Ali, S. Islam, "A New Technique for High Speed Decimal Log Computation", Proceedings of International Conference on Computer and Information technology (ICCIT), Dhaka, Bangladesh, Dec. 2011
 15. T. Mohammad, L. Ali, "Robust Facial Expression Recognition Based on Local Monotonic Pattern", Proceedings of International Conference on Computer and Information technology (ICCIT), Dhaka, Bangladesh, Dec. 2011
 16. S. Hossain, D. Abdullah, W. Abdullah, L. Ali, "Development Of A Fuzzy Logic Based Smart Solar System For Irrigation, ICME, BUET, Dhaka, 2011
 17. Rahman, L. Ali, "Weighted Local Directional Pattern for Robust Facial Expression Recognition" International Conference on Informatics and Computational Intelligence, Indonesia, 2011

18. M. R. Khatun and M. S. Islam, "Analysis of confinement loss and birefringence in hexagonal and octagonal PCF due to external stress", Proceedings of the International Conference on Mechanical Engineering and Renewable Energy 2011 (ICMERE2011), 22- 24 December 2011, Chittagong, Bangladesh, 2011.
19. M. R. Khatun and M. S. Islam, "Effect of external stress on propagation properties of hexagonal and octagonal PCF", Proceedings of the 6th IEEE International Conference on Industrial and Information Systems (ICIIS), 16-19 Aug. 2011, Candy, Sri Lanka, pp. 434 – 438, 2011
20. Hossen Mustafa, Xin Zhang, Zhenhua Liu, Wenyan Xu, Adrian Perrig, "Jamming-Resilient Multipath Routing Leveraging Availability-Based Correlation", In Proceedings of the 4th ACM Conference on Wireless Network Security (WiSec), June, 2011, Hamburg, Germany.
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27. B. Nahar and L. Ali, "Development of a Mobile Phone Based Surveillance System", Proceedings of International Conference on Computer and Information technology (ICCIT), Dhaka, Bangladesh, Dec. 2010
28. L. Ali, T. Ahmed and B. Karim "Development of an FPGA based Low Power Message Displaying System using Scanning Technique", Proceedings of International Conference on Electrical & Computer Engineering (ICECE), Dhaka, Bangladesh, Dec. 2010
29. F. Sharif, L. Ali and N. Roy "Design and Analysis of a High Performance AES Processor", Proceedings of International Conference on Electrical & Computer Engineering (ICECE), Dhaka, Bangladesh, Dec. 2010
30. B. Nahar and L. Ali, "Development of an Intelligent System for Monitoring the ship engine room using mobile phone", Proceedings of International Conference on Marine technology (MARTEC), Dhaka, Bangladesh, Dec. 2010
31. B. Kartim and L. Ali, "Design of a Parameterized Convolutional Encoder and Viterbi Decoder for Wireless Communication", Proceedings of International Conference on Industrial Engineering and Operations management (IEOM), Malaysia, Dec 2010
32. K. S. Ahmed and L. Ali, "FPGA Implementation of an AES Processor", Proceedings of International Conference on Industrial Engineering and Operations management (IEOM), Malaysia, Dec 2010
33. M. M. Islam, K. H. Ansary, L. Ali, A. H. Choudhury and L. Kabir, "Development of a Low cost portable Vending System for Prepaid Utility Meter", Proceedings of International Conference on Industrial Engineering and Operations management (IEOM), Malaysia, Dec 2010

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37. M. A. Khayer Azad and M. S. Islam, "Impact of XPM in WDM fiber-optic transmission system in presence of second order GVD.", Proc. of the 6th International Conference on Electrical and Computer Engineering (ICECE 2010), 18-20 December 2010, Dhaka, Bangladesh.
38. Sher Shermin Azmiri Khan and M. S. Islam, "Chromatic dispersion compensation using linearly chirped apodized fiber Bragg grating.", Proc. of the 6th International Conference on Electrical and Computer Engineering (ICECE 2010), 18-20 December 2010, Dhaka, Bangladesh.
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- and Ivan Seskar, "Security and Privacy Vulnerabilities of In-Car Wireless Networks: A Tire Pressure Monitoring System Case Study", In Proceedings of the 19th USENIX Security Symposium, August, 2010, Washington DC, USA.
42. M. R. H. Mondal and M. Hossain, "Performance Evaluation of Multiple-Antenna DS-CDMA Wireless Communication Systems with Different Diversity Combining Methods", Australasian Telecommunication Networks and Applications Conference (ATNAC), Canberra, Australia, 10-12 November 2009.

CHAPTER 5: RULES AND REGULATIONS FOR ACADEMIC PROGRAMS

5.1 Academic calendar

There will be 13 lectures for each semester. If for any reason such as Hartal, strike, natural calamities normal classes could not be held, make up classes will be taken on the next Thursday or Friday. The evaluation of a course will be carried out by taking three examinations. There will be two mid-term examinations and one final examination. The first mid-term examination will be held in the 5th week and the second one in the 9th week. The mid-term examination will be held during the normal class hour. The duration of the mid-term examination will be one hour.

At the end of 13 weeks of classes, the final examination will be held on the following week without any break (preparatory leave). The duration of final examination for each course will be one and half hour.

The result of the term-final examination and the registration procedure will be finished within the week following the final examination. The classes for the next semester will start on the next week.

The normal class time will be between 5:00 PM to 8:00 PM.

Marks Distribution:

Mid term I	30%
Mid term II	30%
Final exam	40%

5.2 Registration Procedure

Students must register for each class in which they will participate. Each student will fill up his/her Course Registration Form in duplicate. One copy of the Course Registration Form will be submitted to the Registrar's Office and the second copy will be given to the students.

5.3 Calculation of GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes five courses in a semester having credits of C1, C2, C3, C4 and C5 and his grade points in these courses are G1, G2, G3, G4 and C5 respectively then,

$$GPA = \frac{\sum C_i G_i}{\sum C_i}$$

5.4 Conduct and Discipline

A student shall conform to a high standard of discipline and shall conduct himself within and outside the precincts of the

university in a manner befitting the students of a university of national importance. He should show due courtesy and consideration to the employees of the university, good neighborliness to his fellow students and the teachers of the university and pay due attention and courtesy to visitors.

5.5 Restrictions

A student participating in the program will not be considered as a regular student of BUET. Any other benefit except directly related to the program during class hours will not be permissible. The following restrictions will apply to both PG. Dip. and Master's students:

- Accommodations in the residential halls and availing university transport services.
- Use of central library. However, they will be entitled to use institute's own library.
- Participation in any of the student's union activities.
- Availing university medical facilities.

5.5.1 Extract from Ordinance

- For the PG. Dip. a student must earn a minimum of 36 credit hours including a project of 6 credit.
- For the degree M.Sc. Engineering a student must earn a minimum of 36 credits including a thesis of 18 credits.
- For the degree M. Engineering a student must earn a minimum of 36 credits including a project of 6 credits.
- The minimum duration of the PG. Dip. course shall normally be three terms / semesters. A candidate for the PG. Dip. must complete all the requirements for the diploma within three academic years from the date of his/her first admission in the respective program.

- The minimum duration of the M.Sc. (ICT) course shall normally be three semesters. A candidate for the Master's degree must complete all the requirements for the degree within five academic years (Session) from the date of the first admission in the program.
- There shall be two categories of students, namely, full-time students and part-time students.
- Students, serving in different organizations, may be admitted as part-time students with a written consent of the employer. A part-time student may be assigned a maximum of 9 credit hours of course work.

Final grades for courses shall be recorded as follows:

Grade	Merit description	Grade Points
A+	Excellent	4.00
A	Very Good	3.50
B+	Good	3.00
B	Average	2.50
C	Pass	2.00
F	Failure	0.00
I	Incomplete	-
S	Satisfactory	-
U	Unsatisfactory	-

All final grading to be reported to the Controller of Examinations will be in the letter grade system as detailed below:

Numerical grade Point	Letter Grade	Grade Points
90% or above	A+	4.00
80% to below 90%	A	3.50
70% to below 80%	B+	3.00
60% to below 70%	B	2.50
50% to below 60%	C	2.00
Below 50%	F	0.00

- Full-time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per term / semester. A full-time student shall not be allowed to be in the employment of any organization (even as a part-time employee). However, they may be employed as Teaching / Research Assistant at the University.
- A student on recommendation of the relevant BPGS or the RAC and as approved by the CASR may be allowed a transfer of credits of the courses completed by the student at a recognized institution provided that

the courses were not taken earlier than three calendar years from the date of his first enrolment in the respective program at BUET and that the student obtained a minimum GPA of 3.0 out of 4.0 or its equivalent and that the courses are equivalent to the approved courses of BUET.

- The qualifying requirement for the diploma or degree is that a student must earn a minimum grade point of 2.65 based on the weighted average in his/her course works.
- Courses in which the student gets F grades shall not be counted towards credit hour requirements and for the calculation of Grade Point Average (GPA).
- Grade I is given only when a student is unable to sit for the examination of a course at the end of the term /semester because of circumstances beyond his control. He/she must apply to the Head or Director of the concerned Department or Institute within one week after the examination to get an I grade in that course. It must be completed within the next three terms / semesters, otherwise, the I becomes an F grade. He/she may, however, be allowed to register without further payment of tuition fees for that course.
- Officially withdrawn from a course - A student may withdraw officially from a course within two working weeks of the commencement of the term / semester otherwise his/her grade in that course shall be recorded as F unless he/she is eligible to get a grade of I. A student may be permitted to withdraw and change his/her course within the specified period with the approval of his/her Adviser, Head of the department or the Director of the Institute and the respective teachers(s) concerned.

- If the cumulative number of F grades obtained by the student is three or more in the same or different subjects taken together, he/she shall not be allowed to continue in the program.
- If at the end of the second or any subsequent semester / term, the cumulative GPA falls below 2.5, he/she shall not be allowed to continue in the program.
- Caution money may be refunded if the student withdraws officially from all the courses including project or at the end of his academic program and the amount will be determined from the statement of clearance from all Departments / Institutes /Offices.

CHAPTER 6: COURSE STRUCTURE AND OUTLINE

6.1 Present Structure of Courses

6.1.1 Postgraduate Diploma in Information and Communication Technology

Summary

Group A (Core Courses)	3x6=18 credits
Project	6 credits
Group B(Optional Courses)	3x4=12 credits
Total Credits	36 credits

Group A

All of the following to be taken: 21 credit hours

Course Number and Name	Credit Hours
ICT 5100 (Project)	3
ICT 5101 (Programming Concepts)	3
ICT 5102 (Data Structure and Algorithm)	3
ICT 5103 (Database Design and Management)	3
ICT 5104 (Introduction to Telecommunications)	3
ICT 5105 (Data Communications)	3
ICT 5106 (Computer Networks)	3

Group B

Any four of the following to be taken: $3 \times 4 = 12$ credit hours.

Course Number and Name	Credit Hours
ICT 5201 (Operating System Concepts)	3
ICT 5202 (Visual Programming)	3
ICT 5203 (Web Technologies, Protocols, and Applications)	3
ICT 5204 (Multimedia Design and Development)	3
ICT 5205 (Client Server Technologies)	3
ICT 5206 (Electronic Commerce)	3
ICT 5207 (Information System Analysis and Design)	3
ICT 5208 (Software Engineering and Application Development)	3
ICT 5209 (Software Quality Management)	3
ICT 5301 (Information System and Network Security)	3
ICT 5302 (Advanced Internet Technologies)	3
ICT 5303 (Network Programming and Management)	3
ICT 5304 (Digital Communications)	3
ICT 5305 (Mobile Communications)	3
ICT 5306 (Software and Database in Telecommunication)	3
ICT 5307 (Embedded System Design)	3
ICT 5308 (Network System Design)	3
ICT 5309 (Optical Communication)	3

6.1.2 Master's in Information and Communication Technology

Summary

Courses	M.Sc. Engg. Credits	M. Engg. Credits
Theory Courses	3x6=18	3x10=30
Thesis/Project	18	6
Total Credits	36	36

Any six of the following to be taken for M.Sc. Engg., $3 \times 6 = 18$ credit hours.

Any ten of the following to be taken for M.Engg., $3 \times 10 = 30$ credit hours.

Course Number and Name	Credit Hours
ICT 6511 (Graph Theory and Application)	3
ICT 6512 (Parallel Algorithms)	3
ICT 6513 (VLSI Layout Algorithms)	3
ICT 6514 (Bioinformatics Computing)	3
ICT 6521 (Advanced Database Systems)	3
ICT 6522 (Data Warehousing and Mining)	3
ICT 6531 (Computational Linguistics)	3
ICT 6532 (Statistical Machine Translation)	3
ICT 6533 (Speech Processing)	3
ICT 6534 (Speech Recognition)	3

ICT 6535 (Advanced Artificial Intelligence)	3
ICT 6536 (Neuro-Fuzzy Systems)	3
ICT 6541 (Applied Cryptography)	3
ICT 6543 (Computer Graphics and Animation)	3
ICT 6544 (Distributed Systems)	3
ICT 6611 (Advanced Digital Communication)	3
ICT 6612 (Advanced Optical Communication)	3
ICT 6613 (Mobile and Wireless Communications)	3
ICT 6615 (Teletraffic Engineering)	3
ICT 6616 (Radio Frequency Technology)	3
ICT 6621 (Advanced Networking)	3
ICT 6632 (Advanced VLSI Design)	3
ICT 6633 (Advanced VLSI Testing)	3
ICT 6641 (Advanced Embedded System Design)	3
ICT 6642 (Real Time Computing for Embedded System)	3
ICT 6651 (Advanced Digital Signal Processing)	3
ICT 6900 (Special Topics Related to ICT)	3

CHAPTER 7: DETAIL OUTLINE OF COURSES

7.1 Postgraduate Diploma in Information and Communication Technology

7.1.1 ICT 5101: Programming Concepts: 3 Credits

Introduction to programming and logic flow, procedural versus object oriented programming, data types, variables, constants, operators, expressions, input-output, control structures, arrays, functions, pointers, file access, structures, dynamic memory allocation, classes, objects, constructor and destructor, inheritance, polymorphism, files, exception handling.

7.1.2 ICT 5102: Data Structure and Algorithm: 3 Credits

Introduction to elementary data structures: arrays, records, linked lists, stacks, queues, trees; Complexity analysis of algorithms; Basic search and traversal techniques; Sorting algorithms; Methods for the design of efficient algorithms: recursion, divide and conquer, greedy method, dynamic programming; Graph algorithms; etc.

7.1.3 ICT 5103: Database Design and Management: 3 Credits

Introduction to database; Relational model: structure, relational algebra, SQL and advanced SQL, Database design and the entity-relationship model, Relational database design and normalization, application design and development, indexing, Database storage and file structure, transaction management, concurrency control recovery management, object database and database administration.

7.1.4 ICT 5104: Introduction to Telecommunications: 3 Credits

Overview of telecommunication: history, evolution, convergence of telecommunication and data networks, standards; Basics of communication systems: modulation, multiplexing; Switching system: circuit switching, packet switching; Voice over Internet Protocol (VoIP), Fax over IP network, voice over frame relay, and ATM; Telephony: operating principles, telephone apparatus, description of the modern phone; Telephone switching systems: PBX, Centrex, ACDs, call centers, computer integration; Data communication equipment: introduction to terminals, modems, RS-232 and other interfaces, modem types; Tele-Traffic analysis; Cellular telephony: Frequency reuse, frequency management, channel alignment, handoffs strategies, FDMA, TDMA, CDMA and GSM, Introduction to satellite communication, Optical fiber communication, Submarine cables, Digital Radio Microwave, etc.

7.1.5 ICT 5105: Data Communications: 3 Credits

Introduction to data communication and networks; transmission media, signals, noises, modulation and demodulation, synchronous and asynchronous transmission, line encoding, error detection and correction, RS 232 interface, HDLC, flow control and error control; Channel multiplexing; Data network: point to point connections, circuit-switched, message switched and packet switched networks, WANs, ISPs and LANs, differences in ownership, speed and cost; Types of communication: client server communication, broadcast, unicast and multi-cast modes, simplex, duplex and half duplex information flow; Bandwidth: distribution of bandwidth, discrete bandwidth requirements, implications of other factors; Internet, OSI reference model, TCP/IP reference model, TCP/IP architecture.

7.1.6 ICT 5106: Computer Networks: 3 Credits

Overview of LAN concepts, media, collision and broadcast; MAC address; Token ring, Fiber Distributed Data Interface (FDDI), Ethernet and Carrier Sense Multiple Access Collision Detect (CSMA/CD), IEEE 802.3., LAN topology; Network layer: internet-working, routing, IPv4 and IPv6 addressing, subnetting, VLSM, NATPAT, ACL, ARP and RARP, DHCP, RIP, IGRP and EIGRP, OSPF; Upper layers of OSI model; Wireless LAN: Ad hoc, infrastructure networks; WAN services: analog dial-up, ISDN dial-up, dedicated leased line, X.25, frame relay, ATM; IEEE802.11: physical layer, framing, multiple access techniques, bluetooth, IEEE 802.15; Broadband wireless: Wireless ATM, 802.16; local multipoint distribution service (LMDS), Multichannel

Multipoint Distribution System (MMDS); Network protocols: mobile IP, cellular IP, mobile Ad hoc networking.

7.1.7 ICT 5201: Operating System Concepts: 3 Credits

Overview of operating system and its role in computer systems; Process: process model, inter-process communication; thread model; CPU scheduling; Memory management, virtual memory, address translation; File systems: files, directories, protection and security; Input, output; Deadlock; Introduction to UNIX, UNIX kernel, UNIX commands, services, device structure, memory structure, process and jobs, file system and file management, vi and emacs editors, shell programming; LINUX: user management, privilege, using rpm, using configuration files.

7.1.8 ICT 5202: Visual Programming: 3 Credits

Concepts of visual programming; Data types, variables and expressions, control structures; Classes and objects, constructors; Inheritance, packages and interfaces; Exception handling; Collection classes: array, vector; Threads; GUI development; applets; Graphics and multimedia; Servlet; JDBC; Java beans; Java server page; Java networking.

7.1.9 ICT 5203: Web Technologies, Protocols, and Applications: 3 Credits

Web architecture and HTTP: history and architecture of the World Wide Web, overview of the Hyper Text Transfer Protocol, other related protocols; Hyper Text Mark Language (HTML): concept of markup, overview

of HTML (table, form, frame, window, link etc.); Client side scripting: variables data types, control structure, functions, Document Object Model (DOC), event handlers, properties methods, cookies; Server side scripting: concepts, variables, data types, control structure, functions, objects; Database: content generation, data exchange; Regular expressions, mails, cookies, sessions; Middleware: object management architecture, object request brokers (CORBA, OLE/COM), services (trading, naming, event, transaction, security), interorb protocols (e.g. the Internet Interorb protocol).

7.1.10 ICT 5204: Multimedia Design and Development: 3 Credits

Introduction to multimedia, image, sound, video formats and their different properties, compression, playing and recording techniques, merits and demerits, conversions between different formats and their combinations; Multimedia authoring, introduction to web and HTML, basic HTML tags design principles; Drawing: basic image properties, image manipulation, layers, colors, text, texture, brightness, contrast, filters and effects; Interactive application development using multimedia tools.

7.1.11 ICT 5205: Client Server Technologies: 3 Credits

Introduction, components of client server architecture, middleware, socket, Remote Procedure Call (RPC), Distributed Computing Environment (DCE), Common Object Request Broker Architecture (CORBA), Java Remote Method Invocation (RMI), Enterprise Java Beans (EJB), distributed data management, client-server application development, storage management,

security and user management, backup and recovery, performance tuning.

7.1.12 ICT 5206: Electronic Commerce: 3 Credits

Overview of electronic commerce, business models; E-commerce channels: portals, auctions, communities, marketplace; Managing the marketplace: Demographics and advertising; Customer relationship management, web services for B2B and B2C e-commerce, electronic payment systems; Network security, cryptography, digital certificates; Markup for e-commerce: ebXML, M-commerce, L-commerce, wireless and U-commerce, digital money and electronic banking; Ethical, legal, and regulatory environment: Intellectual property, copyright, trademark, patents.

7.1.13 ICT 5207: Information System Analysis and Design: 3 Credits

Different types of information systems, attributes of information, roles, tasks and attributes of a system analyst, sources of information, information gathering techniques, handling of missing information, steps of system analysis, different types of feasibility analysis; Design of an information system: process modeling, logic and timing modeling, conceptual data modeling; Project effort analysis method, designing user interfaces, database and file design, project team organization, project management and documentation, system installation and commissioning, analysis of system maintenance and upgrading; Ethics, privacy control and security; Case study of an information system.

7.1.14 ICT 5208: Software Engineering and Application Development: 3 Credits

Software engineering paradigms, process models, complexity models, requirement engineering, different models of effort, schedule and cost estimation, risk analysis and management, project management, different software design methodologies, verification and validation, testing philosophy and methods, software configuration management, software metrics, software reliability and availability, software maintenance and software reengineering, development of applications using software engineering concepts.

7.1.15 ICT 5209: Software Quality Management: 3 Credits

Software quality, software process and process metrics, different quality metrics of software; Verification and validation tasks and techniques, software error and defect removal, SQA management and models, statistical quality control; Quality management system: ISO 9000, ISO 9001, and IEEE 12207 Standards; Compliance criteria of different standards: 9000/AS-3563 and ISO 9001, Capability Maturity Model (CMM), People Capability Maturity Model (P-CMM); Benchmarking and certification.

7.1.16 ICT 5301: Information System and Network Security: 3 Credits

Fundamentals of cryptography, security for communication protocols, security for operating systems and mobile programs, and security for electronic commerce, passwords and offline attacks, DES, RSA, DSA, SHA, SSL, CBC, IPSec, SET,

DDOS attacks, biometric authentication, PKI smart cards, S/MIME, privacy on the Web, viruses, security models, wireless security, and sandboxing.

7.1.17 ICT 5302: Advanced Internet Technologies: 3 Credits

Introduction to the Internet: Introduction to XML, XHTML, XSL, integrating JavaScript and XSL; Internet Address, sockets; Application specific protocols and services: authentication, domain name services (DNS), electronic mail, world wide web, web caching, network management, internet control message protocol (ICMP), file transfer protocol (FTP), secured remote access; Voice over IP and its protocols, Next generation of internet, Revolutionary application of internet.

7.1.18 ICT 5303 Network Programming and Management: 3 Credits

Concepts of network operating system, streaming technology, inter process communication (IPC) between application programs, Abstract Syntax Notation One (ASN.1), TELNET, File Transfer Protocol (FTP), simple mail transfer protocol (SMTP), Simple Network Management Protocol (SNMP), network programming, socket-level interface, algorithm and issues in client / server software design; installation, administration and management of commercial network software packages; Network information service (NIS) and network file system (NFS); State-of-the-art network management tools and systems, high speed LAN, MAN, network management and troubleshooting techniques.

7.1.19 ICT 5304: Digital Communications: 3 Credits

Overview of different types of communication networks and their architecture; A/D conversion; GIF, JPEG, PNG; Audio coding for fixed telephone network and speech coding for mobile communications; Image and video coding: JPEG and MPEG; Channel coding: scrambling, convolution coding, cyclic redundancy checks, scrambling and interleaving; Modulation schemes: ASK, PSK, FSK, and GMSK. Modulation for local access: ADSL, DSL; Multiple access technologies, high speed PSTN access technology; Routing strategies, numbering schemes, Switching techniques: space switching, store and forward switching; Routing strategies; Numbering schemes; VSAT and satellite communication; Audio and video conferencing technique, Cable and satellite TV networks, HDTV transmission.

7.1.20 ICT 5305: Mobile Communications: 3 Credits

An introduction to ubiquitous communication; Wireless transmission: frequencies for transmission, International Regulations and Regulatory Authorities, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum; Medium access control: SDMA, FDMA, TDMA, CDMA; Radio network planning; Fundamentals of cellular telephony: concept of cellular communications, frequency reuse, cell splitting, registration, terminal authentication, handoff; GSM and GPRS: services, system architecture, radio interface, protocols, handover, security; Next generation mobile telecommunications systems: 2.5G systems (EDGE, TETRA), 3G systems (UMTS, UTRAN), 4G and beyond; Wireless LANS and

personal area networks: 802.11, IrDA, Bluetooth, data services: WAP, mobile IP.

7.1.21 ICT 5306: Software and Database in Telecommunication: 3 Credits

Introduction to hardware and software evolution; Software components: database, distributed database, real-time software, mapping of software components etc; Constraints on the software components: real-time behavior, service continuity, hardware limitations, software and hardware integration and dimensioning etc; Telecommunication software development: examples of life cycles; Methods and tools for: requirement capture, analysis, specification, architecture, design and development; Interfaces definition: problem overview, transparency of distribution; System tests; Database in telecommunication systems, database environment, relational and object databases; Database planning, design and administration; Database trends in telecommunication: real-time database, multimedia database, WWW servers and database, 3D image handling in database, multimedia and existing RDBMS.

7.1.22 ICT 5307: Embedded Systems Design: 3 Credits

Concepts, classifications; Characteristics; Requirements; Introduction to embedded system design process, Unified Modeling Language (UML); Embedded microcontroller cores; Embedded memories; Technological aspects; Interfacing between analog and digital blocks; Signal conditioning, digital signal processing, sub-system interfacing; Interfacing with external systems, user interfacing;

Design trade-offs, thermal considerations; Networked embedded systems: the I2C bus, the CAN bus, the FlexRay; Example of applications.

7.1.23 ICT 5308: Network Systems Design: 3 Credits

General design process, issues, documents. LAN design: Media, devices and tools; LAN topology, star and extended star, ring, bus; Physical layout, network map, cables and conduits, labeling; Firewall. Wireless LAN: Issues and motivations; standards, IEEE 802.11; Transmission techniques: Infrared, spread spectrum and narrow band microwave; Application areas: Extension, cross building interconnect, nomadic access, ad hoc networks; Equipments and devices. WAN design: Types and technologies; Equipments and devices; Structured design approach, considerations of design, selection and placement of devices; Evaluation of network performance, security, reliability, and management capabilities.

7.1.24 ICT 5309: Optical Communication: 3 Credits

Introduction; Light propagation through optical fiber: Ray optics theory and mode theory; Optical fibers: Structure, conditions of propagation, attenuation, pulse dispersion, fiber joint and fiber couplers; Light sources and transmitters: Principle of light emission, modulation bandwidth and spectral properties; Photodiodes and receivers: Operational principles, electrical bandwidth, noise and sensitivity; Optical amplifiers: Construction, amplification and noise; Optical communication systems with analog and digital modulation formats: performance and system budgets; Multichannel systems.

7.2 Master's in Information and Communication Technology

7.2.1 ICT 6000: Thesis for M.Sc. Engg. (ICT): 18 Credits

Project for M. Engg. (ICT): 6 Credits

7.2.2 ICT 6511: Graph Theory and Application: 3 Credits

Introduction to graphs and digraphs; Fundamental concepts: isomorphism, adjacency and connectivity; Trees, spanning trees, shortest paths, distances in graphs; Hamiltonian and Eulerian graphs, Travelling Salesman problem, Chinese Postman problem; Matching and covers: Hall's theorem, marriage theorem, optimal assignment, vertex covers, edge covers; Connectivity and cuts: vertex and edge connectivity, Menger's theorem, Max-flow Min-cut theorem in networks; Graph coloring: vertex coloring and edge coloring, k-chromatic graphs, application to scheduling; Planar graphs: embeddings, dual graphs, Euler's formula, Kuratowski's theorem; Perfect graphs.

7.2.3 ICT 6512: Parallel Algorithms: 3 Credits

Introduction, parallel processing, parallel models, performance of parallel algorithms, work-time presentation framework; Basic techniques: Pointer jumping, balanced trees, divide and conquer, pipelining, partitioning, symmetry breaking; List ranking, Euler tour technique, tree contraction; Parallel searching, merging and sorting; Connected components; Minimum spanning trees; Bi-connected

components; Simulation between PRAM models: EREW, CREW and CRCW.

7.2.4 ICT 6513: VLSI Layout Algorithms: 3 Credits

Introduction: VLSI design process, layout styles, difficulties in physical design, definitions and notations; Circuit Partitioning: problem definition, cost functions and constraints, Kernighan-Lin algorithm and its variations, simulated annealing; Floor planning: problem definition, models, cost functions and constraints, cluster growth, simulated annealing, dual graph technique; Placement: problem definition, models and cost functions, approaches to placement; Grid routing: problem definition, cost functions and constraints, maze routing algorithms, line search algorithms; Global routing: problem definition, cost functions and constraints, routing regions, sequential global routing, hierarchical global routing; Channel routing algorithms; Layout generation.

7.2.5 ICT 6514: Bioinformatics Computing: 3 Credits

Introduction to the genome: DNA, RNA, amino acids, and proteins; Information flow from the genome: genes, transcription, and translation; Integration of biological data: data integration systems, biological queries, query processing, data warehouses, and data visualization; Genome and protein sequencing and analysis, spectrum graphs; Clustering and classification: microarrays, gene expression analysis, hierarchical clustering, k-means clustering, clustering and classification algorithms; Drug discovery:

technologies and strategies, identification of drug target molecules, drug design approaches.

7.2.6 ICT 6521: Advanced Database Systems: 3 Credits

Object-oriented database systems, XML, database and the web, data management in distributed mobile computing environment, data broadcasting, text database, digital library design and implementation; Multimedia database: Basic concept, design and optimization of access strategies; parallel database, spatial database, temporal database.

7.2.7 ICT 6522: Data Warehousing and Mining: 3 Credits

Data warehouse introduction, evolution of decision support system, Data warehouse environment, data model, design, Data warehouse technology, Data loading, clean up and transformation, Data cube and OLAP, Data mining introduction, classification, clustering, mining association rules, Data mining tools and applications, Data visualization.

7.2.1 ICT 6531: Computational Linguistics: 3 Credits

Introduction; Syntactic processing: Grammars and parsing, augmented grammars, grammars for natural language, parsing, ambiguity resolution; Semantic interpretation: Semantics and logical form, linking syntax and semantics, scoping; Context and world knowledge: Knowledge representation and reasoning, local discourse context and reference, using world knowledge, conversational agent.

7.2.2 ICT 6532: Statistical Machine Translation: 3 Credits

Introduction: Statistical versus structured natural language processing (NLP), basic statistics and statistical model, linguistics essentials, corpus-based NLP; Models and techniques: Collocations, statistical Inference, word sense disambiguation, lexical acquisition, Markov models; Grammar: Part-of-speech tagging, probabilistic context free grammars, probabilistic parsing; Applications and techniques: Statistical alignment, clustering, information retrieval, text categorization.

7.2.3 ICT 6533: Speech Processing: 3 Credits

Speech production models: Acoustic theory of speech production, discrete-time speech model, lossless model of the vocal tract; Speech perception, digital processing of speech signals: Short-term processing of speech, linear prediction analysis, cepstral analysis; Speech coding: LPC, MRA, enhancement, human auditory system, quality assessment, speech synthesis; Speaker recognition and verification systems.

7.2.4 ICT 6534 Speech Recognition: 3 Credits

Introduction; Modeling human speech perception: Auditory, neural and cognitive processing, pattern matching, linguistic processing; Representations of speech signal: Band-pass filter energies, formants, LPC and ARMA, cepstrum and melcepstrum, auditory-model based representations, difference coefficients, comparison of parametric representations; Recognition modes and modalities: Speaker dependency, isolated and continuous words,

vocabulary size, speaking environment, perplexity, real-time operation; Stochastic models, linguistic models, prosodic knowledge sources; Knowledge-based approaches: Templates versus features, segmentation, labeling, fuzzy reasoning; Stochastic approaches: Hidden Markov Models (HMM), training and testing algorithms; Connectionist approaches: Neural networks, learning algorithms; Applications: Dictation systems, voice-based communications, system control, security systems, speaker verification.

7.2.5 ICT 6535: Advanced Artificial Intelligence: 3 Credits

Introduction; Advanced search techniques in AI, knowledge based system design, advanced plan generating systems; Probabilistic Reasoning, decision networks; Making complex decisions: Sequential decision problems, partially observable Markov decision problems (POMDPs); Multiple agent theory: Cooperation among multiple agents; Learning from observations: Inductive learning, decision trees, ensemble learning; Knowledge in learning: Use of logic, explanation based learning, inductive logic programming; Statistical learning: Complete data, hidden nodes (EM method), instance based learning, neural networks and neural belief networks; Fuzzy logic and genetic algorithm.

7.2.6 ICT 6536: Neuro-Fuzzy Systems: 3 Credits

Overview of artificial neural networks; Neuro-Models; Simple neural networks; Multi-layer neural networks: Multilayer Perceptions (MLP), logistic activation function, backpropagation algorithm; Neural network applications; Overview of fuzzy system; Crisp sets to

fuzzy sets; Operations on fuzzy sets, fuzzy arithmetic, fuzzy relations; Applications.

7.2.7 ICT 6541: Applied Cryptography: 3 Credits

Overview of cryptography: terminology, steganography, computer algorithms; Protocol building blocks: one way function, hash function, digital signatures, random and pseudo-random sequence generation; Basic protocols: key exchange, authentication, formal analysis of authentication and key-exchange protocols, secret splitting, secret sharing, cryptographic protection of databases; Intermediate protocols: time-stamping services, subliminal channel, different types of signatures, computing with encrypted data; Advanced protocols: zero knowledge proofs, blind signatures, identity based public key cryptography, digital certified mail, simultaneous exchange of secrets; Cryptographic techniques: key length, key management issues such as generating, transferring, storing, updating, backup and destroying of key; Cryptographic algorithms: DES, newDES, IDEA, double encryption, triple encryption, public key algorithms; Implementation of cryptographic algorithms.

7.2.8 ICT 6543: Computer Graphics and Animation: 3 Credits

Introduction to computer graphics; Viewing model; Transformations: Rotation, translation, and scaling; Rendering techniques: Scan conversion, clipping, filling polygon; Hidden line and hidden surface removal; Illumination and shading, texture mapping; Animation techniques: Mesh based system, skeletal animation system; Animation models, fractals.

7.2.9 ICT 6544: Distributed Systems: 3 Credits

Introduction, communication model: Socket, Remote Procedure Call, Remote object invocation, message oriented communication; Naming service; Clock synchronization, distributed object based system: CORBA, distributed COM; Distributed file system, replication, distributed transactions; Security management, recovery.

**7.2.10 ICT 6611: Advanced Digital
Communication: 3 Credits**

Characteristics of different types of channels, storage channels; Digital modulation schemes, Digital transmission: Mapping, impulse shaping, receiver design, inter-symbol interference, eye diagram, noise, symbol error probability for multilevel transmission, partial response technique; Equivalent baseband channel; Equalizer, adaptive equalizer; System design with joint Nyquist and matched filter condition; Orthogonal signals, correlation receiver and equivalent matched filter receiver; Optimum detection: Bayes, Maximum Likelihood (ML) and Maximum A posteriori Probability (MAP) detection, ML symbol by symbol and sequence detection, soft and hard decision, Viterbi algorithm, Viterbi-equalizer; Soft input decoding of convolutional codes; Principles of Code Division Multiplex and Access (CDMA), near-far problem, multi-user interference, synchronous orthogonal receiver; Time varying multipath channels for mobile communication, time and Doppler-variant transfer function, statistical channel description, scattering function, AWGN channel with Rayleigh-fading, error probability; Principles of Turbo Coding.

7.2.11 ICT 6612: Advanced Optical Communication: 3 Credits

Introduction to optical communication: Communication system, basic optical communication system, evolution of optical communication, advantages and disadvantages of optical communication; Optical fiber waveguides: construction, classification of fibers, modes of light propagation, transmission characteristics; Optical sources: Light emitting diodes (LED), semiconductor laser diodes, optical detectors: p-n photodiode, p-i-n photodiode, and avalanche photodiodes (APDs); Fiber connection: Fiber joints and fiber couplers, wavelength MUX and DeMUX, optical add-drop MUX; Optical amplifiers: optoelectronic amplifiers, fiber amplifiers, Raman and Brillouin amplifiers; Optical modulation and detection schemes, direct and coherent detection receivers: Configuration, operation, noise sources, sensitivity and loss calculation, and performance curves; Digital and analog receivers; Fiber nonlinearities: Kerr effects–SPM, XPM, and FWM; Scattering effects–SRS and SBS; Transmission link analysis: point-to-point and point-to-multi point links, system configuration, link power budget, line-coding schemes. Optical multiplexing schemes: WDM, OFDM, OTDM and OCDMA; Optical networks.

7.2.12 ICT 6613: Mobile and Wireless Communications: 3 Credits

Introduction and History of Wireless Systems, Cellular Systems, Wireless LANs, Satellite Systems, Paging Systems; Radio Propagation: free space propagation, propagation mechanisms, link budget design using path loss model, outdoor propagation models, indoor propagation models; Introduction to small-scale fading,

impulse response model of multipath fading, parameters of multipath channel, type of small scale fading, Rayleigh and Ricean Distribution; Media Access Control: FDMA, TDMA, and CDMA, Aloha, CSMA, MACA; GSM overview: Standards, services and structure, GSM air interface physical layer: physical channels, logical channels, frame structures, modulation, coding and interleaving, GSM signaling: Data link layer, radio resource management, mobility management, Handover, location update and roaming in GSM; Short message service (SMS), circuit switched data, General Packet Radio Service (GPRS), Enhanced GPRS (EGPRS); CDMA Digital Cellular System (IS-95): Forward CDMA Channel, Reverse CDMA Channel; Satellite mobile communications: History, Localization, Handover, Routing; Broadcast System: Unidirectional distribution systems, DAB-architecture, DVB-container; WCDMA in 3rd generation system, Difference between WCDMA and 2G air interface, 3rd generation standards.

7.2.13 ICT 6615: Teletraffic Engineering: 3 Credits

Introduction, traffic sources, resources, operational modes and traffic, unit of traffic, inter-arrival time and call holding time, traffic variation and busy hours; Random variables: Random variables, probability distribution function, probability density function, moments, Bernoulli random variable, uniform discrete random variable, Binomial distribution, Poisson distribution, negative exponential distribution, quality of service circuit switching voice networks, packet switched networks, probabilities of traffic systems; Models for circuit switched networks: Kendall notation, Erlang's loss formula ($M/M/n/n$) and examples,

marginal utility, Wilkinson's model, equivalent random method and examples, overflow routing in circuit switched networks; Models for packet switched networks: M/M/1, M/G/1, M/G/1 priority queues, Erlang's delay formula (M/M/n), System simulation: random number and random variable generation, event-by-event simulation method, sampling theory, simulation program organization, use of GSPN and other simulation tools.

7.2.14 ICT 6616: Radio Frequency Technology: 3 Credits

Antennas: Launching of waves, transmission, definition of antennas, reciprocity, wave propagation, principal of equivalent sources: electric and magnetic surface current, uniqueness principle, Huygens principle, Hertzian vector, image theory; Aperture antennas: Rectangular apertures, horn antenna, corrugated horn, circular aperture, reflector and lens antennas; Linear antennas: Field calculation, current distribution, linear dipoles and monopoles, design and feeding of dipole antennas, electrically short antennas, elementary dipole, receiving antennas - group antennas: Directivity, group factor, phased arrays, parasitic antennas; Electronic noise: Characteristics of noise voltages and currents, calculations with noise: Fourier analysis, correlation, superposition of noise quantities, transmission through linear networks, noise of 2-port networks: noise factor and temperature, noise matching, concatenation of noisy 2-port-networks; RF amplification: 2-terminal amplifiers, 2-port amplifiers: design with scattering parameters, selection of the point of operation, stability, unilateral design, wide-band amplifiers.

7.2.15 ICT 6621: Advanced Networking: 3 Credits

The TCP/IP protocol stack: IP, ARP, TCP and UDP, DNS, ICMP, Internet addressing, routing, IP multicast, RSVP, Next Generation Interior gateway protocols: RIPv2, IGRP, EIGRP, OSPF; Wireless: Radio basics, satellite systems, WAP, current trends, issues with wireless over TCP; Congestion control: control, avoidance, control and avoidance Algorithms, congestion in the Internet; Network Security: IP security, firewalls; Management: Quality of service (QoS), network vs. distributed systems management, integrated service, differentiated service, protocols, web-based management.

7.2.16 ICT 6632: Advanced VLSI Design: 3 Credits

Overview of VLSI technology; Review of CMOS logic circuits; Scaling And Interconnect Issues; Deep submicron design issues; Advanced clocking strategies; Clock distribution trees; High speed switching circuits; Low power design; Memory circuit design trends, Performance optimization; SOI technology and circuits; VLSI circuit in signal processing, VLSI circuit in wireless communication; Introduction to ASIC design.

7.2.17 ICT 6633: Advanced VLSI Testing: 3 Credits

Overview of VLSI circuit; Faults in VLSI circuit; Fault modeling; Fault simulation: Serial, parallel and deductive fault simulation; Testing stuck faults and bridging faults; Test algorithms; Automatic test equipment, Functional testing; Design For Testability:

controllability and observability, scan techniques, Built in self Test; Compression techniques; Testing of digital core; Memory Testing; Testing of analog and mixed signal core; Iddq Testing, Production Testing; Test effectiveness: coverage, yield and defect levels; System level test and diagnosis; MCM and core based testing.

7.2.18 ICT 6641: Advanced Embedded System Design: 3 Credits

Hardware design for embedded systems; Software development for embedded systems; Network based embedded systems; Sensors and Transducers for embedded systems; Case study on advanced embedded system; Co-design using FPGAs; Multiprocessor systems; Case study on multiprocessor systems; Introduction to digital control; Its use within embedded systems; Case study on digital control in embedded systems; Design examples: a telephone PBX, PDA, etc.

7.2.19 ICT: 6642 Real Time Computing for Embedded System

Definition of real-time, temporal and event determinism, design principles and practice; Architecture review and interfacing, interrupts, traps and events, response times and latency, real-time clocks; Operating systems: Structure of an RTOS, nucleus, servers, schedulers and dispatchers; Synchronization and communication: priority and distribution queues, system Modeling, static scheduling, priority drive scheduling; Real-time communication, device drivers, operating systems; Languages in real-time, concurrency issues, Real-time programming.

7.2.20 ICT: 6651 Advanced Digital Signal Processing

Overview of digital signal processing: Bandpass lowpass equivalent signals, Bandpass sampling, concept of digital frequency, DFT-based filtering, windows, frequency measurement; Spectral estimation: Introduction and periodogram, classical methods, minimum variance method, parametric methods; Multirate signal processing: Applications motivation, decimation and interpolation, sample rate conversion for rational D/I , approximate sample rate conversion for irrational D/I , polyphase implementation of sampling rate conversion, DFT filter banks, general filter banks - alias cancellation and perfect reconstruction; Adaptive signal processing: Applications motivation, Wiener filtering, the Widrow LMS algorithm, performance analysis of LMS algorithm, introduction to the RLS algorithm; Probability and random processes: Overview of probability, probability density function, mean, variance, correlation/covariance, Gaussian random variables, overview of random processes, classification, multiple random processes, examples.

7.2.21 ICT 6900: Special Topics Related to ICT: 3 Credits

A selected topic of current interest on information and communication technology. Syllabus should be approved by RAC prior to the commencement of the term. In each term only one such course title under this course number can be offered. However, a student can register only once for this course regardless of the topic offered under this course number and title.