BANGLADESH UNIVERSITY OF PROFESSIONALS (BUP)

Department of Information & Communication Technology (ICT)

Faculty of Science and Technology (FST)
Mirpur Cantonment, Dhaka-1216
Website: www.bup.edu.bd

Last worked on: 09.August.15

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CHAPTER 1
BUP AT A GLANCE

1.1 Introduction

Bangladesh University of Professionals (BUP) is one of the newest Public Universities of the country established on June 05, 2008. It is the only public university in Bangladesh supported by the Armed Forces. BUP welcomes those students who will dedicate their total attention and devotion to serious academic pursuits to build up better tomorrows for the nation. BUP is the only educational entity in the country where there is an opportunity of blending between civil students and uniformed Armed Forces students with diversified skills, exposure, experience and outlook.

BUP, with its own unique features, is set up in a green landscape away from the busy life of metropolitan city. The university promises to provide the best possible congenial academic atmosphere.

Chapter- 1 introduces BUP in brief, Chapter- 2 contains short brief about Faculty of Science and Technology (FST) and Chapter– 3 contains detail curriculum of this course and the rules and details.

1.2 Motto

The motto of BUP is **"EXCELLENCE THROUGH KNOWLEDGE"**.

1.3 Mission

To develop the civil and military human capital through advanced education and research to respond to the knowledge-based society of the contemporary world.

1.4 Vision

Bangladesh University of Professionals will emerge as a leading university for both professionals and general students through need-based education and research with global perspective.

1.5 Core Values

Integrity: Highest ethical and moral uprightness.
Discipline: Strict discipline in all activities.
Creativity: Creativity in all spheres.
Commitment: High quality academic standards.
Wisdom: Enhanced education and research.

1.6 Objectives

1. To become a leading public university in Bangladesh and in the region.
2. To promote knowledge in the field of science and technology, business, medicine, social science, strategy and security.
3. To promote leadership and civil-military relationship.
4. To develop intellectual and practical skills.
5. To provide the best possible academic atmosphere.

6. To preserve the spirit of national culture, heritage and traditions.
7. To facilitate higher education in the Armed Forces.
8. To prepare the faculty and staff with necessary competencies.
9. To deliver competent professionals relevant to the demands of the society.
10. To sustain collaborative relationships with communities and educational partners.
11. To provide efficient services to support programs, campus community and quality of life.

1.7 Affiliated Entities

The BUP acts as a regulatory body for the degrees offered by the following affiliated institutes, colleges, academies and organizations:

- National Defense College (NDC)
- Defense Services Command and Staff College (DSCSC)
- Military Institute of Science and Technology (MIST)
- Armed Forces Medical College (AFMC)
- Armed Forces Institute of Pathology (AFIP)
- Armed Forces Medical Institute (AFMI)
- Bangladesh Military Academy (BMA)
- Bangladesh Naval Academy (BNA)
- Bangladesh Air Force Academy (BAFA)
- Other organizations/institutes affiliated with BUP

1.8 Embodied Faculties

The university has five faculties to run all educational institutions of the Army, Navy and Air Force and facilitate professional degree for the Armed Forces personnel and civilian as well. It awards undergraduate and post-graduate degrees. BUP has the authority to confer M Phil and PhD like any other public university. The faculties are:

- Faculty of Science and Technology(FST)
- Faculty of Business Studies (FBS)
- Faculty of Security and Strategic Studies (FSSS)
- Faculty of Arts and Social Science (FASS)
- Faculty of Medical Studies (FMS)

1.9 University Mailing Address

Registrar
Bangladesh University of Professionals
Mirpur Cantonment
Dhaka-1216
Phone : 8802-8000368, 8000300
Fax : 880-2-8000300
Email : info@bup.edu.bd
Website : www.bup.edu.bd

CHAPTER 2
Faculty of Science and Technology

2.1 Introduction

The Faculty of Science and Technology (FST) under BUP started its activity in full swing from the early 2012.

ICT plays vital and in fact indispensable role in all fields of modern human activities. Consequently, recent development in ICT has a considerable impact on society. It has already expanded to all fields of study starting from genetic engineering to space technology. Recent development in Artificial Intelligence has taken the human history a long way. That day is not very far when man can make machine like him.

The Department of Information and Communication technology is one of the pioneer Departments of this Institute providing top-quality education in Information and Communication technology (ICT) at its undergraduate program. ICT is the leading booming sector in present day. It is already declared as a thrust sector in Bangladesh. Keeping this in mind, the department offers ICT courses to produce Information Technology and Communication specialist.

2.2 Academic Programs

2.2.1 Current Programs

The faculty is running following programs:

a. **BSc (Hons) in Information and Communication Technology (ICT)**
b. **Masters (MSc Engr /M Engg) in Information and System Security (MISS)**
c. **Certificate Course on Information and System Security (CISS)**
d. **Certified CISCO Network Administrator (CCNA)**

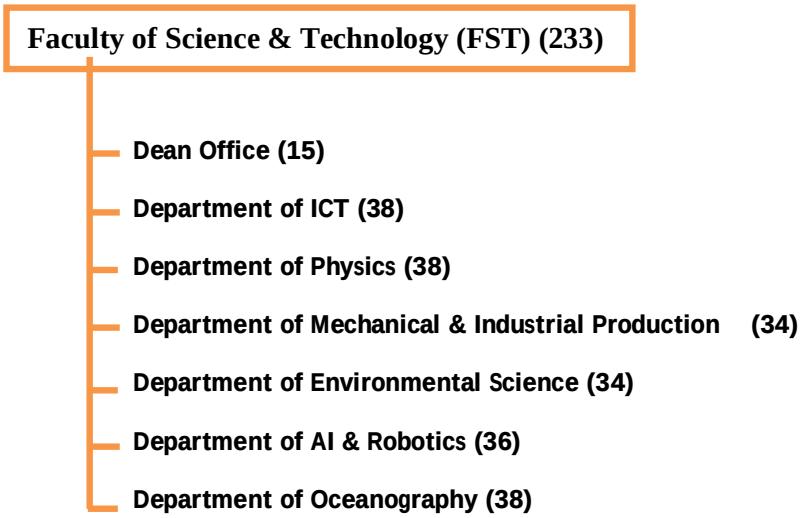
Programs	Duration	Total Courses Theory+ Laboratory	Credit on Courses	Industrial Attachment / Dissertation Credit	Total Credit	Remarks
ICT	4 Years	37 +26	153	7	160	
MISS	2 Years	10	18*/30	18*/6	36	MSC*/M Engrr
CISS	4 Months	03 Modules	-	-	-	
CCNA	4 Months	04 Modules	-	-	-	

2.2.2 Future Programs

a. **Software and Database: PHP and My SQL**
b. **Hardware and Networking: Dot Net and SQL**
c. **Graphics and Animation Design: Oracle 10G Developer**
d. **Embedded System and Robotics**
e. **Web Design and Apps Development**
f. **Information System Security: CISSP, CISA**

2.2.3 Organogram of Faculty

Department wise



2.3 Faculty Members

1.	**Brig Gen Shaikh Muhammad Rizwan Ali, psc, te** **Dean** **Faculty of Science & Technology**
2.	**Commander M Moyezuddin, BN** **Chairman** **Department of ICT**
3.	**S M Salim Reza** **Asst. Professor** **Department of ICT**
4.	**Mohammed Nasir Uddin** **Lecturer** **Department of ICT**
5.	**Nandita Barman** **Lecturer** **Department of ICT**
6	**Roksana Khanom** **Lecturer** **Department of ICT**
7	**Zarin Tasnim** **Lecturer** **Department of ICT**

2.4 Administration

2.4.1 Regulatory Bodies

There are different regulatory bodies and committees, which regulate the faculty and the university as a whole. These are:

1) **Senate:** The highest policy and decision making body of the university.

2) **Syndicate:** The key executive body for general management and supervision.

3) **Academic Council:** The key executive body for academic affairs of the university.

4) **Faculty Executive Committee:** This is the executive body of the faculty to define curriculum, syllabus, events etc. and recommend the same to the academic council.

2.4.2 Vice Chancellor

Major General Sheikh Mamum Khaled, SUP, psc
Vice Chancellor
Bangladesh University of Professionals (BUP)

2.4.3 Dean

Brig Gen Shaikh Muhammad Rizwan Ali, psc, te
Dean
Faculty of Science & Technology (FST)
Bangladesh University of Professionals (BUP)

2.4.4 Program Office

Overall Coordinator: Lecturer Mohammed Nasir Uddin

1) Program Coordinator (ICT- Sec A): Lecturer Nandita Barman

2) Program Coordinator (ICT- Sec B): Lecturer Roksana Khanom

3) Program Coordinator (MISS- Sec A): Lecturer Zarin Tasnim

4) Program Coordinator (MISS- Sec B): Asst Prof Salim Reza

2.4.5 Faculty Mailing Address

Dean, Faculty of Science and Technology
Bangladesh University of Professionals (BUP)
Mirpur Cantonment
Dhaka-1216
Phone: 02-8000439

2.4.6 Program Advisors

1) ICT- 1 (Sec A) Commander M Moyezuddin, Chairman, Department of ICT.
2) ICT- 1 (Sec B) S M Salim Reza, Assistant Professor, Department of ICT.

2.5 Academic Support

2.5.1 BUP Campus and Building

The FST is located in the academic building of the purpose built campus of the university at Mirpur Cantonment. The academic building is the northern wing of BUP complex with 6 floors, which will

ultimately be extended up to 14 floors. The classrooms, faculty chambers, program and administrative offices, library, computer lab and cafeteria are housed in the same building.

2.5.2 Library

The faculty and its students use the central library facility located on the 1st floor of the academic building. The library is growing fast with stock of books to meet the requirements of the teachers and the students. The library is focused to build its e-resources keeping in view the recent trend in publication of reading material in the e-platform. The library is spacious and provides computer work stations with internet facility, hard copies of text and reference books, e-book readers etc. It subscribes many journals, periodicals, newspapers, web resources etc.

2.5.3 Wi-Fi Network

In order to provide dynamic access to the students to e-resources and to facilitate easy communication, BUP has installed high speed Wi-Fi network, which has the coverage at both academic and administrative buildings.

2.5.4 Class Rooms

The classrooms of FST are spacious and well ventilated and equipped with state of the art audio-visual equipment, classroom aids and seating arrangements.

2.5.5 Bijoy Auditorium

There is an auditorium at the 5th floor of the administrative building of BUP campus with 500 seat capacity, which can be used for central programs like seminar, workshop, central lectures and presentations, cultural events etc.

2.5.6 Student Accommodation

Pending the construction of purpose-built halls for the students, ad-hoc arrangements have been made to accommodate limited number of male and female students in two separate rented houses at Mirpur DOHS. The seats in the hall are allotted on the basis of need of the students and availability. The halls are fully furnished and there are administrative staffs to support the tenants. The students pay rent for accommodation and meet expenses for food, services, security etc.

2.5.7 Transport

BUP provide short distance transport facilities to the students with its integral bus service. The long distance service will be provided along 3 routes with hired bus, if adequate numbers of students register for the same.

2.5.8 Computer Lab

There is a computer lab facility for the students on the ground floor of the academic building. The lab computers are connected by both Wi-Fi and broadband internet network. This facility has been established with a view to catering for enhancing computer literacy and skill of the students.

2.5.9 Cafeteria

A well decorated and air-conditioned cafeteria "Café Vista" is located on the ground floor of the academic building, which is operated on contract basis. It provides quality food items at reasonable price. A stationery shop is also run by the café as an extension, which sells stationery, confectionery and gift items and also provide printing, reproduction and binding facilities.

2.6 Student Services

2.6.1 Guidance and Counseling

The guidance and counseling service is available to students on academic and other matters of interest. A faculty member is assigned as Program Coordinator and one senior faculty as Program Advisor for each batch, who, as a routine work, meets the batch at least once a week and also attends them whenever the students feel necessary. The Program Coordinator and the Program Advisor keeps close contact with the students in understanding and solving the problems relating to their academic program, facilities and other issues, if any.

2.6.2 Scholarship

Each year scholarships and stipend are granted to a large number of students based on criteria set by the University. The aim is to reward the best performing students and also support the students who need financial assistance. The students are granted scholarships and stipends duly scrutinized by a committee.

2.6.3 Industrial Attachment

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Practical/On Job Training		
		Industrial Attachment	-	3- 4 Weeks	1.00	

The Program Coordinator and the Program Advisor will propose to faculty academic committee about the organization at which the attachment will be done. The committee is comprised of Faculty Dean, Batch Faculty Advisor/ Course Coordinator and Placement Officer (if any).

2.7 Extra Curricular and Club Activities

The Program Coordinator and Program Advisor will propose Dean, FST to organize visits to different industries and organizations for all the programs of FST and Study Tour/Excursion for the students of ICT final year as part of their academic curriculum.

2.8 Study Tour/Excursion and Industrial/Organizational Visits

FST organizes visits to different industries and organizations for all the programs of FST and Study Tour/Excursion for the students of ICT final year as part of their academic curriculum.

2.9 Guest Lectures/ Seminars

Seminars/workshops on important academic issues and lectures/presentations by eminent academician/professionals/experts are organized throughout the academic year for the students. Attending such seminars/ workshop by students is mandatory.

CHAPTER 3

ICT RULES AND CURRICULUM

3.1 Objective of ICT Program

Bachelor of Information and Communication technology (ICT) program is designed to produce graduates with solid foundation in information technology skills and knowledge that can be applied across a wide range of application. It focuses on the systems development aspects of employment in the information technology profession. Students gain extensive experience in developing information and communications technology to address the needs of modern organizations.

The program includes basic programming concepts and modern programming environments, network engineering principles, communication system networking, object-oriented software architectures, enterprise web, cloud and mobile technologies, and software quality management it also encompasses.

Industrial orientation, project management and communication skills are developed in addition to exploration of the technical and human aspects of information technology and its use. Modern communication technologies with internet protocol, wireless, optical mobile, satellite multimedia etc are different signal processes.

3.2 Degree Requirement

The degree requirements for the program are appended below:

a. Passing of all courses (with minimum grade D) individually and maintaining a minimum Cumulative Grade Point Average (CGPA) of 2.50 in 4.00 point rating scale at the end of the program.

b. Completion of industrial attachment with a minimum grade of C+ and Completion of Thesis/project of 6 credits with minimum C+ grade.

c. Passing of all semester final examination (comprising syllabus of whole course) for all courses.

3.3 Semester System

The ICT Program is a 4 years full time regular undergraduate program. The program is divided into 8 semesters of 6 months each (2 semesters in each year). In each semester, minimum 14 to maximum 16 weeks is dedicated for classroom learning, while remaining weeks are utilized for makeup classes, preparatory leave, final examination, other curricular and co-curricular activities.

3.4 Distribution of Credit Hours

Summary Table for Theory, Laboratory, Credit Hour (Semester wise)

Level and Term	Hours/Week		Credits	No of Theory Courses	No of Laboratory Courses
	Theory	Laboratory			
Level-1 Term-I	15.00	4.00	19.00	5	3
Level-1 Term-II	15.00	5.00	20.00	5	4
Level-2 Term-I	16.00	4.50	20.50	5	3
Level-2 Term-II	17.00	4.50	21.50	5	3
Level-3 Term-I	15.00	6.00	21.00	5	4
Level-3 Term-II	16.00	4.00	20.00	5	3

Level-4 Term-I	16.00(3.00*)	3.50	19.50	4	3
Level-4 Term-II	13.00(3.00*)	4.50	17.50	3	3
Thesis/Project	6.00*	0			
Industrial Attachment	1.00	0	1.00		
Grand Total	**124.00**	**36 .00**	**160.00**	**37**	26

***Included in Level 4**

3.5 ICT Curriculum and Syllabus

3.5.1 Course Structure

Course Category	No. of Theory Courses (credits)	No of Laboratory Courses(credits)	Total credits
Basic ICT Courses	**2(6)**	**3(4)**	**10**
Basic Science Courses	**5(16)**	**-**	**16**
General Education (GED) Courses	4(8)	1(1)	09
ICT Core Courses	**26(79)**	**22(31)**	**110**
Information Technology Core Courses	*13 (39)*	*11 (16)*	*55*
Communication Technology Core Courses	*13 (40)*	*11 (15)*	*55*
Industrial Attachment	-	-	1
Thesis/ Projects	-	-	6
Comprehensive Viva Voce	-	-	8
Total	37	26	160

3.6 Detail Course Curriculum

3.6.1 Basic ICT Courses (10 Credits). The Basic ICT Courses are designed to give fundamental idea n basic knowledge building on ICT. These courses are prerequisite for ICT students.

Basic ICT				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
01	ICT Fundamentals	0.0	2.0	2.0
02	Electrical and Electronics Fundamental	3.0	1.0	4.0
03	Digital Electronics Fundamentals	3.0	1.0	4.0
	Total	6.0	4.0	6+4=10

3.6.2 Basic Science (16 Credits). The courses of basic science have been designed to enhance students' knowledge on basic science courses like physics with great emphasis on all areas of mathematics that will be needed during the understanding of ICT core Courses. All Courses are compulsory.

Basic Science Courses				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
01	Physics	3.0	00	3.0
02	Mathematics-I (Differential Calculus and Integral Calculus)	3.0	00	3.0
03	Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)	3.0	00	3.0
04	Mathematics-III (Vector Analysis, Matrices and Fourier Analysis)	3.0	00	3.0
05	Mathematics-IV (Complex Variable, Laplace Transform and Discrete Mathematics)	4.0	00	4.0
	Total	16	00	16+0=16

3.6.3 General Education (GED) Courses (9 Credits)

The courses of general education have been designed to enhance students' knowledge on general arts and cyber law related Courses. All Courses are compulsory.

GED Courses				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
01	English	2.0	1.0	3.0
02	Sociology, Ethics and Cyber Law	2.0	00	2.0
03	Economics	2.0	0.0	2.0
04	Accounting and MIS	2.0	00	2.0
	Total	**8**	**1.0**	**8+1.0=9**

Information Technology Core Courses				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
1	Computer Programming	3.0	1.5	4.5
2	Object Oriented Design and Programming	3.0	1.5	4.5
3	Data Structures and Algorithm	3.0	1.5	4.5
4	Database Management System	3.0	1.5	4.5

5	Microprocessor and Assembly Languages	3.0	00	3.0
6	Pervasive Computing	3.0	1.5	4.5
7	Computer Networks	3.0	1.5	4.5
8	System Analysis and Design	3.0	00	3.0
9	Software Engineering	3.0	1.5	4.5
10	Artificial Intelligence and Neural Networking	3.0	1	4.0
11	Option-I (Information Technology Related Courses)	3.0	1.5	4.5
12	Computer Peripherals and Interfacing	3.0	1.5	4.5
13	Web Engineering	3.0	1.5	4.5
	Total	**39**	**16**	**55**

Communication Technology Core Courses				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
01	AC Fundamentals	3.0	1.0	4.0
02	Electronic Devices and Circuit	3.0	1.5	4.5
03	Analog and Digital Communication	4.0	1.5	5.5
04	Continuous Signals and Linear Systems	3.0	1.5	4.5
05	Microwave Communication and Radar Engineering	3.0	1.5	4.5
06	Digital Signal Processing	3.0	1.5	4.5
07	Telecommunication Systems	3.0	1.5	4.5
08	Cellular and Mobile Communication	3.0	1.0	4.0
09	Optical Fiber Communications	3.0	1.5	4.5
10	Satellite Communication	3.0	00	3.0
11	Random Signals and Process	3.0	00	3.0
12	Wireless Communication	3.0	1.0	4
13	Option-II (Communication Related Courses)	3.0	1.5	4.5
	Total	**40**	**15**	**55**

Other Courses				
01	**Comprehensive Viva Voce**	**08**		**08**
02	**Thesis/ Project**	**06**		**06**
03	**Industrial Attachment**	**01**		**1**

Option I - Information Technology Related Course				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
1	Digital Image Processing	3.00	1.5	4.5
2	Pattern Recognition	3.00	1.5	4.5
3	Simulation and Modeling	3.00	1.50	4.5
4	Data Ware-housing and Data Mining	3.00	1.50	4.5
5	Bioinformatics	3.00	1.50	4.5
6	Software Quality Assurance	3.00	1.50	4.5
7	VLSI Design	3.00	1.50	4.5
8	Information Systems Availability and Quality Assurance	3.00	1.50	4.5
9	OS and Network Security	3.00	1.50	4.5

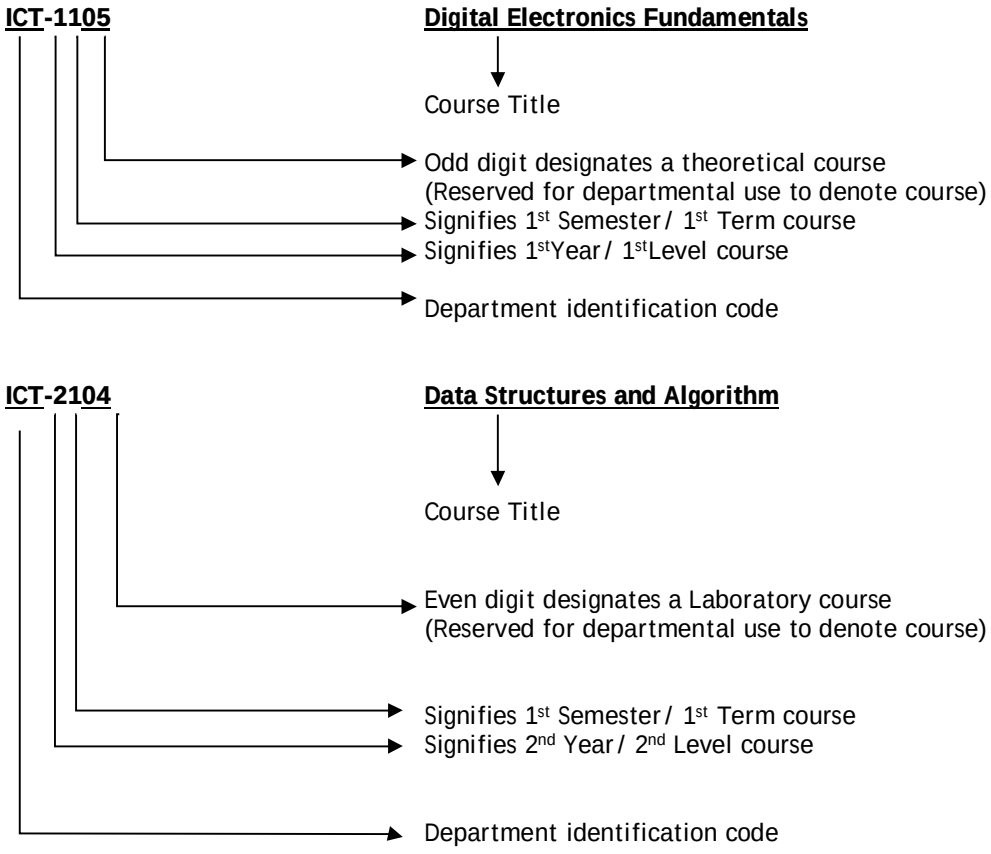
Option II Communication Related Courses				
Sl	**Name of the Course**	**Theory**	**Lab**	**Total**
1	Communication Network	3.00	1.50	4.5
2	Radio Communication and Technology	3.00	1.50	4.5
3	Modern Telecommunication Engineering and technology	3.00	1.50	4.5
4	IP Communication	3.00	1.50	4.5
5	Optical Networks	3.00	1.50	4.5
6	Power Electronics	3.00	1.50	4.5

3.6.6 Course Designation System

Each course is designated by a maximum of four letter code identifying the department offering the course followed by a three-digit number having the following interpretation:

• The first digit corresponds to the year/level in which the course is normally taken by the students.
• The second digit corresponds to the semester/ term in which the course is normally taken by the students.
• The last two digits denote various courses, where an odd number is used for theoretical courses and an even number for Laboratory courses.

The course designation system is illustrated as Follows:



3.7 Semester Wise Distribution of Courses

Semester Wise Course Distribution (Effective from January, 2015)

To obtain B.Sc. (Honors) degree in Information and Communication Technology (ICT), a student must complete the courses as follows:

Year /Level	Sem /Term	Sl	Course code	Title	Theory	Lab	Credit Hour	Weekly Contact Hour
1st	1st	1	ICT1102	ICT Fundamentals	00	2.00	0+2=2	0+4=4
		2	ICT1103 ICT1104	Electrical and Electronics Fundamental	3.00	1.00	3+1=4	3+2=5
		3	ICT1105 ICT1106	Digital Electronics Fundamentals	3.00	1.00	3+1=4	3+2=5
		4	PHY1101	Physics	3.00	0.00	3+0=3	3+0=3
		5	MATH1101	Mathematics-I (Differential Calculus and Integral Calculus)	3.00	00	3+0=3	3+0=3
		6	GED1101	English	2.00		2+0=2	2+0=2
		7		Comprehensive Viva Voce	1.0		1.0	
				Total	**15**	**4**	**19**	**(14+8=22)**
1st	2nd	1	ICT1201 ICT1202	AC Fundamentals	3.00	1.00	3+1.0=4.0	3+2=5
		2	ICT1203 ICT1204	Electronic Devices and Circuit	3.00	1.50	3+1.5=4.5	3+3=6
		3	MATH1201	Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)	3.00		3+0=3	3+0=3
		4	GED1202	English Lab		1.00	0+1.00=1	0+2=2
		5	ICT1205 ICT1206	Computer Programming	3.00	1.50	3+1.50=4.5	3+3=6
		6	GED1203	Sociology, Ethics and Cyber Law	2.00		2+0=2	2+0=2

		7		Comprehensive Viva Voce	1.0		1.0	
				Total	**15**	**5**	**20**	**(14+10=24)**
2nd	1st	1	MATH2101	Mathematics-III (Vector Analysis Matrices and Fourier Analysis)	3.00		3+0=3	3+0=3
		2	GED2101	Economics	2.00		2+0=2	2+0=2
		3	ICT2101 ICT2102	Object Oriented Design and Programming	3.00	1.50	3+1.5=4.5	3+3=6
		4	ICT2103 ICT2104	Data Structures and Algorithm	3.00	1.50	3+1.5=4.5	3+3=6
		5	ICT2105 ICT2106	Analog and Digital Communication	4.00	1.50	4+1.5=5.5	4+3=7
		6		Comprehensive Viva Voce	1.0		1.0	
		7		**Total**	**16**	**4.5**	**20.5**	**(15+9=24)**
2nd	2nd	1	MATH2201	Mathematics-IV (Complex Variable , Laplace Transform and Discrete Mathematics)	4.00		4+0=4	4+0=4
		2	ICT2201 ICT2202	Continuous Signals and Linear Systems	3.00	1.50	3+1.5=4.5	3+3=6
		3	ICT2203 ICT2204	Microwave Communication and Radar Engineering	3.00	1.50	3+1.5=4.5	3+3=6
		4	ICT2205 ICT2206	Database Management Systems	3.00	1.50	3+1.5=4.5	3+3=6
		5	ICT2207	Microprocessor and Assembly Languages	3.00		3+0=3	2+0=2
		6		Comprehensive Viva Voce	1.0		1.0	
		7		**Total**	**17**	**4.5**	**21.5**	**(16+9=25)**
3rd	1st	1	GED3101	Accounting and MIS	2.00		2+0=2	2+0=2
		2	ICT3101 ICT3102	Pervasive Computing	3.00	1.50	3+1.5=4.5	3+3=6

		3	ICT3103 ICT3104	Computer Networks	3.00	1.50	3+1.5=4.5	3+3=6
		4	ICT3105 ICT3106	Digital Signal Processing	3.00	1.50	3+1.5=4.5	3+3=6
		5	ICT3107 ICT3108	Telecommunication Systems	3.00	1.50	3+1.5=4.5	3+3=6
		6		Comprehensive Viva Voce	1.0		1.0	
				Total	**15**	**6**	**21**	**(14+12=26)**
3rd	2nd	1	ICT3201	System Analysis and Design	3.00		3+0=3	3+0=3
		2	ICT3203 ICT3202	Software Engineering	3.00	1.50	3+1.5=4.5	3+3=6
		3	ICT3205 ICT3204	Cellular and Mobile Communication	3.00	1	3+1=4.0	3+2=5
		4	ICT3207 ICT3206	Optical Fiber Communication	3.00	1.50	3+1.5=4.5	3+3=6
		5	ICT3209	Random Signals and Process	3.00		3+0=3	3+0=3
		6		Comprehensive Viva Voce	1.0		1.0	
				Total	**16**	**4**	**20**	**(15+8=23)**
Industrial attachment for 3-4 weeks of 1.00 credit								
4th	1st	1	ICT4000	Project/ Thesis	3.00	0	3	3+0=3
		2	ICT4101 ICT4102	Artificial Intelligence and Neural Networking	3.00	1.00	3+1=4	3+2=5
		3	ICT4103	Satellite Communication	3.00		3+0=3	3+0=3
		4	ICT4105 ICT4104	Wireless Communication	3.00	1.00	3+1.0=4.0	3+2=6
		5	ICT4107 ICT4106	Option I- Information related Courses	3.00	1.50	3+1.5=4.5	3+3=6
		6		Comprehensive Viva Voce	1.0		1.0	
				Total	16	3.5	19.5	(15+7=22)
Optional-I (Information Technology Related Courses)								
		1	ICT4111 ICT4112	Pattern Recognition	3.00	1.50	4.5	
		2	ICT4113 ICT4114	Simulation and Modeling	3.00	1.50	4.5	
		3	ICT4115 ICT4116	Data Ware-housing and Data Mining	3.00	1.50	4.5	

		4	ICT4117 ICT4118	Bioinformatics	3.00	1.50	4.5	
		5	ICT4119 ICT4120	Software Quality Assurance	3.00	1.50	4.5	
		6	ICT4121 ICT4122	Information Systems Availability and Quality Assurance	3.00	1.50	4.5	
		7	ICT4123 ICT4124	OS and Network Security	3.00	1.50	4.5	
		8	ICT4125 ICT4126	Computer Architecture	3.00	1.0	3.O	
		9	ICT4127 ICT4128	Operating System Concepts	3.00	1.00	3.0	
		10	ICT4129 ICT4130	Cloud Computing	3.00	1.50	4.5	
		11	ICT4131 ICT4132	Cryptography	3.00	1.50	4.5	
		12	ICT4133 ICT4134	Network Programming	3.00	1.50	4.5	
4th	2nd	1	ICT4000	Project and Thesis	3.00		3+0=3	3+0=3
		2	ICT4201 ICT4202	Computer Peripherals and Interfacing	3.00	1.50	3+1.5=4.5	3+3=5
		3	ICT4203 ICT4204	Web Engineering	3.00	1.50	3+1.5=4.5	3+3=6
		4	ICT4205 ICT4206	Optional II Communication related Subjects	3.00	1.50	3+1.5=4.5	3+3=6
		5		Comprehensive Viva Voce	1.0		1.0	
				Total	**13**	**4.5**	**17.50**	**(12+9=21)**
Optional-II (Communication Technology Related Courses)								
		1	ICT4209 ICT4210	VLSI Design	3.00	1.50	4.5	
		2	ICT4211 ICT4212	Optical Networks	3.00	1.50	4.5	
		3	ICT4213 ICT4214	Optical Wave guide theory and Photonics	3.00	1.50	4.5	
		4	ICT4215 ICT4216	Radio Communication Engineering				
		5	ICT4217 ICT4218	Information Theory and Coding	3.00	1.50	4.5	
		6	ICT4219 ICT4220	Multimedia Communication	3.00	1.50	4.5	
		7	ICT4221 ICT4222	Advanced Tele-communication Engineering	3.00	1.50	4.5	
		8	ICT4223 ICT4224	Network Planning and Spectrum Management	3.00	1.50	4.5	
		9	ICT4225 ICT4226	ICT Project Management	3.00	1.50	4.5	

		10	ICT4227 ICT4228	Wireless sensor Networks	3.00	1.50	4.5	
		11	ICT4229 ICT4230	Antenna and Propagation	3.00	1.50	4.5	

3.8 Course Description

Short description of courses are given at Annexure A.

Chapter – 4

Rules and Regulations for ICT Program

4.1 Admission Procedure

BUP seeks applications from prospective candidates, who fulfill ICT admission qualifications as specified in BUP Admission Guideline. The program is offered annually to fresh candidates only. The admission notice is circulated usually in the month of July/August of each year through media advertisement and BUP website notice board. The candidates are asked to apply through online. The detailed admission procedure has been spelled out in Admission Guideline, which is available in BUP website (www.bup.edu.bd).

4.1.1 Eligibility for Admission

To be eligible for admission in ICT program of BUP, a candidate must pass SSC, HSC and Dhakhil examinations or its equivalent in Science discipline. Minimum qualifications to take part in the admission test are as follows:

1) Minimum GPA of 4.50 in SSC/equivalent and 4.50 in HSC/equivalent or collective/ totaling GPA of 9.0 with Mathematics, Physics and Chemistry excluding forth subjects.

2) Applicants must have passed SSC/ equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/ Technical Education Board in Science group with minimum GPA 4.50 in a 5-point scale.

3) Applicants must have passed HSC/ equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/ Technical Education Board in Science group with minimum GPA 4.50 in a 5-point scale.

4) In HSC/ Alim/ equivalent examination the applicant must have obtained minimum "A" grade in any two (02) Courses out of four (04) subjects including Mathematics, Physics, Chemistry and English with minimum "A-" (A minus) grade in rest two (02) Courses.

5) Applicants with GCE "O" Level/equivalent background must have to qualify in minimum five (05) subjects including Mathematics, Physics, Chemistry and English.

6) Applicants with GCE "A" Level/equivalent background must have to qualify in minimum two (02) Courses from Mathematics, Physics and Chemistry.

7) G.C.E. Students: Students who passed at least 5 subjects at the "O" level Examinations, and at least 2 subjects at the 'A' level examinations, and out of these seven subjects, have at least "B" grade in 4 subjects and "C" subjects 2 subjects are eligible to apply.

8) Applicants who have passed HSC or equivalent examination in the current year or one year before the notification for admission can apply.

4.1.2 Selection Process

1) Written Admission Test: Admission test will be conducted on the basis of the syllabus of Mathematics, Physics, Chemistry and English (Comprehension and Functional) subjects of HSC examinations of all Boards of Secondary and Higher Secondary School Certificates. Admission test will be in MCQ and/or Subjective written test and that conducted out of 100 or 200 marks with the syllabus and distribution of marks is given below (Weightage is 50):

Serial	Subjects	Syllabus	Marks
1.	Mathematics	Syllabi of the current year of HSC Examinations of all Boards of Intermediate and Secondary Education	40
2.	Physics		30
3.	Chemistry		20
4.	English	Comprehension and functional	10
	Total =		**100**

2) Communication Test (Interview/ Viva-voce): The candidates are selected for communication test based on their written test result. Panels of faculty members will take the communication test/interview (Weightage is 10 marks).

3) Marks from Past Public Examinations: The results of past public examinations carry 40 marks weightage, where 25% is from HSC and equivalent and 15% from SSC and equivalent. The marks are calculated in a simple linear distribution method from candidates' GPA.

4) Final Selection: Final selection will be made on the basis of merit. The merit list is prepared according to combined marks obtained by candidates in the written admission test (50 marks), score in communication test (10 marks) and in past public examinations (40 marks) out of 100 marks.

4.2 Admission in the Program

After final selection, the candidates are asked to go through a medical checkup at BUP Medical Centre to ascertain their medical fitness. The selected candidates must collect Admission Form from Admission Section of Registrar Office and complete admission and registration formalities within the given time frame with respective BUP Admission Section and Faculty by paying required fees. The following rules will apply in this regard:

1) Candidate failing to complete admission formalities within the prescribed date and time, his/ her selection will be considered as cancelled.

2) Student who fails to attend the class within two weeks of the commencement of 1st semester class, his/her admission will be considered as cancelled.

In case, If the prescribed vacancies are not filled up by the candidates in the first merit list, other merit list(s) will be published from the waiting candidates for admission, who will have to follow the same procedure for admission.

4.3 Tuition and other fees

4.3.1 Security Money

The students must pay specific amount as security money, which is refundable on completion of last semester. The following rules will apply for refund of security money:

1) There will be no forfeiture, if a student opts to withdraw before the closing of admission activities allowing another candidate to avail the seat.

2) 25% of the security money will be forfeited, if a student opts to withdraw before completion of one year after admission. However, rest of the money will be refunded on completion of 1st year.

3) For withdrawal after 1st year of study, there will be no refund of security money. But all other fees/charges (case by case basis) may be refunded to the student, and in such case the security money will be converted into caution money and the same may be refunded excluding any claim from BUP, if any.

4.3.2 Current Fee Structure

The current fee structure for ICT program is given below:

Sl	Category of Fees/Charges	Amount/Rate (Tk)	Frequency	Total Amount in Program (Tk)
1.	Application Processing Fee	500.00	Once	500.00
2.	Admission Fee	10,000.00	Once	10,000.00
3.	Registration Fee	1,000.00	Once	1,000.00
4.	Library Fee	500.00	Each Semester	4,000.00
5.	Security Money	20,000.00	Once, Refundable	20,000.00
6.	Exam Fee/ Course Registration Fee	500.00	Per Credit	76,500.00
7.	Internship/Industrial Attachment	2,000.00	Once (with 6th semester)	2,000.00
8.	Grade Sheet Fee	500.00	Each Semester	4,000.00
9.	Tuition Fee	2,000.00	Each Semester	16,000.00
10.	Medical Fee	600.00	Each Semester	4,800.00
11.	Sports Fee	600.00	Each Semester	4,800.00
12.	Lab and Training Aid Fee	600.00	Each ~~Credit~~ Semester	4,800.00
13.	Student Welfare Fee	2,000.00	Each Semester	16,000.00
14.	Education Enhancement Fee	600.00	Each	4,800.00

			Semester	
15.	Cultural/Magazine Fee	300.00	Each Semester	2,400.00
16.	ID Card Fee	100.00	Once	100.00
17.	Center Fee	500.00	Each Semester	4,000.00
18.	MT Development Fee	2,000.00	Once	2,000.00
19.	Transport Fee	500.00	Each Semester	4,000.00
20.	Recreation Fee	300.00	Each Semester	2,400.00
21.	Thesis/Project Fee	3000.00	Once (7th & 8th Semester only)	3,000.00
22.	Miscellaneous Fee (Tie/Scarf etc)	500.00	Once	500.00
			Grand Total	**1,87,600.00**

Additional Fees/Payments (As Required)

Ser	Categories of Fees/Charges	Amount (Tk)
1.	Re-admission	5000.00
2.	Migration	500.00
3.	Non Collegiate	3000.00
4.	Provisional / Original Certificate Fee	500.00
5.	Late Registration Fee	1000.00
5.	Convocation	5000.00
6.	Special Final Exam Fee	4000.00

At the beginning of the semester, the students will be issued with payment schedule for the particular semester.

4.3.3 Review of Fee Structure

All fees mentioned in the above table will be reviewed as and when necessary by the university authority and the students will be liable to pay the fees as per changed/reviewed fees.

4.3.4 Deadline for submission of Fees/ Dues

The 1st year students will have to clear all the fees during the admission process after publication of result. For subsequent semesters, the payment of all fees/dues must be maintained semester wise and the following rules will apply in this regard:

1) The semester fees can be paid within 15 days after commencement of each semester without any penalty.

2) The students may pay their fees after 1st 15 days within 3 month time by paying a penalty of Tk 100.00 for each 15 days.

3) If a student fails to pay the semester fees within one and a half month, his/her name will be dropped and the student will have to apply for re-admission, should he/she desires to continue his/her study. If approved, he/she may take re-admission paying required re-admission fee.

4) All payments are to be completed semester wise and the semester wise payment dates will be circulated through notice.

4.4 Course Load to Student

The students must enroll for all courses offered by faculty in each semester. As a general rule, students must take all courses in a semester. If someone gets F grade s/he will not be selected for Deans/ Chancellor's award .

4.5 Conduct of Courses

In a semester, Teacher/teachers is/are assigned to plan and teach a particular course. The following guidelines will be followed for conduct of courses:

1) At the beginning of the semester, the course teacher will prepare a course outline incorporating the course syllabus, performance evaluation and grading system (as laid down in the policy), list of suggested text books/references, and a tentative schedule of classes, examinations and events. He/she will distribute a copy of the same to each student registered for the course and will submit a copy to the Program Office.

2) Assignment of Credits. The assignment of credits to theoretical course is different from that of laboratory course, which is stated as follows:

a. For theoretical courses one lecture of 60 minutes (50 minutes class + 10 minutes break) per week per term is equivalent to one credit.

b. For laboratory courses two class hours per week per term is equivalent to one credit.

c. Credits are also assigned to Thesis/Project work taken by the students. The amount of time assigned to such work may vary depending on the Thesis/Project.

3) A term paper, a project or a research work should be assigned, either individually or in groups on any issue pertaining to the course, if necessary.

4) A number of individual and group assignments, presentations, etc. should be assigned to students as per the course requirements.

5) Any fraction in the marks obtained is to be rounded up to the advantage of student i.e. any fraction to be rounded up to the next number.

6) Attendance in all classes is mandatory. A certain percentage of marks are allotted for class attendance.

4.6 Examination and Assessment

BUP follows a single examiner system and continuous assessment is done to evaluate a student in a semester. The following rules will apply for all tests and examinations:

1) All tests, assignments, presentations, class performance will be evaluated by the course teacher. He/she will show the scripts, assignments etc. to the students in the classroom in the following week. However, the scripts of final examination will not be shown to them.

2) The course teacher is required to submit all scripts, assignments, etc with a compiled up-to-date result summary for all the tests/performance evaluated prior to semester final examination to the Controller of Examination of BUP through the Faculty Office.

3) The questions for the semester final examination will be set by the course teacher, who will submit the same to the Controller of Examination.

4) The course teacher alone will evaluate the scripts which will be scrutinized and submit marks obtained to the Controller of Examination.

The duration of each of Term will be as follows:

Number of Terms in a Year (Level) There will be two regular Semesters/ terms (Term I and Term II) in an academic year. Those who will not be able to clear all the subjects will require appearing in the re-examination after a short term of about 4-6 weeks and fulfilling the other conditions as per policy.

Duration of Terms. The duration of each of term will be as follows:

Events	Durations			Remarks
	Academic	Others	Total	
Classes	7 weeks			
Mid Term Vacation		1 week		
Classes (7 weeks minimum), Makeup and Preparatory leave	9 Weeks			
Term Final Examination	3 weeks			
Term End Vacation		2 weeks		May vary
Total	19 weeks	3 weeks	**22 weeks**	

The duration for Short Term and Re-examination examination will be as follows:

Short term/ Preparatory Leave	* 6 weeks	* Duration may vary depending on the situation.
Examination	1 weeks	
Total	**7 Weeks**	

4.7 Special Final Examination

Taking of Special Final Examination will not be accepted. However, if any student fails to appear scheduled semester final examination for extremely unavoidable and valid reasons, his/her semester final examination may be conducted on case to case basis under the following guidelines:

a. He/she should appear in final examination preferably within 45 days from end of scheduled examination and after result published.

b. Students should apply to Dean FST with required supporting documents for his/her inability in appearing scheduled semester final examination before commencement of scheduled final examination. The Office of Dean will forward the case to the Controller of exam office with necessary recommendation for getting necessary approval of Academic Council.

c. Student needs to pay the required fees for appearing special final examination and complete other examination formalities for the course/courses so appeared.

d. The highest possible grade/grades for the course(s) appeared will be no higher than 'B+'.

e. In the case of course(s) enrolled are pre-requisites for the course(s) offered in the following semester, still student may continue with next semester. Should students fail to obtain a passing grade, it will automatically lead student to withdraw from that/those course(s).

f. Students may be allowed to register for these courses in the following semester after having received the grade(s) for the courses appeared.

g. All other necessary arrangements including question setting, moderations, evaluation, and result publication will be as per existing rules/ system.

4.8 Performance Evaluation System

4.8.1 Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment, for theory courses this continuous assessment is made through a set of quizzes, class evaluation, class participation, homework assignment and a term final examination. The assessments for laboratory courses are made by evaluating performance of the student at work during the class, viva-voce during laboratory hours and quizzes. Besides that, at the end there will be a final lab test. Each course has a certain number of credits, which describes its corresponding weight. A student's Performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points are given as follows:

Numerical Markings	**Grade**	**Grade Points**
80% and above	A+	4.0
75% to below 80%	A	3.75
70% to below 75%	A-	3.50
65% to below 70%	B+	3.25
60% to below 65%	B	3.00
55% to below 60%	B-	2.75
50% to below 55%	C+	2.50
45% to below 50%	C	2.25
40%to below 45%	D	2.00

below 40%	F*	0.00
Incomplete	I	-
Withdrawal	W	-
Project/ Thesis continuation	X	-

Subject in which the student gets F grade shall not be regarded as earned credit hours for the calculation of Grade Point Average (GPA).

4.8.2 Distribution of Marks for Evaluation

For Theory Courses

Thirty percent (30%) of marks of theoretical course shall be allotted for continuous assessment, i.e. quizzes, class tests, home assignments, class evaluation and class participation etc. Term Final Examination is conducted centrally by the Bangladesh University of Professionals. Term Final Examination will be of 3-hour duration. Distribution of marks for a given course is as follows.

Category	**Marks %**
Class Participation/ Observation	5%
Class Attendance	5%
Homework assignment and quizzes/class tests	20%
Final Examination	70%
Total	**100%**

The number of quizzes/ class tests of a course shall be *n+1,* where *n* is the number of credits of the course. Evaluation of performance in quizzes/ class tests will be on the basis of the best *n* quizzes. The scheme of continuous assessment that a particular teacher wishes to follow for a course will be announced as course outline on the first day of the term.

For Laboratory Courses

The marks for the Laboratory courses will be distributed according to the type of the Laboratory course. The distribution of marks for three types of Laboratory is given below:

Marks distribution of lab based Laboratory

Category	**Marks %**
Lab test	40
Quiz	20
Viva	10
Attendance	10
Home Assignment / Report	10
Class Performance / Observation	10
Total	**100**

Marks distribution of project based Laboratory

Category	**Marks %**
Project	40
Quiz	10
Viva / Presentation	20
Attendance	10
Home assignment / report	10
Class Performance / Observation	10

Total	**100**

Marks distribution of programming based Laboratory

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Attendance	10
Observation	10
Class Performance	20
Total	**100**

Note: No referred is allowed for laboratory courses

4.8.3 Computation of CGPA

Grade Point Average (GPA) is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes *n* courses in a term having credits of C_1, C_2, ...,C_n and his grade points in these courses are G_1, G_2,...G_n respectively, then

$$\mathbf{GPA} = \frac{\textbf{Grad points earnd in the semester}}{\textbf{Credits completed in the semester}}$$

$$= \frac{\textbf{Summation of(Credit hours in a course x Grade point earned in that course)}}{\textbf{Total number of credit hours completed}}$$

$$= \frac{\sum_{i=1}^{n} C_i * G_i}{\sum_{i=1}^{n} C_i}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the terms passed/completed by a student. For example, if a student passes/ completes n terms having total credits of TC_1, TC_2, ... , TC_n and his GPA in these terms are GPA_1, GPA_2, ... , GPA_n, respectively then

$$\mathbf{CGPA} = \frac{\sum_{i=1}^{n} TC_i * GPA_i}{\sum_{i=1}^{n} TC_i}$$

Numerical Example

Suppose a student has completed eight courses in a term and obtained the following grades:

Course	**Credit Ci**	**Grade Points**	**Gi**	**Ci*Gi**
ICT1103	3.00	A	3.75	11.25
ICT2105	0.75	A+	4.00	3.00
MATH1201	3.00	A-	3.50	10.5
PHY1101	3.00	B+	3.25	9.75
GED1202	3.00	A	3.75	11.25
GED2103	1.50	A	3.75	5.625
ICT4201	3.00	A	3.75	11.25
ICT2201	3.00	A-	3.50	10.5

ICT3205	1.5	B+	3.25	4.875
Total	**21.75**			**78**

$$\mathbf{GPA} = \frac{\mathbf{78}}{\mathbf{21.75}} = \mathbf{3.586}$$

Suppose a student has completed four semester/ terms and obtained the following CGPA:

Year/ Level	Semester/ Term	Earned Hours TCi	Credit	Earned GPA GPAi	TCi*GPAi
1	I	21.75		3.75	81.5625
1	II	20.75		3.61	74.9075
2	I	19.50		3.21	62.595
2	II	21.00		2.98	62.58
Total		83			281.645

$$\mathbf{CGPA} = \frac{\mathbf{281.645}}{\mathbf{83}} = \mathbf{3.39}$$

4.9 Incomplete Grades

A student will be assigned '**Incomplete**' grade for incomplete course work, provided he/she is permitted by Academic Committee of FST. This will be recorded as 'I' with an alternative grade based on the work completed at that point in time. The alternative grade will come into effect if the student fails to complete the course requirement within 4 weeks from the publication of the provisional results in a semester.

4.10 Repeating/Retaking Course(s)

The repeating/retaking course(s) will be guided by the following rules:

1) A student earning an 'F' grade in any course shall be required to improve the grade by retaking the course offered in the subsequent semester(s), since achieving a passing grade in all courses individually is a degree requirement.

2) A student earning a "A-" (A minus) grade or below may also elect to improve the grade by repeating a course, when offered in the subsequent semester(s). The following rules will apply for in this regard:

a) In order to repeat a course, the student must apply to the Dean of the Faculty at least 4 (four) weeks before the commencement of a semester. A student desiring to repeat a course in final semester, shall have to apply to the Dean to withhold his/her graduation too.

b) The grade earned on the repeated course will be shown in the transcript by 'R' symbol meaning 'Repeat'. The grade earned on such course(s) would be used for computing the final CGPA.

c) A course can be repeated only once. However, repeating a course is not allowed after the graduation.

d) In the case of student's failure to improve his/her course grade at the course improvement examination, the previous grade shall remain valid.

4.11 Students' Grievance Procedure

The Controller of Examination reserves the right to arrange re-scrutiny of a student's script or re-evaluation of grading, if a student submits a grievance application to Controller of Examination within one week of publication of provisional results.

4.12 Rules for Withdrawal/ Dismissal

4.12.1 Probation and Withdrawal for Poor Performance

As a general rule a student will have to maintain a CGPA of 2.50 individually for each semester. In case a student fails to maintain a CGPA of 2.50 at the end of a semester, but obtains a CGPA 2.00 or more, will be placed on probation. If a student placed on probation, fails to raise the CGPA to 2.50 in the immediate next semester, he/she may be withdrawn from the program.

4.12.2 Withdrawal on Own Accord

4.12.2.1 Temporary Withdrawal

A student may be allowed a temporary withdrawal on account of unsatisfactory performance or for any other valid reasons; provided he/she has completed at least one semester, maintaining a CGPA of 2.80 at the time of application and it is approved by the Academic Council. A student, when taking temporary withdrawal, will have to complete the program within valid registration period (i.e. 6 years) from the date of initial registration.

4.12.2.2 Permanent Withdrawal

A student may apply for a permanent withdrawal due to poor academic performance or for any other valid reason, provided it is approved by the Academic Council. The admission and registration of the student will be cancelled, when he/she is allowed a permanent withdrawal. When a student is permanently withdrawn, he/she will require a fresh admission and fresh registration for re-entry into the program like any other new candidate.

4.12.3 Dismissal on Disciplinary Ground

4.12.3.1 Unfair means

Adoption of unfair means may result in the dismissal of a student from the program and expulsion from the university Course to the decision of the BUP disciplinary committee. Following would be considered as unfair means adopted during Examinations and other contexts:

(a) Communicating with fellow students for obtaining help in the examination.

(b) Copying from another student's script/paper/report.

(c) Copying from desk or palm of a hand or from other incrimination documents.

(d) Possession of any incriminating document whether used or not.

4.12.3.2 Expulsion

The term 'Expulsion' means expulsion from the university on disciplinary ground. A student, if expelled, will never be allowed to re-enter the course or similar programs in BUP and be subjected to other terms and conditions as set by the authority while approving the expulsion order.

4.12.3.3 Other Breach of Discipline

Academic council may dismiss any student on disciplinary ground if any form of indiscipline or unruly behavior is observed in him/ her which may disrupt the academic environment or program or is considered detrimental to BUP's image. ~~Academic~~ Discipline Committee will process the matter.

4.13 Class Attendance

1. Students are responsible to attend classes regularly and contrary to this rule will be viewed seriously. Absence in more than 25% classes without permission and without valid reason in any course will disqualify a student to appear semester final examination of the same. A student must obtain permission from his/her course teacher for any kind of absence on valid reason and must inform the program office too. The marks distribution for attendance is given below:

Attendance	Marks
90% and Above	5.0
85% to < 90%	4.5
80% to < 85%	4.0
75% to < 80%	3.5
70% to < 75%	3.0
65% to < 70%	2.5
60% to < 65%	2.0
Less Than 60%	0.0

4.14 Discipline and Code of Conduct

Adherence to strict discipline is considered to be a core concept of building future leaders at FST. The students must abide by the rules, regulations and code of conduct of the university. Students are forbidden either to be a member of or to organize students' organization, club, society etc. other than those set up by the University authority. They must maintain a quiet and congenial atmosphere in the academic building particularly adjacent to the classroom,

library, faculty rooms etc. The students will not be allowed to enter the classroom, if he/she is in contrary to the following rules:

- Arriving late in the class
- Not wearing appropriate dress/attire as per the dress code

The Students' Discipline Rules are available in BUP website.

4.15 Dress Code

The way a student dress up in the classroom determines how people perceive him or her as a professional/executive. It is assumed that the ICT students understand about the professional attire. However, the authority has the right to implement some kind of dress code for its students particularly the ICT students as classroom attire. The BUP prefers that its students will wear appropriate executive dress during classroom/academic activities. The dress code for BUP students, which is effective from January 2015, is given below:

- **Male**
  - **Summer**
    - Sober colored trouser/pant
    - Collared button-down full sleeved shirt duly tucked in
    - Appropriate leather belt
    - Appropriate leather shoes
    - Suit/blazer/sports coat (optional during summer)
  - **Winter**
    - Sober colored trouser/pant
    - Collared button-down full sleeved shirt duly tucked in
    - Suit/blazers/Sports coat (preferred)
    - Sober colored Jacket/Sweaters
    - Appropriate leather belt
    - Appropriate Tie (optional)
    - Appropriate leather shoes
- **Female**
  - **Summer**
    - Sober colored salwar and kamiz or trouser/pant and kamiz with appropriate scarf (orna)
    - Appropriate shoes/sandals
    - Women suit/blazer with collared shirt (optional)
  - **Winter**
    - Sober colored salwar and kamiz or trouser/pant and kamiz with appropriate scarf (orna)
    - Women suit/blazer with collared shirt (preferred)
    - Sober colored Jacket/Sweater/Cardigan
    - Appropriate shoes/sandals
- **Accessories and Jewelry**
  - Accessories should be tasteful, professional
  - Jewelry should be worn in good taste
- **Makeup, Perfume/Cologne**

- A professional appearance is encouraged and excessive makeup is deemed as unprofessional. Someone may be allergic to the chemicals in perfumes and makeup, so one should wear these substances with restraint.

- **ID Card**

Students must hang their ID card as part of the dress code in a manner so that it is visible while they are in the campus.

- **Do not wear**
  - T-shirt, frayed or faded shirts
  - Sleeveless kamiz/blouses, tops, sweatshirt, sweatpants
  - Leggings, stretch pants, cargo style pants, pants that are frayed, holes or are faded, all kind of skirts
  - Denim/Jeans (pants or shirts), leather trousers/pants
  - Birkenstock type sandals or flip flops/slippers, athletic or hiking shoes
  - Shorts or three-quarters
  - Any kind of indecent clothing

Disclaimer: The university authority reserves the right to cancel/ modify/ change any information given in this prospectus at any time.

Annexure -A

Syllabus for BSc (Hons) in ICT

1st Year, 1st Semester

ICT- **ICT1102** 4 hours in a week,2.00 Cr.

ICT Fundamentals

ICT basics and C Language, The Part of a Computer System, The Information Processing Cycle, Essential Computer Hardware, Software, Device for the hand, I/O Device.
Operating System: its role in computer systems; Operating system concepts; Operating system structure. Basic concepts: Communication systems, Synchronous and asynchronous communications, Hardware interfaces, multiplexers, concentrators and buffers.
Emerging technologies: Bluetooth, Radio Frequency Identification (RFID), Wireless Broadband (WiMAX), Mobile IP, Voice Over Internet Protocol (VOIP), Session Initiation Protocol (SIP).
Mobile communication: GSM Architecture, CDMA Architecture. The generations of mobile communications (2G, 3G, 4G).C language identifier names, Variable, Type Quality, Storage Class Specification, Variable Initialization, Constants, Operators Single Character Input, Single Character Output, Entering Input Data, Writing Output Data, The Gets and Puts Function, Single Dimension Array, Generating a Pointer to an Array, Passing Single-Dimension Array to Function ,String, Two-Dimensional Array, Pointer Variables, The Pointer Operators, Pointer, Array, Function, Introduction to Matlab.

Reference Book(s):

1. Teach Yourself C - Herbert Schidl- McGraw-Hill.
2. Learning Web Design: A Beginner's Guide to (X)HTML, StyleSheets, and Web Graphics - Aaron Gustafson – Oreilly.
4. Introduction to Computer Graphics- J D Foley and others- Pearson.
5. Mat Lab the language of technical Computing- Raj Kumar Bansal – Pearson.
6. Wireless communication- Rappaport.
7. Modern Operating System –Andrew S, Prentice.

ICT- ICT1103 3 hours in a week, 3.00 Cr.

Electrical and Electronics Fundamental

Electrical:

Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, resistance. Basic laws: Ohm's law, Kirchoff's current and voltage laws. Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation. Techniques of circuit analysis: Nodal and mesh analysis including supernode and supermesh. **Network theorems:** Source transformation, Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem. Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors. Responses of RL and RC circuits: Natural and step responses.

Electronics:

P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified dc and ac diode models, dynamic resistance and capacitance. Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clamping and clipping circuits.

Bipolar junction transistor (BJT) as a circuit element:

Bipolar Junction Transistor (BJT): principle of operation, I-V characteristics; Transistor circuit configurations (CE, CB, CC), BJT biasing, load lines; BJT as switch and Amplifier

Reference Book(s):

1. Introductory Circuit Analysis – R.L. Boylestad; Prentice Hall of India Private Ltd.
2. Fundamental of Electric Circuits – Alexander ,Sadiku- McGraw- Hill.
3. Electronic Devices and Circuit Theory – R.L Boylsted; Prentice Hall of India Private Ltd.
4. Introductory Circuits for Electrical and Computer Engineering – James. W. Nilsson, S. A. Riedel;
5. Electronic Devices and Circuits – Jacob Millman& Christos C. Halkias; Tata McGraw-Hill.
6. Foundation of Analog and Digital Electronics circuit – AnantAgarwal, JefercyH.Lang.

ICT- ICT1104 2 hours in a week, 1.00 Cr.

Electrical and Electronics Fundamentals Lab

Laboratory will be cover topics from ICT-1103.

ICT- ICT1105 3 hours in a week, 3.00 Cr.

Digital Electronics Fundamental

Introduction to number systems and codes. Analysis and synthesis of digital logic circuits, Basic logic functions, Boolean algebra, combinational logic design, minimization of combinational logic. Implementation of basic static logic gates in CMOS, DC characteristics, noise margin and power dissipation. Power optimization of basic gates, multiplexer, demultiplexer and their implementation in CMOS, decoder, encoder, comparators, binary arithmetic elements and ALU design. Sequential circuits: Different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits. Modular sequential logic circuit design: shift registers, counters and their applications.

Programmable logic devices: Logic arrays, field programmable logic arrays and programmable read only memory. FPGA Basics.

Reference Book(s):

1. Digital Fundamentals - F Loyd; Prentice Hall International, Inc.
2. Digital Logic and Computer Design- M Morris Mano; Prentice Hall of India Private Ltd.
3. Pulse, Digital and Switching waveforms - Jacob Millman& Herbert Taub; Tata McGraw- Hill.
4. Electric Circuits Analysis and Design – Nicholas L.Pappas.

ICT- ICT1106 2 hours in a week, 1.00 Cr.

Digital Electronics Fundamentals Laboratory

Laboratory will be cover topics from ICT-1105.

PHY- PHY1101 3 hours in a week, 3.00 Cr.

Physics

Waves-Oscillations & Wave mechanics

Oscillations: Differential equation of simple harmonic oscillator, total energy and average energy, Combination of simple harmonic oscillations, spring-mass system, damped oscillation, forced oscillation, resonance, stationary wave, phase velocity, group velocity. Wave mechanics: Fundamental postulates of wave mechanics, Schrodinger's equation (time dependent and time independent), Operators, Uncertainty principle, energy of a free particle.

Optics and Laser: Theories of light: Interference of light, Young's double slit experiment, Fresnel's bi-prism. Interference in thin films, Newton's rings, Interferometers, Diffraction of light: Fresnel and Fraunhofer diffractions, Diffraction by single slit, diffraction by double slits, diffraction gratings, Resolving power of optical instruments, Polarization of light: production and analysis of polarized light, polarization by double refraction, Brewster's law, Malus law, Nicole prism, , optical activity and polarimeter. Laser, spontaneous and stimulated emission, Helium-Neon laser, laser applications, Fiber optics.

Electricity: Coulomb's law, electric field, Gauss' law and its application, electric potential, capacitors and capacitance, dielectrics on atomic view, dielectric and Gauss's law, Ohm's law, resistivity -an atomic view, current density and drift velocity, Ampere's law, Faraday's law; Lenz's law, self-inductance and mutual inductance.

Reference Book(s):

1. A Text Book of Optics - Brijlal and Subramannyam
2. Fundamentals of optics - Francis and Harvey
3. Waves and oscillation - Brijlal and Subramannyam
4. Physics part-I - Resnick and Haliday
5. Physics part-II - Resnick and Haliday
6. Fundamentals of Physics - Haliday, Resnick and Walker
7. Electricity & Magnetism - K.K Tewari
8. Elementary Solid State Physics -M Ali Omar

MATH- MATH1101 3 hours in a week, 3.00 Cr.

Mathematics-I (Differential Calculus and Integral Calculus)

Differential Calculus: Function, Limit, continuity and differentiability, successive differentiation of various types of functions, Leibnit'z theorem, Rolle's theorem, Mean Value theorem, expansion in finite and infinite forms, Lagrange's form of remainder, Cauchy's form of remainder (expansion of remainder), expansions of functions differentiation and integration, indeterminate form, partial differentiation, Euler's theorem, tangent and normal, sub tangent and subnormal in Cartesian and polar coordinates, maxima and minima of functions of single variables, curvature, asymptotes.
Integral Calculus: Definition of integrations, integration by the method of substitution, integration by parts, standard integrals, integration by the method of successive reduction, definite integrals, definite integral properties and its use in summing series, Wally's formula, improper integrals, Beta function and Gamma function, multiple integral and its application, area, volume of solid of revolution, area under a plane curve in Cartesian and polar coordinates, area of the region enclosed by two curves in Cartesian and polar coordinate, arc lengths of curves in Cartesian and polar coordinates.

Reference Book(s):

1. A text Book of Differential Calculus – Rahman and Bhattachrjee.
2. Differential Calculus – Shanti Narayan.
3. Differential Calculus – Dr. B. D. Sharma.
4. Differential Calculus – Das and Mukhajee.
5. Integral Calculus – Rahman and Bhattacharjee.
6. Integral Calculus – Abu Eusuf.
7. Integral Calculus – Das and Mukhajee.

GED- GED1101 2 hours in a week, 2.00 Cr.

English

General Discussion: Introduction, various approaches to learning English, characteristics of good learners, learning styles and strategies.
Grammar and Usage: Construction of sentences, *Vocabulary*, diction, *Synonyms and Antonyms,* grammatical errors, *WH Questions,* sentence variety and style, conditionals. Academic word lists, Collocation, phrases and idioms.
The phonetics: IPA, English vowels and consonants, weak forms, assimilation and elision, differences between British, American and other accents, Accentuation and Intonation, Common Mistakes in English Pronunciation.
Reading Skill: Discussion, readability, scan and skim reading, generating ideas through purposive reading, reading selective stories, *comprehension. Reading and identifying differences between different genres of texts*, critical reading.
Speaking Skill: Practicing dialogue, storytelling, describing pictures, charts/graphs, sharing anecdotes. Essay Writing: Types of Essay (Narrative, Descriptive, Expository, Persuasive), Structure of Essay, Thesis statement.
Reading Comprehensions: Short stories, scholarly articles, dialogues.

Reference Book(s):

1. Prose of Our Time-Ahsanul Haque, Serajul Islam Chowdhury & M. Shamsuddoha
2. A Guide to Correct Speech- S.M. Amanullah;
3. Business Correspondence and Report Writing –R.C. Sharma & Krishna Mohan
4. Advance Learners Degree General English – Chowdhury and Hossain

5. The Most Common Mistakes in English Usage – Thoma's Ellioft Berry.
6. A Practical English Grammar – A Thomas, A V Martinet.

1st Year, 2nd Semester

ICT- ICT1201 3 hours in a week, 3.00 Cr.

AC Fundamentals

Introduction: Generation of AC voltage and current, Simple and complex wave form, RMS value, Average value, Form factor, peak factor, AC through RLC circuits,

Instantaneous Current: Magnetic quantities and variables: Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve. Laws in magnetic circuits: Ohm's law and Ampere's circuital law.*Phasor Algebra*: Mathematical Representation of Vectors, Symbolic Notation, Significance, Trigonometrical Form of Vector Representation, Exponential Form of Vector Representation Series A.C. Circuits: A.C. Through Resistance and Inductance, Power Factor, Active and Reactive Components of Circuit Current, Q,Factor of a Coil, Resistance and Capacitance, Resonance in R,L,C Circuit

Parallel A.C. Circuits: Solving Parallel Circuits, Vector or Phasor Method, Admittance Method, Series,Parallel Circuits, Series Equivalent of a Parallel Circuit, Parallel Equivalent of a Series Circuit, Resonance in Parallel Circuits,

***Polyphase Circuits*:** Phase Sequence, Conversions—Star and Delta Connected Lighting Loads, Power Factor, Parallel Loads, Three Wattmeter Method, Two Wattmeter Method, Millman'sThereom, Application of Kirchhoff's Laws—Delta/Star and Star/Delta Conversions—*Harmonics*: General Equation of a Complex Wave, R.M.S. Value of a Complex Wave, Form of a Complex Wave, Power Supplied by Complex Wave, Harmonics in Single phase A.C. Circuits—Selective Resonance due to Harmonics, Harmonics in Single and Three Phase Transformers, Harmonic Analysis, Fourier Analysis, Analytical Treatment of Some Typical, Waveforms,

Transients: Types of Transients, Important Differential Equations, First Order Equations, Second Order Equations, Transients in R,L Series Circuits (D.C.), Short Circuit Current, Time Constant, Transients in R,L Series Circuits (A.C.), Transients in R,C Series Circuits (D.C.), Transients in R,C Series Circuits (A.C.), Double Energy Transients. *Transformer*: Working Principle of a Transformer, Transformer Construction and types, Elementary Theory of an Ideal Transformer, Voltage Transformation Ratio (K), Regulation of a Transformer, Percentage Resistance, Reactance and Impedance, of a Transformer, Parallel Operation of Single phase Transformer

References:

1. Alternating Current Circuits- Russell M Kerchnel , George F Corcoran
2. Principles of Electromagnetic – Matthew N.O. Sadiku – Oxford University Press
3. Electronic Device and Circuit theory – Robert L. Boylestad- Pearson Education.

ICT- ICT1202 2hours in a week, 1.00 Cr.

AC Fundamentals Lab

Laboratory will be cover topics from ICT-1201.

ICT- ICT1203 3 hours in a week, 3.00 Cr.

Electronic Devices and Circuit

BJTs at low frequencies; Hybrid model, h parameters, simplified hybrid model; Small-signal analysis of single and multi-stage amplifiers, frequency response of BJT amplifier. Field Effect Transistors (FET): principle of operation of JFET and MOSFET; Depletion and enhancement type NMOS and PMOS; biasing of FETs; Low and high frequency models of FETs, Switching circuits using FETs; Introduction to CMOS.

Operational amplifiers (Op-Amp): Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, dc imperfections . Negative feedback: properties, basic topologies, feedback amplifiers with different topologies, Nyquist plot and stability criterion, frequency compensation Poles, zeros and Bode plots,.

Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and bandpass filters using Op-Amps.

Power Amplifiers: Classification of output stages, class A, B, C, AB and D.
Signal generators: Basic principle of sinusoidal oscillation, Op-Amp RC oscillators, and LC and crystal oscillators

Reference Book(s):

1. Electronic Devices and Circuit Theory -Robert L. Boylestad and Louis Nashelsky-Pearson
2. Electronic Principles – Albert P. Malvino.
3. Electronic Devices and Circuit Theory - R.L Boylsted; Prentice Hall of India Private Ltd.
4. Semi Conductor Circuit Approximation - Albert P Malvino- Tata McGraw- Hill.
5. Electronic Devices and Circuits – Jacob Millman& Christos C. Halkias- Tata McGraw-Hill.
6. Electronic Instruments and Instrumentation Technology – M.M.S. Anand; Prentice Hall of India
7. Op Amps & Linear Integrated Circuits - James M. Fiore- Delmar Thomson Learning.
8. Microelectronic Circuits – Adel S. Sedra&Keneth C. Smith- Oxford University Press

ICT-1204 3 hours in a week, 1.50 Cr.

Electronic Devices and Circuit Lab

Laboratory will be cover topics from ICT-1203.

MATH- MATH1201 3 hours in a week, 3.00 Cr.

Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)

Ordinary Differential Equations: Formulation of Differential Equations; Solution of first order differential equations by various methods, Solution of differential equation of first order but higher degrees; Solution of general linear equations of second and higher orders with constant co-efficient, Solution of Euler's Homogeneous linear differential equations. Partial Differential Equations: Introduction, Linear and non linear first order differential equations; Standard forms; linear equations of higher order; Equation of second order with variable coefficients; **Coordinate Geometry**: Transformation of coordinates, axes and its uses; Equation of conies and its reduction to standard forms; Pair of straight lines; Homogeneous equations of second degree; Angle between the pair of straight lines; Pair of lines joining the origin lo the point of intersection of two given curves, circles; System of circles; Orthogonal circles: Radical axis, radical center, properties of radical axes; Coaxial circles and limiting points: Equations of parabola, ellipse and hyperbola in Cartesian and polar co-ordinates; Tangents and formals; pair of tangents; Chord of contact; Chord In terms of Its middle points; Pole and polar parametric co-ordinates; Diameters; Conjugate diameters and then- properties; Director circles and asymptotes.

Reference Book(s):

1. Ordinary and Partial differential Equations – M. D. Raisenghania.
2. Differential Equations – M. L. Khanna.
3. Differential Equations – B. D. Sharma.
4. Differential Equations – P. N. Chatterjee.
5. A text book on of coordinate geometry with vector analysis- Rahman and Bhattachrjee

GED- GED1202 2 hours in a week, 1.00 Cr.

English Lab

Introduction: Principles of effective writing, organization, planning and development of writing, writing of composition, Paragraph, précis and amplification; General Strategies for the Writing process: Generating ideas, stating problems, drafting and finalizing, revising and editing.
Report Writing: Defining a report, classification of reports, structure of a report and writing of report; Professional writing and communication: Communication today, business communication, tenders and quotations, journal articles, job letters and official Letters, writing arguments, biographies, memoirs, describing charts/graphs etc. MS Word for professional report formatting; Communicative English: Email; Presentation; Public Speaking; Referencing & Bibliography;
Difference in various formats (APA & MLA); Details of APA formatting (in-text citation & bibliography), IEEE citation style

Reference Book(s):

1. Prose of Our Time-Ahsanul Haque, Serajul Islam Chowdhury & M. Shamsuddoha
2. A Guide to Correct Speech- S.M. Amanullah;
3. Business Correspondence and Report Writing –R.C. Sharma & Krishna Mohan
4. Advance Learners Degree General English – Chowdhury and Hossain

ICT-1205 3 hours in a week, 3.00 Cr.

Computer Programming

Introduction to JVM, JDK, JRE, PATH, CLASSPATH, JDK Commands, Java Integrated Development Environment (IDE), History of Programming languages, Introduction to Java and its evolution; OOP programming concepts, Understanding Java platform, Language Features, enter, compile and run a program, Introduction to Abstract Window Toolkit (AWT), Difference between AWT and Swing;Java Programs: Application vs Applet:Introduction to Java programming environment: Write Java classes, save class files, compile class files, run Java applications, Introduction to program and execute simple algorithms in Java.Data types, Variables, Conditional statements, Methods, Flow of Control, Object, classes, Wrapper classes, Nested classes, strings, modifiers, Garbage collection, Packages and Interfaces;Methods, Events handling, Decisions and Buttons Loops, Constructors, Overloading, Inheritance, Overridden;Arrays, Abstraction, Polymorphism, Annotations;Test Driven Development (TDD): Basic unit testing, JUnit, FindBugs and PMD in NetBeans; Exceptions, Thread, Streams, Files I/O, Applications, Object Serialization, Tokenization; Object-Oriented Design Concepts in UML (Unified Modelling Language), Writing Code with Class Diagram;Swing & SWING MVC (model-view-controller):Cloning, Application Program interface (API), Graphical User Interface (GUI), Rapid Application Development (RAD), Graphics, Java 2D graphics, Draw chart using Java API, Java Maths Package

Reference Book(s):

1. Java, Java, Java™: Object-Oriented Problem Solving, 3rd edition, Ralph Morelli & Ralph Walde, **Prentice Hall**

2. JAVA How To Program, 4th to 9th Editions, Deitel and Deitel, **Prentice/Hall International**

3. Teach Yourself Programming With Java In 24 Hours, 4th Edition (2005), by Rogers Cadenhead, **Sams Publisher**

4. JAVA in Two Semesters, Q. Charatan & A. Kans, **McGraw Hill**

5. JAVA for Students, 3rd edition, Douglas Bell & Mike Parr, **Prentice/Hall International**

ICT1206 3 hours in a week, 1.50 Cr.

Computer Programming Lab

Laboratory will be cover topics from ICT-1205.

GED1203 2 hours in a week,2.00 Cr.

Sociology, Ethics and Cyber Law

Sociological perspective: definition, nature, scope and importance of sociology; Sociology and scientific approach: methods of social research, stages of social research; Primary concepts of sociology: society, community, association, institution, group; Social evolution: stages in the evolution of human civilization; Culture: definition, characteristics, culture contents (material and non-material), cultural lag, culture and civilization; Industrial revolution: the growth of capitalism, features and social consequences, socialism.

Introduction to ethical theories and principles: Ethics and critical reasoning in computer science, Privacy, personal information, and trust, Software piracy, Music and video piracy, Misuse of software, Viruses and hacking, Computer communication and freedom of expression, Security and encryption, Content control and censorship, Computer crime, Professional issues and decision-making, Intellectual property and licensing, ACM Code of Ethics and Professional Conduct Software Engineering, Code of Ethics and Professional Practice as recommended by the ACM/IEEE-CS Joint Task Force.

Cyber Law: National ICT Act, National ICT Policy, National e-services rules, National Information security policy guideline, National Copyright, patent, trademark related laws, Laws on document & records retention, UN conventions/Laws related to internet or cyber security, Rights to know, Freedom of Information. Case Study: Methods for case analysis, Analysis of Cases, Minutes of Annual Meetings of ITU, UN on ICT policy, Report/Presentation.

Reference Book(s):

1. Introduction to Sociology – Mitchell Dunerier, Richard P. Appelbaum.
2. An Introduction to ethics – John Deigh.
3. Information Technology: Law and Practice – Sharma Vakul.

2nd Year, 1st Semester

MATH2101 3 hours in a week, 3.00 Cr

Mathematics-III(Vector Analysis Matrices and Fourier Analysis)

Matrices And Fourier Analysis: Matrices: Definition of matrix; Algebra of matrices; multiplication of matrices, transpose of a matrix, inverse of matrix; rank and elementary transformations of matrices; Solution of linear equations; linear dependence and independence of vectors. Quadratic forms, matrix polynomials, determination of characteristic root and vectors, null space and nullity of matrix, characteristic subspace of matrix. Fourier Analysis: Real and complex form of Fourier series; Finite transform; Fourier Integral; Fourier transforms and their uses in solving boundary value problems of wave equations. Vector Analysis: Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars; Scalar and vector product of two vectors and their geometrical interpretation: Triple products and multiple products; Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications; Definition of line, surface and volume integrals; Gradient, divergence and curl of point functions, various formulae, Gauss's theorem, Stokes's theorem, Green's theorem.

Reference Book(s):

1. Vector Analysis – Dr. Muhammad Abdus Sattar.
2. Vector Analysis – M. D. Raisinghania.
3. Martices and Linear Transformations – Mohammad Iman Ali.
4. An Introduction to Matrices – S. C. Gupta.
5. Matrics – FrandAsyres, JR.

GED2101 2 hours in a week, 2.00 Cr.

Economics

Economics and Engineering: Definition of economics, economics and engineering, principles of economics. Microeconomics: The theory of demand and supply and their elasticity, price determination, nature of an economic theory, applicability of economic theories to the problems of developing countries, indifference curve technique, marginal analysis, production, production function, types of productivity, rational region of production of an engineering firm, concepts of market and market structure, cost analysis and cost function, small scale production and large-scale production, optimization theory of distribution.

Macroeconomics: Savings, investment, employment, national income analysis, inflation, monetary policy, fiscal policy and trade policy with reference to Bangladesh. Economics of planning and development: Economics of development and planning dimensions of development, relevance of theory, the employment problem, human resource development, planning and market, policy models, planning experience.

References:

1. Fundamentals of Engineering Economics- Chan S. Park, Pearson Prentice Hall.
2. Contemporary Engineering Economics- Chan S. Park, Prentice-Hall.
3. Engineering Economy- Blank and Tarquin-McGraw-Hill
4. Engineering Economics- R. Panneerselvam- PHI Learning Pvt. Ltd.
5. Engineering Economics- Riggs - McGraw-Hill
6. Fundamentals of Engineering Economics- Chan S. Park- Pearson Education.

ICT2101 3 hours in a week, 3.00 Cr.

Object Oriented Design and Programming

Object Oriented Design; Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Encapsulation, classes and objects, data and module encapsulation, access specifies, static and non-static members; Constructors, destructors and copy constructors; Array of objects, object pointers, and object references; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O; object-oriented design; generic classes, static and dynamic binding, generic classes; exception handling, Namespace and standard template library, Template functions and classes; Multi-threaded Programming.

Reference Book(s):

1. The Complete Reference of Java – Patric Naughton and Herbert Schildt - McGraw-Hill.
2. Java programming – H. Schildt- McGraw-Hill.
3. How to Program Java – Deitel & Deitel
4. Beginning Java - 2 Horstman

ICT2102 3 hours in a week, 1.50 Cr.

Object Oriented Design and Programming Lab

Laboratory will be cover topics from ICT-2101

ICT2103 3 hours in a week, 3.00 Cr.

Data Structures and Algorithm

Internal data representation; Abstract data types; Elementary data structures: arrays, lists, stacks, queues, trees, graphs; Advanced data Structures: heaps, Fibonacci heaps, B-trees; Recursion, sorting, searching, hashing, storage management.

Techniques for analysis of algorithms; Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound; Basic search and traversal techniques; Topological sorting; Connected components, spanning trees, shortest paths; Flow algorithms; Approximation algorithms; Parallel algorithms; Algebraic simplification and transformations; Lower bound theory; NP-completeness, NP-hard and NP-complete problems.

Reference Book(s):

1. Data Structures-Schaum's Series
2. Data Structures-Edward M. Reingol& Wilfred T. Hason
3. Data Structures with C- Kruse - Pearson
4. Data Structures with C/C++ - Jannenbaum
5. Fundamental of Computer Algorithm – Ellis Howrowuz & Sartaj Sahni- Universities press.
6. Fundamental Algorithm – Donal E. Khuth- Person

ICT2104 3 hours in a week, 1.50 Cr.

Data Structures and Algorithm Lab

Laboratory will be cover topics from ICT-2103

ICT2105 4 hours in a week, 4.00 Cr.

Analog and Digital Communication

Overview of communication systems: Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity. Noise: Source, characteristics of various types of noise and signal to noise ratio. Information theory: Measure of information, source encoding, error free communication over a noisy channel, channel capacity of a continuous system and channel capacity of a discrete memory less system.

Communication systems: Analog and digital. Continuous wave modulation: Transmission types, base-band transmission, carrier transmission. Amplitude modulation: Introduction, double side band, single side band, vestigial side band, quadrature, spectral analysis of each type, envelope and synchronous detection. Angle modulation: Instantaneous frequency, frequency modulation (FM)

and phase modulation (PM), spectral analysis, demodulation of FM and PM.
Pulse modulation: Sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling. Pulse amplitude modulation: Principle, bandwidth requirements. Pulse code modulation (PCM): Quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM.
Delta modulation (DM): Principle, adaptive DM, line coding – formats and bandwidths.

Digital modulation: Amplitude-shift keying - principle, ON-OFF keying, bandwidth requirements, detection, noise performance. Phase-shift keying (PSK): Principle, bandwidth requirements, detection, differential PSK, quadrature PSK, noise performance. Frequency-shift Keying (FSK): Principle, continuous and discontinuous phase FSK, minimum-shift keying, bandwidth requirements, detection of FSK. Multiplexing: Time division multiplexing (TDM) - principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems, frequency division multiplexing - principle, de-multiplexing, wavelength-division multiplexing, multiple-access network – time-division multiple access, frequency-division multiple access, code-division multiple access (CDMA), spread spectrum multiplexing, coding techniques and constraints of CDMA.

Reference Book(s):

1. Modern Digital & Analog Communication System - B. P. Lathi- Oxford
2. Communication System - Simon Haykin- John Wiley & Sons, Inc.
3. Digital Telephony -John Bellamy- John Wiley & Sons.
4. Digital and Analog Communication System - Leon W. Couch- Pearson Education
5. Telecommunication Switching Systems and Networks – Thiagarajan Viswanathan

ICT1206 3 hours in a week, 1.50 Cr.

Analog and Digital Communication

Laboratory will be cover topics from ICT-1205

2nd Year, 2nd Semester

MATH 2201 4 hours in a week, 4.00 Cr

Mathematics-IV (Complex Variable , Laplace Transform and Discrete Mathematics)

Complex Variable: Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, Complex function, differentiation and the Cauchy-Riemann Equations. Line integral of a complex function, Cauchy's Integral Formula, Liouville's Theorem, Taylor's and Laurent's Theorem, Singular Residues, Cauchy's Residue Theorem.
Laplace Transform: Definition. Laplace transforms of some elementary functions. Sufficient conditions for existence of Laplace transform. Inverse Laplace transforms. Laplace transforms of derivatives. The unit step function. Periodic function, some special theorems on Laplace transform, Partial fraction. Solutions of differential equations by Laplace transform. Evaluation of improper integral.
Discrete Mathematics:
Logic: Propositional logic, Logical equivalence, Predicates & quantifiers, Logical reasoning
Sets: Basics, Set operations
Functions: One-to-one, Onto, Inverse, Composition, Graphs
Integers: Greatest common divisor, Euclidean algorithm
Sequences and Summations
Mathematical Reasoning and Induction: Proof strategies, Mathematical induction, Recursive definitions, Structural induction
Counting: Basic rules, Pigeonhole principle, Permutations and Combinations, Binomial coefficients and Pascal triangle, Sterling numbers
Probability: Discrete probability, Expected values and variance, Bayes' Theorem
Relations: Properties, Combining relations, Closures, Equivalence, Partial ordering
Graphs & Trees: Directed, undirected graphs, Erdos-Bacon Number, Connectivity, Isomorphism, Trees and their applications, Spanning trees

Reference Book(s):

1. Schaum's Outline of Theory and Problems of Complex Variables– Murray R. Spiegel.

2. Theory of functions of a Complex Variables – Shanti Narayan.
3. The Laplace Transform: Theory and Applications - Joel L. Schiff
4. Schaum's Outline of Discrete Mathematics -Seymour Lipschutz, Marc Lipson
5. Discrete Mathematics and Its Applications- Kenneth Rosen
6. Kenneth H. Rosen. Discrete Mathematics and its Applications, McGraw Hill
7. How to think like a computer scientist

ICT2201 3 hours in a week, 3.00 Cr.

Continuous Signal and Linear Systems

Classification of signals and systems: Signals classification, basic operation on signals, elementary signals, representation of signals using impulse function, systems classification. Properties of Linear Time Invariant (LTI) systems: Linearity, causality, time invariance, memory, stability, invertibility. Time domain analysis of LTI systems: Differential equations - system representation, order of the system, solution techniques, zero state and zero input response, system properties, impulse response - convolution integral, determination of system properties, state variable - basic concept, state equation and time domain solution. Frequency domain analysis of LTI systems: Fourier series- properties, harmonic representation, system response, frequency response of LTI systems, Fourier transformation- properties, system transfer function, system response and distortion-less systems. Applications of time and frequency domain analyses: Solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing. Laplace transformation: Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.

Reference Book(s):

1. Continues and Discrete Signals & Systems - S.S. Soliman& M. D. Srinath
2. Signal and System (Continuous & Discrete) - R.E. Ziemer

ICT2202 3 hours in a week, 1.50 Cr.

Continuous Signal and Linear Systems Lab

Laboratory will be cover topics from ICT-2201

ICT2203 3 hours in a week, 3.00 Cr.

Microwave Communication and Radar Engineering

Frequency spectrum, VHF, UHF and microwave frequency ranges, microwave, advantages and applications, Overview of Maxwell's and Helmholtz Equations, Plane wave and its solution, Poynting's theorem, Plane wave reflection for normal and oblique incidence. Transmission Line: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith Chart: impedance matching and lossy transmission lines. Waveguides: General formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides. Strip-line, Micro strips, Resonators: structures and characteristics. Rectangular Resonant Cavities: Energy storage, losses, Q. Microwave circuit and devices: microwave tubes, transmit time and velocity modulation, Klystron, Multi-cavity Klystron, Oscillator, Magnetron. Radiation: Small current element, radiation resistance, Radiation pattern and properties, Hertzian and halfwave Dipoles, Beam solid angle, radiation intensity, directivity, effective aperture.

Antenna: Introduction to antenna arrays and their design, radiation from a dipole antenna, antenna temperature, Mono-pole, horn, rhombic and parabolic reflectors. Microwave Communication systems: Types, Friis power transmission formula, Microwave transmitters and receivers. RADAR systems: Application, Radar equation, range, Types of Radar, Polarization, noise, interference, Atmospheric and ground effects. Other applications of microwave, microwave oven etc.

Reference Book(s):

1.Microwave Devices and Circuits - Samuel Y. Liao; Prentice Hall of India.
2.Foundations for Microwave Engineering– E. Colliong; McGraw-Hill International.
3.Microwave Engineering - M.Pozar; Addision Wesley Publishing Company

ICT-ICT2204 3 hours in a week, 1.50 Cr.

Microwave Communication and Radar Engineering Lab

Laboratory will be cover topics from ICT-2203

ICT- ICT2205 3 hours in a week, 3.00 Cr.

Database Management System

Introduction to concepts and methods for storing and manipulating data. File retrieval and organization. Database models and designing of database systems, principles of database management systems, Relational database management systems, Query formulation and language, Methods used for the storage, selection and presentation of Data, Database integrity and security, database languages , popular application packages. Structure of SQL , principals behind the design of SQL.

Introduction of database systems; Common database management systems. Models: Entity-Relationship model, Relational model; Relational algebra; Advanced SQL; Some applications using SQL. Integrity constraint; Relational database design; File organization and retrieval, file indexing and hashing; Transaction manager; Concurrency controller; Recovery manager; Security system; Database administration; Introduction to advanced database management systems: distributed database, parallel database, data mining and warehousing, multimedia, object-oriented, object-relational, real-time database.

Reference Book(s):

1. Database System Concepts- Abraham Silbeschatz, Henry F. Korth, S. Sundarshan - **McGraw Hill**
2. Files and Databases An Introduction- Peter D. Smith and G.M. Barnes

ICT-ICT2206 3 hours in a week, 1.50 Cr.

Database Management Systems Lab

Laboratory will be cover topics from ICT-2205

ICT- ICT2207 3 hours in a week, 3.00 Cr.

Microprocessor and Assembly Languages

Introduction to 8-bit, 16-bit, and 32-bit microprocessors: architecture, addressing modes, instruction set, interrupts, multi-tasking and virtual memory; Memory interface; Bus interface; Arithmetic co-processor; Microcontrollers; Integrating microprocessor with interfacing chips , Evaluation of Microprocessors Applications, Intel 8086 Microprocessor: internal architecture, register structure, programming model, addressing modes, instruction set, Hardware architecture and software architecture; Instruction types and their formats; Assembly program format; Assembly process; Interrupts and system services; Addressing methods; High level control structure formation; Use of subroutines and macros; Numeric processing and string processing; Concurrent processes and high level linking; Disk geometry, file system and file I/O handling. Coprocessors. An overview of Intel 80186, 80286, 80386, 80486 and Pentium microprocessors, RISC processors.

Reference Book(s):

1. Microprocessors And Interfacing - DAUGLAS HALLTata –McGraw Hill Education
2. Assembly Language Programming and Organization of the IBM PC- Ytha Y. Yu, Charles Marut
3. Microprocessor Architecture, Programming, and Applications with the 8085-Ramesh S. GaonkarPrentice Hall

3rd Year, 1st Semester

GED- GED3101 2 hours in a week, 2.00 Cr.

Accounting and MIS

Accounting: Accounting as an information system. Computerized system applications in accounting. Recording system, double entry mechanism; account and their classification; Accounting equation:

Accounting cycle: Journal, ledger, trial balance. Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions.
Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost: Overhead recover method/rate; Job order costing: preparation of job cost sheet and question price, Inventory valuation: absorption costing and marginal/variable costing technique; Cost-Volume-Profit analysis: meaning, breakeven analysis, contribution margin analysis sensitivity analysis.
MIS: Overview of MIS-MIS and its Characteristics, MIS and other academic disciplines, Management accounting, Operation Research, Management and organization theory, Subsystem of MIS, Functional, Activity, Structure of MIS, Challenge of Information System-Why information system, Contemporary approaches to information systems, Key system application in two organizations, Strategic role of Information Systems-Information as a strategic resource, Systems for competitive advantages, Value chain model, Information Systems and Organizations-Relationship between organization and information system, how organizations affect information system, how information system affect organizations, Management, Information and Decision Making- Concept of management and information, Types and process of decision, Ethical and Social Impact of Information System- Concept of Ethical and Social issues, Ethics in an information society, Moral dimension of information system, Managing Data Resources-Organizing data in a traditional file environment, a modern database environment, designing database

Reference Book(s):

1. Account Best Practices – Steven M. Bragg.
2. Accounting Principles – Kieso and Kimmel.
3. An Introduction to MIS –David M. Kroenke, Earl McKinney.
4.

ICT3101 3 hours in a week, 3.00 Cr.

Pervasive Computing

Introduction to ubiquitous computing; Security in Mobile Agents; Security in Wireless Sensor Networks (WSN): key management, Secure routing, Attacks and Countermeasures; Trust and Reputation Models: Trust-Based Web Service Provision, Trust Based Security, Reputation Systems, Authentication: Multi-factor Authentication, Persistent/Continuous Authentication, Security in Pervasive Computing: Concepts, basis and trends, Identity and access control, Languages for Identity and access control, Risk Assessment for Better Identity Management in Pervasive Computing, Security of Multi-Application Smart Cards, Context-Aware Security, Biometric security for Pervasive systems; Privacy: Incorporating privacy and security into the design and development process of pervasive applications, Privacy and security for smart homes, smart cars, healthcare, urban computing, smart phones, wearable computers, RFIDs.

Reference Book(s):

1. Security for Ubiquitous Computing -Frank Stajano-John Wiley and Sons, Ltd.
2. Security in Distributed, Grid, Mobile, and Pervasive Computing. -Yang Xiao. -Auerbach Publications.
3. Pervasive Computing and Networking -Mohammad S. Obaidat, Mieso Denko, Isaac Woungang - Wiley.
4. Unit and Ubiquitous Internet of Things-HuanshengNing- CRC Press

ICT3102 3 hours in a week, 1.50 Cr.

Pervasive Computing lab

Laboratory will be cover topics from ICT-3101

ICT3103 3 hours in a week, 3.00 Cr.

Computer Networks

Introduction to computer networks, Uses of computer networks, Network models, Network topology, Layered approach of networking protocols, Design issues of layers, and TCP/IP protocol suite.
Data link layer: Design issues; error control, detection and correction; Logical link control sub-

layer, Medium access sub-layer; Multiple access protocols, Medium access mechanisms – ALOHA, slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, WDMA; Medium access protocols – IEEE 802.3: Ethernet, IEEE 802.4: Token bus, IEEE 802.5: Token ring, Introduction to Wi-Fi-IEEE 802.11 , WIMAX- IEEE 802.16; High speed LANs, FDDI, Fast Ethernet, and Gigabit Ethernet; LAN extension – Bridges, Switches, and VPN,
Network layer: IP addressing, IP packet forwarding, Subnetting, CIDR, Internet protocol, ICMP, ARP, RARP, DHCP, and IPv6 overview; Routing protocols -
Transport layer: Functionalities; User datagram protocol (UDP) – UDP operations and UDP package modules, Transmission control protocol (TCP) – TCP features, TCP Connection establishment and termination, TCP Flow control and error control, Congestion control.

Reference Book(s):

1. Data Communication & Networking – Behrouza Forouzan- McGraw Hill Education
2. Computer Network –Tannenbaum – Pearson Education
3. Computer Networks: Protocols, Standards, and Interfaces - Uyless Black - PHI
4. Computer Networks a System Approach – Larry L. Peterson and Bruce S. Davie – MK Education
5. Internetworking with TCP/IP: Principles, Protocols, Architecture - D. E. Comer - PHI

ICT3104 3 hours in a week, 1.50 Cr.

Computer Networks lab

Laboratory will be cover topics from ICT-3103

ICT3105 3 hours in a week, 3.00 Cr.

Digital Signal Processing

Spectral estimation: Nonparametric methods – discrete random processes, autocorrelation sequence, periodogram, parametric method – autoregressive modeling, forward/backward linear prediction, Levinson-Durbin algorithm, minimum variance method and Eigenstructure method I and II. Adaptive signal processing: Application, equalization, interference suppression, noise cancellation, FIR filters, minimum mean-square error criterion, least mean-square algorithm and recursive least square algorithm. Multirate DSP: Interpolation and decimation, poly-phase representation and multistage implementation. Perfect reconstruction filter banks: Power symmetric, alias-free multi-channel and tree structured filter banks. Wavelets: Short time Fourier transform, wavelet transform, discrete time orthogonal wavelets and continuous time wavelet basis.

Reference Book(s):

1. Digital Signal Processing - Emmanuel C. Ifeachor, Barrie W. Jervis- Pearson Education
2. Digital Signal Processing Using Matlab - Vinay K. Langle& John G. Proakis-
3. Handbook for Digital Signal Processing – Sanjit K. Mitra- John Wiley & Sons.
4. Digital Signal Processing Lab Using Matlab - Sanjit K. Mitra.

ICT3106 3 hours in a week, 1.50 Cr.

Digital Signal Processing Lab

Laboratory will be cover topics from ICT-3105

ICT3107 3 hours in a week, 3.00 Cr.

Telecommunication Systems

Introduction: Principle, evolution, networks, exchange and international regulatory bodies. **Telephone apparatus:** Microphone, speakers, ringer, pulse and tone dialing mechanism, side-tone mechanism, local and central batteries and advanced features. Switching system: Introduction to analog system, digital switching systems – space division switching, blocking probability and multistage switching, time division switching and two dimensional switching. Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. Modern telephone services and network: Internet telephony, facsimile, integrated services digital network, asynchronous transfer mode and intelligent networks.
Introduction to cellular telephony and satellite communication. SS7

Reference Book(s):

1. Digital Switching Systems - Syed R. Ali- McGraw Hill international.
2. Digital Telephony - John Bellamy- John Wiley & Sons, Inc.
3. Telecommunication Switching Systems and Networks – ThiagarajanViswanathan- Prentice Hall of India.
4. Telephones and Telegraphy – S.F. Smith- Oxford University Press.

ICT3108 3 hours in a week, 1.50 Cr.

Telecommunication Systems lab

Laboratory will be cover topics from ICT-3107

3rd Year, 2nd Semester

ICT3201 3 hours in a week, 3.00 Cr.

System Analysis and Design

System concepts, System and System analysis, tools and techniques in systems analysis, design data flow diagram and E-R diagrams. System planning, approach to systems development, user involvement, feasibility assessment. System investigations: objectives, methods, recording. Logic System Design, Physical Design of computer and manual sub-system, project management and documentation. System development methodologies; approaches and role of design; problem definition; evaluation and feasibility study; describing process and data; quality and testing; design of user interface, programs, files and databases; control and security. Basic design and architecture of distributed systems; data communication requirements; implementation and maintenance. Analysis tools: information gathering, interview and questionnaire; organization charts; documentation standards; data dictionary, decision tree, decision tables; prototyping; CASE tools. Software Project Management: life cycle, specification design, documentation, maintenance and control. Nature and sources of software tools. Program system organization, analysis of program performance, testing and verification methods, editing formatting, Micro processing co-ordination of multiple programs.

Reference Book(s):

1. System analysis and design - Kendal & Kendal – Pearson international
2. System analysis and design – Awad

ICT3203 3 hours in a week, 3.00 Cr.

Software Engineering

Software Engineering principles, Life cycle models, complexity models, requirement engineering, Requirements specification, Functional specification and design, modular, structure design, Estimation, Planning and control. Programming methodologies, Debugging aids, Documentation, Management of programming teams. Measurement of software verification and testing techniques, Integration and testing strategies .Design modeling and web applications, Formal Methods, Clean room Software Engineering, Component Based Software Engineering, Quality assurance, Configuration management, Analysis Concepts and Principles, Analysis Modeling , Design Concepts and Principles , Architectural Design , User Interface Design , Component-Level Design , Software Testing Techniques , Software Testing Strategies , Technical Metrics for Software, Component-Based Software Engineering , Client/Server Software Engineering , Web Engineering , Reengineering, Computer-Aided Software Engineering , The Road Ahead, Software maintenance and re-engineering, Modification and portability. Software support tools. Software project organization, quality assurance, and management and communication skills, The Software Process , Software Process Models , The Linear Sequential Model , The Prototyping Model , The RAD Model. Capability maturity model (CMM), CMM integration and their application.

Reference Book(s):

1. "Software Engineering: A Practitioner's Approach"- Roger S Pressman, Roger Pressman- McGraw-Hill
2. "Software Engineering"- Ian Sommerville- Addison Wesley

ICT3204 3 hours in a week, 1.50 Cr.

Software Engineering Lab

Laboratory will be cover topics from ICT-3201

ICT-3205 3hours in a week, 3.00 Cr.

Cellular and Mobile Communication

Cellular concepts: frequency reuse, handoff strategies, interference and system capacity, grade of service, improving capacity and coverage, call blocking probability.

Introduction to Mobile Communication: history and evolution of mobile radio systems, types of mobile wireless services/systems - cellular, WLL, paging, satellite systems, standards, and future trends in personal wireless systems. Cellular concepts and system design fundamentals/frequency management and channel Assignment: Cellular concept and frequency reuse, Multiple Access Schemes, fixed Channel assignment, non-fixed channel assignment and handoff. Interference and system capacity, Trunking and Erlang capacity calculations. Mobile radio propagation Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and base band impulse response models, Parameters of mobile multipath channels, Antenna systems in mobile radio.

Modulations and signal processing: Analog and digital modulation techniques, Performance of various modulation techniques - Spectral efficiency, Error-rate, Power Amplification, Equalization Rake receiver concepts, Diversity and space-time processing, Speech coding and channel coding. System examples and design issues: Multiple Access Techniques – FDMA, TDMA and CDMA systems, Operational systems, Wireless networking, security in wireless networks, Design issues in personal wireless systems.

Reference Book(s):

1. "Mobile Communications Engineering: Theory and Applications"- Lee W.C.Y- McGraw-Hill
2. "Mobile Communications"-J. Schiller- Pearson Education Asia Ltd.

ICT3206 2 hours in a week, 1.00 Cr.

Cellular and Mobile Communication Lab

Laboratory will be cover topics from ICT-3205

ICT3207 3hours in a week, 3.00 Cr.

Optical Fiber Communication

Introduction: evolution of fiber optic system, Light propagation through optical fiber: Ray optics theory and mode theory.

Optical fiber: Types and characteristics, transmission characteristics, fiber joints and fiber couplers. Signal degradation in optical fibers: Attenuation– Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses Light sources: Light emitting diodes and laser diodes. Detectors: PIN photo-detector and avalanche photo-detectors. Receiver analysis: Direct detection and coherent detection, noise and limitations. Transmission limitations: Chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises. Optical amplifier: Laser and fiber amplifiers, applications and limitations. Multi-channel optical system: FDM(Frequency division multiplexing), WDM (wavelength division multiplexing) and co-channel interference.

Optical networking: local-area network (LAN), wide-area network (WAN), optical communication, lasers or LEDs , optical networking system include: Fiber. Multi-mode or single-mode. OFDM, Crosstalk, BER

Reference Book(s):

1. Optical Communication, Principles and Practice- J. Senior- Prentice Hall.
2. Optical Communication System - J. Gowar- Prentice Hall
3. Optical Fiber Communication - G. Keiser-McGraw-Hill International

ICT3208 3 hours in a week, 1.50 Cr.

Optical Fiber Communication Lab

Laboratory will be cover topics from ICT-3207

ICT3209 3 hours in a week, 3.00 Cr.

Random Signals and Process

Probability and random variables. Distribution and density functions and conditional probability. Expectation: Moments and characteristic functions. Transformation of a random variable. Vector random variables. Joint distribution and density. Independence. Sums of random variables. Random Processes. Correlation functions. Process measurements. Gaussian and Poisson random processes. Noise models. Stationarity and Ergodicity. Spectral Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs. Introduction to discrete time processes, Mean-square error estimation, Detection and linear filtering.The Axioms of Probability: Set Theory , Probability Space , Conditional Probability, Repeated Trials : Combined Experiments , Bernoulli Trials , Bernoulli's Theorem , The Concept of a Random Variable: Distribution and Density Functions , Specific Random Variables , Conditional Distributions , Asymptotic Approximations for Binomial Random Variable . Functions of One Random Variable: The Random Variable g(x), The Distribution of g(x), Mean and Variance, Moments , Characteristic Functions .Sequences of Random Variables: General Concepts, Conditional Densities, Characteristic Functions, and Normality, Mean Square Estimation, Stochastic Convergence and Limit Theorems, Random Numbers: Meaning and Generation.

Reference Book(s):

1. Probability, Random variables and Stochastic Processes – Papuolis- McGraw-Hill Higher Education.
2. Random Processes for Image - Edward R. Dougherty- Prentice Hall of India Private Ltd.
3. Probability and Random Processes - Henry Stark & John W. woods- Pearson Education.

ICT-3299

Industrial attachment **3-4 weeks,1.00 cr**

4th Year, 1st Semester

ICT- 4000 6 hours in a week ,3.00 Cr.

Project and Thesis

ICT4101 3 hours in a week, 3.00 Cr.

Artificial Intelligence and Neural Networking

Introduction to old and new AI techniques; Knowledge representation; Propositional and first order logic, inference in first order logic; Frame problem; Search techniques in AI; Game playing; Planning; Probabilistic reasoning; Learning in symbolic and non-symbolic representation; Natural language processing. Introduction to expert system.

Biological nervous system: the brain and neurons, Introduction to artificial neural network , Theory and application of Artificial neural networks ; Multi-layer perception: Back propagation algorithm, Self organization map, Radial basis network, Hop field network, Recurrent network, Fuzzy set theory, Failing Adaptive Linear and Multiple Adaptive Linear networks, Generating internal representation, Cascade correlation and counter propagation networks, Higher order and bi-directional associated memory, Lyapunov energy function, attraction basin, Probabilistic updates: simulated annealing, Boltzmann machine, Adaptive Resonance Theory (ART) network. ARTI. ART2. Fuzzy ART mapping (ARTMAF) networks. Learning Vector Quantization (LVQ) networks, Logic control: Adaptive fuzzy neural network; Genetic algorithm and evolution compacting, Applications to control; Pattern recognition; Nonlinear system modeling, Speech and image processing.

Reference Book(s):

1.Artificial Intelligence – Eline Rich - McGraw-Hill
2.Artificial Intelligence –RananB .Banerji
3.Introduction to Artificial Neural Systems - Jacek M. Zurada
4.Artificial neural systems: foundations, paradigms, applications, and implementations - Patrick K. Simpson - McGraw-Hill

ICT4102 2 hours in a week, 1.00 Cr.

Artificial Intelligence and Neural Networking Lab

Laboratory will be cover topics from ICT-4101

ICT4103 3 hours in a week, 3.00 Cr.

Satellite Communication

Satellite Communication: Introduction, Orbits, station keeping, satellite altitude, transmission path, path loss, noise consideration, satellite system, saturation flux density, effective isotropic radiated power, multiple access methods, earth station antenna, satellite link design, frequency plan, satellite communication for Internet, VSAT network, One-way, two-way and open-sky satellite communication, GNSS-GPS and Galileo systems and GIS, Satellite Navigation, DBS-TV, Satellite Program in Bangladesh, Application of Satellite. Communications network and service, comparison of network transmission technology, growth of satellite communications, orbital mechanics, classical orbital elements, the geostationary orbit, change in longitude, orbital transfers, orbital perturbations, other orbits for satellite communications, spacecraft design, structure, primary power, thermal subsystem, telemetry, tracking and command, attitude control, propulsion subsystem, the basic RF link, limits on link, satellite links, composite performance.

Reference Book(s):

1. "Satellite Communication Systems Engineering"- W. L. Pritchard, G. H. Suyderhood, R. A. Nelson- Prentice Hall
2. "The Satellite Communication Applications Hand Book"-B. R. Elbert- Artech House Boston.
3. "Satellite Communications"- D. Roddy- McGraw Hill.

ICT 4105 3 hours in a week, 3.00 Cr.

Wireless Communication

Introduction to wireless networks: wireless access networks – wireless mesh networks, personal area networks (wireless sensor networks, body area networks, LowPan, and Bluetooth), wireless and mobile ad hoc networks, challenged networks (DTNs, VANETs).

Propagation effects: outdoor propagation models, indoor propagation models, power control, small and large scale fades; Wireless LAN Technology; IEEE 802.11: standard, protocol architecture, physical layer and media access control; Mobile IP; Wireless Application Protocol; IEEE 802.16 **Broadband Wireless Access:** Brief review of 2nd and 3rd generation wireless: GSM, GPRS, CDMA; Cordless system; Wireless local loop

Reference Book(s):

1. Wireless Communications and Networks,William Stallings
2. IEEE 802 Wireless Systems, B. H. Walke, S. Mangold and L. Berlemann, Wiley

ICT- 4106 2 hours in a week, 1.00 Cr.

Wireless Communication Lab

Laboratory will cover topics from ICT-4105

Optional-I (Information Technology Related Courses)

Theory course (One out of 4111-4133) is to be selected from optional –I and laboratory will cover topics (one out of 4112-4134)

Optional-I (Information Technology Related Courses)

ICT- 4111 3hours in a week, 3.00 Cr.

Pattern Recognition

Introduction to pattern recognition, classification, Description. Patterns and Feature extraction. PR approaches, Training and Learning in PR, Common Recognition Problems.
Statistical PR, The gussian case and class dependence, Discriminate Function, classifier performance, Risk and Errors, Supervised Learning, Parametric Estimation and Supervised learning, Maximum likely hood estimation, The Bayesian Parameter Estimation Approach. Supervised Learning Using Non parametric Approaches, Parzen windows.
Linear Discriminate Function and the Discrete and Binary Feature cases, Unsupervised Learning and clustering, Syntactic Pattern Recognition (SPR), Syntactic Pattern Recognition via parsing and other grammars, Graphical approaches to Syntactic Pattern Recognition, Graph based structural presentation, graph Isomorphism, similarity measurements, Learning via grammatical Inference. Introduction to Neural Recognition and Neural Pattern associators and Matrix approaches.

Reference Book(s):

1. Pattern Recognition : statistical structural and Neural Approaches- Robert J. schalkoff- John Wiley & Sons, Inc.
2.

ICT- 4112 3 hours in a week, 1.50 Cr.

Pattern Recognition lab

Laboratory will cover topics from ICT-4111

ICT-4113 3hours in a week, 3.00 Cr.

Simulation and Modeling

Introduction and basic simulation procedures. Model classification like Monte Carlo simulation, discrete-event simulation, continuous system simulation, mixed continuous/ discrete-event simulation, Simulation Languages, random number generation and testing, analysis of simulation results, confidence intervals, variance reduction techniques. Case studies of analytical and simulation studies of computer systems.
Analytical versus simulation modeling, Workload modeling, Random variables. Commonly used distributions. Stochastic processes, Markov chain models of computer systems, steady-state and transient analyses, queuing models, Single server and multi-server queues, openand closed queuing networks. Model verification and validation, Petri nets, state charts, hybrid models, system dynamics and object-oriented modeling. Simulation and modeling in life.
Input and output analysis: random numbers, generating and analyzing random numbers, sample generation, trace- and execution-driven simulation, point and interval estimation. Process-oriented and parallel and component simulation and modeling

Reference Book(s):

1. The Art of Computer Systems Performance Analysis- Raj Jain - Wiley
2. The Art of Computer Systems Performance Analysis- Raj Jain - Wiley
3. Simulation Modeling and Analysis- Law, A.M, and Kelton, W.D,

ICT-4114 3 hours in a week, 1.50 Cr.

Simulation and Modeling Lab

Laboratory will cover topics from ICT-4113

ICT-4115 3hours in a week, 3.00 Cr.

Data Ware-housing and Data Mining

Introduction; Data warehousing and OLAP technology for data mining; Data preprocessing; Data mining primitives, languages and systems; Descriptive data mining: characterization and comparison; Association analysis; Classification and prediction; Cluster analysis; Mining complex types of data; Applications and trends in data mining, the need for data warehousing, paradigm shift, business problem definition, operational and informational data stores, data warehouse architecture, host-based processing, master-slave processing, first-generation client/server processing, second-generation client/server processing, server function, server hardware

architecture, system considerations, RISC versus CISC, multiprocessor system, SMP implementations, distributed-memory architecture, optimal hardware architecture, server operating systems, operating system implementations, implementation trends and features, DBMS connectivity, RDBMS features, RDBMS reliability and availability, RDBMS administrator, system management, oracle universal server, oracle context option, oracle spatial data option, Informix, Sybase.

Reference Book(s):

1. Data Mining and Data Warehousing - Bharat Bhushan Agarwal, Sumit Prakash Tayal - Mcgraw Hill
2. Data Warehousing, Data Mining, and OLAP - Alex Berson and Stephen J. Smith- Mcgraw Hill

ICT-4116 3 hours in a week, 1.50 Cr.

Data Ware-housing and Data Mining lab

Laboratory will cover topics from ICT-4115

ICT-4117 3 hours in a week, 3.00 Cr.

Bioinformatics

Introduction of bioinformatics, Biological analysis, Software development and use of bioinformatics, Data models and web resources. Tools for informatics, Biological databases and databanks and data mining.

Applications for Bioinformatics, Biostatistics, Various biological databases, Bio tools and computer techniques Sequence similarity. Pairwise alignment: scoring model, dynamic programming algorithms, biological algorithms, correct versus incorrect algorithms, algorithm design techniques, heuristic alignment, and pairwise alignment using Hidden Markov Models. Multiple alignments: scoring model, local alignment gapped and ungapped global alignment. Motif finding: motif models, finding occurrence of known sites, discovering new sites. Gene Finding: predicting reading frames, maximal dependence decomposition. Analysis of DNA microarray data using hierarchical clustering, model-based clustering, expectation-maximization clustering, Bayesian model selection. Molecular biology primer, restriction mapping, impractical restriction mapping algorithm, regulatory motifs in DNA sequence, the motif finding problem, search trees, finding motifs, finding a median string, the power of DNA sequence comparison , the change problem revisited, manhattan tourist problem, edit distance and alignments, global sequence alignment, scoring alignment .

Reference Book(s):

1. An Introduction to Bioinformatics Algorithms- Neil C. Jones,Jean-Michel Claverie
2. Bioinformatics: Sequence and Genome Analysis- David W. Mount
3. Statistical Methods in Bioinformatics : An Introduction- Warren J. Ewens, Gregory Grant - Springer
4. Developing Bioinformatics Computer Skills- Cynthia Gibas, Per Jambeck – O'REILLY.

ICT-4118 3 hours in a week, 1.50 Cr.

Bioinformatics Lab

Laboratory will cover topics from ICT-4117

ICT-4119 3 hours in a week, 3.00 Cr.

Software Quality Assurance

Software nature and its qualities, software engineering principles, emphasis on rigor, formality, anticipation of change. Software design, specification, verification, production process, management of software engineering, software engineering tools and environments. Principals: economics, mutual benefit, self-similarity, improvement, diversity, reflection, flow, opportunity, redundancy. Information workspace, energized work, pair programming, weekly cycle, quarterly cycle, slack, continuous integration, and incremental design.

Pragmatic approach: evils of duplication, orthogonality, reversibility, tracer bullets, domain language. Basic tools: power of plain text, shell games, power editing, source code control, text manipulation, code generation. Design by contract, assertive programming, use exceptions, balance resources. Decoupling and law Demeter, metaprogramming, temporal coupling, blackboards. Programming by coincidence, algorithm speed, and refactoring, evil wizards. Pragmatic teams, ubiquitous automation, ruthless testing, great expectations, pride

and prejudice.

Reference Book(s):

1. The pragmatic programmer – Andrew Hunt and David Thomas
2. Extreme Programming Explained: Embrace Changes – Kent Beck
3. K-Agile Software Development: Principles, Patterns and Practices – Rober- Pearson education.

ICT-4120 3 hours in a week, 1.50 Cr.

Software Quality Assurance Lab

Laboratory will cover topics from ICT-4119

ICT-4121 3 hours in a week, 3.00 Cr.

Information Systems Availability and Quality Assurance

Concepts of Information System, Different phases of software System Development, Different types of information, qualities of information. Project Management Concepts, Software process and project Metrics, Software Project Planning, Risk Analysis and management, Project Scheduling and Tracking. Analysis Concepts and principles: requirement analysis, Analysis modeling, data modeling. Design concepts and principles, Architectural design, User Interface design, Object Oriented software development and design: Iterative Development and the Unified Process. Sequential waterfall life cycles, Inception. Use case model for requirement writing, Elaboration using System Sequence Diagram, Domain Model. Visualizing concept classes. UML diagrams, Interaction and Collaboration Diagram for designing Software. Designing Objects with responsibilities. GRASP patterns with General Principles in assigning responsibilities: Information expert, Creator, Low Coupling and High Cohesion, Creating design class diagrams and mapping design to codes. Software Testing: White Box and Black Box testing. Basis Path Testing. Testing for specialized environment. Software testing strategies: Unit Testing, Integration Testing, Validation Testing, System Testing, Art of debugging. Analysis of System Maintenance and upgrading: Software repair, downtime, error and faults, specification and correction, Maintenance cost models, documentation. Software Quality Assurance, Quality factors. Software quality measures. Cost impact of Software defects. Concepts of Software reliability, availability and safety. Function based metrics and bang metrics. Metrics for analysis and design model. Metrics for source code, testing and maintenance.

Reference Book(s):

1. System Analysis and Design – Elias M. Awad
2. System Analysis and Design – Robert J. Thierauf
3. Information System – J.G. Burch Jr, F.R Strater
4. Information System – Cyril H.P Broodes

ICT-4122 3 hours in a week, 1.50 Cr.

Information Systems Availability and Quality Assurance Lab

Laboratory will cover topics from ICT-4121

ICT-4123 3 hours in a week, 3.00 Cr.

OS and Network Security

Introduction of Operating System, types of OS; Process: process managements, process states, job and process scheduling, CPU scheduling algorithms, process coordination, critical section problems, semaphores, Inter-Process Communication (IPC), classical IPC problems, multiprocessing and timesharing, message and mailbox etc.; Memory management: swapping, memory allocation schemes, Paging and segmentation, virtual memory, page replacement strategies, working sets, demand paging; Input/output: hardware/software, disk, disk scheduling algorithms, Secondary storage management, terminals, clocks; Deadlock: resource allocation, detection, prevention, avoidance and recovery; File management; Operating system security;
confidentiality using symmetric encryption public, Key encryption and Hash functions, Public-key Cryptography, Key management, Diffie-Hellman key exchange, Other Public Key Cryptosystem, Message Authentication and Hash function, Hash Algorithm, Digital Signatures and Authentication protocols, Network Security practice, Authentication application, Wireless Network Security, Electrical Mail security, IP security, Web security, System security, Intruders, Malicious software

and Firewall, Legal and Ethical Aspects.

Reference Book(s):

1. Operating System Concepts – James L Peterson & Abraham Silberschatz - Wiley
2. Operating System –Tannenbaum – Pearson Education
3. Cryptography and Network Security – William Stalling - Pearson Education.
4. Cryptography and Network Security- Behrouz A. Forouzan – SE Education.

ICT-4124 3 hours in a week, 1.50 Cr.

OS and Network Security Lab

Laboratory will cover topics from ICT-4123

ICT4125 3 hours in a week, 3.00 Cr.

Computer Architecture

Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Arithmetic Logic Unit (ALU) operations, floating point operations, designing ALU; Processor design: data paths single cycle and multicycle implementations; Control Unit design-hardware and microprogramming; Hazards; Exceptions; Pipeline: pipelined datapath and control, superscalar and dynamic pipelining; Memory organization: cache, virtual memory, channels; DMA and Interrupts; Buses; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

Reference Book(s):

1. Computer Architecture and Organization – John P. Hayes - McGraw Hill.
2. Computer Organization and Design – John L. Hennessy & David A. Patterson – MK Education
3. Computer Organization –V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaki - McGraw Hill.

ICT- 4126 3 hours in a week, 1.50 Cr.

Computer Architecture Lab

Laboratory will cover topics from ICT-4125

ICT- 4127 3 hours in a week, 3.00 Cr.

Operating System Concepts

Operating System: Its role in computer systems; Operating system concepts; Operating system structure; Process: process model and implementation, Inter-Process Communication (IPC), classical IPC problems, process scheduling, multiprocessing and time-sharing; Memory management: swapping, paging, segmentation, virtual memory; Input/Output: hardware, software, disk, terminals, clocks; Deadlock: resource allocation and deadlock, deadlock detection, prevention and recovery; File Systems: files, directories, security, protection; Case study of some operating systems.

Reference Book(s):

1. Operating System Concepts – James L Peterson & Abraham Silberschatz
2. Modern Operating System – Tannenbaum A S, Prentice – Pearson Education

ICT- 4128 3 hours in a week, 1.50 Cr.

Operating System Concepts Lab

Laboratory will cover topics from ICT-4127

ICT- 4129 3 hours in a week, 3.00 Cr.

Cloud Computing

Distributed computing, hosting and access solutions, including service-based computing, hardware-

as-a-service, infrastructure-as-a-service, platform-as-a-service, software and applications as-a-service, security-as-a-service, cloudlets and cluster computing as-a-service, high-performance computing as-a-service. In addition, service-based access and sharing/interchange of resources with other clouds. Bare-machine computing 'images' and virtual machine based 'images'. Construct and secure a private cloud computing environment based on open source VCL solutions, and how to federate it with external clouds: public EC2 offering, and some other solutions. Performance, security, cost, usability and utility of cloud computing solutions ;Cloud Computing principles; Cloud Computing components and services. Cloud Computing architectures and implementations; Cloud Computing management and security.

Reference Book(s):

1. Cloud Computing – Kumar Saurabh- Wiley
2. Cloud Computing – John W.Rittinghouse – CRC Press.

ICT- 4130 3 hours in a week, 1.50 Cr.

Cloud Computing Lab

Laboratory will cover topics from ICT-4129

ICT-4131 3 hours in a week, 3.00 Cr.

Cryptography

Cryptography: introduction to simple cryptosystems, cryptanalysis; Shannon's Theory: perfect secrecy, entropy, product cryptosystems; data encryption standard: description of des, differential cryptanalysis; RSA System and Factoring: Public-key cryptography, RSA cryptosystem, attacks on RSA, factoring algorithms; Other Public- RESTRICTED 14 RESTRICTED key cryptosystems: ElGamal cryptosystem and discrete logs, Merkle-Hellman Knapsack System; Signature Schemes: ElGamal signature schemes, Digital signature standard, Fail-stop signatures; Hash Functions: Signatures and Hash functions, Collision-free Hash functions, Birthday attack; Key Distribution and Key Agreement: Key redistributions, Kerboros, Diffie-Hellman key exchange; Identification Schemes: Schnorr identification scheme, Okamoto identification schemes; Authentication Codes: Computing deception probabilities, Combinatorial bounds, Entropy bounds; Secret Sharing Schemes: Shamir threshold scheme, Access structure and general secret sharing; Pseudo-random Number Generation: Indistinguishable probability distribution, probabilistic encryption.

Reference Book(s):

1. Introduction to Cryptography – Hans Delfs, Helmot Kntbl- Springer.
2. Introduction to Cryptography with Coding Theory- Wade Trappe, Lawrence Washington.

ICT- 4132 3 hours in a week, 1.50 Cr.

Cryptography Lab

Laboratory will cover topics from ICT-4131

ICT- 4133 3 hours in a week, 3.00 Cr.

Network Programming

Basic Networking Software (Protocol stacks, TCP/IP, HTTP, etc) Internet architecture and history, Elementary socket programming in C, Low level networking, Ethernet, ARP, The network layer, IP, DHCP, NAT, The network layer, routing, Transport layer protocols, TCP, UDP, The socket interface (writing clients and servers) Advanced socket programming, non-blocking sockets, Server design , daemons, Network Programming in Java, DNS, email, HTTP, cookies, P2P Web services (XML, JSP, SOAP, etc) XML, DTDs, Schemas, XML Parsing, XSLT, Client side scripting, Javascript, AJAX, Web server technologies, Tomcat, servlets, Web server technologies, JSP, Web server, technologies, RPCs, Java RMI, XML-RPC, CORBA, Server scripting languages, PHP, Ruby Web services, SOAP, The Semantic Web.Network security Cryptography, authentication, digital signatures, Network security, Kerberos, IPSec, SSL, Implementation of security, Anonymity on the Web, tor, Multimedia and VoIP, RTP.

Reference Book(s):

1. UNIX Network Programming- Richard Stevens - Prentice Hall.
2. UNIX System Programming using C++ - Terrence Chan.
3. The Design of the UNIX Operating System- Maurice Bach- Prentice Hall.

ICT- 4134 3 hours in a week, 1.50 Cr.

Network Programming Lab

Laboratory will cover topics from ICT-4133

4th Year, 2nd Semester

ICT- 4000 6 hours in a week, 3.00 Cr.

Project and Thesis

ICT4201 3 hours in a week, 3.00 Cr.

Computer Peripherals and Interfacing

Interfacing: Clock and Bus Controller interfacing: Clock generator, Bus demultiplexer, Bus controller interfacing, Memory Interfacing: SRAM and EEPROM Interfacing, Types of I/O: Parallel I/O, Programmed I/O, Interrupt Driven I/O, I/O port address decoding, Programmable Peripheral Interface (8255A), Interface examples– Keyboard matrix, LCD/7-Segment Display, Printer, stepper motor, A/D and D/A converter, Timer Interfacing: The 8254 Programmable Interval Timer (PIT), Timing applications, Serial I/O Interface: Asynchronous and synchronous communication, Physical communication standard-EIA RS232, Programmable Communication Interface, Interfacing serial I/O devices- mouse, modem, PC Keyboard, Interrupts: Interrupt driven I/O, Software & Hardware interrupts, Interrupt vectors and vector table, Interrupt processing, Programmable Interrupt Controller (8259A), DMA: DMA Controller(8237).

Reference Book(s):

1.Computer Peripherals – Barry Wilinson – Pearson Educaion
2.Microprocessor and Interfacing – Dauglas V Hall - McGraw Hill

ICT4202 3 hours in a week, 1.50 Cr.

Computer Peripherals and Interfacing Lab

Laboratory will cover topics from ICT-4201

ICT4203 3 hours in a week, 3.00 Cr.

Web Engineering

Introduction: The Internet model, Web browsers, Useful tools, Layers of the Internet World Wide Web, Domain Name Service, Uniform Resource Locator, Overview of Web Applications.
Web programming using HTML and XHTML: History of Markup Language, HTML Basics, Tags, Formatting Text, Creating Links, Adding Images, Lists, Tables, Frames, Forms, Cascading Style Sheets (CSS), Graphics.
JavaScript: Introduction to JavaScript, JavaScript syntax, Variables, Simple functions. PHP: Generating HTML Dynamically, Processing Forms, Maintaining State in Web Applications, Cookies, Data Tier, Back-end Database Support, SQL Primer, Database Interface in PHP, Searching in Web Applications, Regular Expressions and Matching, Multimedia and Interactivity, Audio on the Web, Video on the Web.

Reference Book(s):

1. Learning Web Design: A Beginner's Guide to (X)HTML, StyleSheets, and Web Graphics - Aaron Gustafson- O'REILLY.
2. PHP and MySQL Web Development. - Laura Thomson - O'REILLY.
3. Learning JavaScript - Shelley Powers- O'REILLY.
4. Professional ASP.NET 2.0 AJAX. - Dan Wahlin – WEOX.
5. AJAX and PHP: Building Modern Web Applications. - Cristian Darie – PACKT.

ICT4204 3 hours in a week, 1.50 Cr.

Web Engineering Lab

Laboratory will cover topics from ICT-4203

Optional-II (Communication Technology Related Courses)

ICT 4209 3 hours in a week, 3.00 Cr

VLSI Design

VLSI design methodology: top-down design approach, technology trends and design automation algorithms; Introduction to CMOS inverters and basic gates; Brief overview of CMOS fabrication process: layout and design rules; Basic CMOS circuit characteristics and performance estimation; Buffer circuit design; Complex CMOS gates, CMOS building blocks: adder, multiplier; data path and memory structures. Hardware modeling: hardware modeling languages, logic networks, state diagrams, data-flow and sequencing graphs, behavioral optimization. Architectural Synthesis: circuit specification, strategies for architectural optimization, data-path synthesis, control unit synthesis and synthesis of pipelined circuits. ASIC design using FPGA and PLDs.

Reference Book(s):

1.VHDL Analysis and Modeling of Digital Systems- Navabi, Zainalabedin- Mcgraw Hill
2. VHDL Programming by Example- Douglas L Perry

ICT- ICT4210 3 hours in a week, 1.50 Cr.

VLSI Design Lab

Laboratory will cover topics from ICT-4209

ICT- 4211 3hours in a week, 3.00 Cr.

Optical Networks

Introduction: Light propagation through optical fiber: Ray optics theory and mode theory.
Optical fiber: Types and characteristics, transmission characteristics, fiber joints and fiber couplers. Light sources: Light emitting diodes and laser diodes.
Detectors: PIN photo-detector and avalanche photo-detectors. Receiver analysis: Direct detection and coherent detection, noise and limitations. Transmission limitations: Chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises.
Optical amplifier: Laser and fiber amplifiers, applications and limitations. Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and optical CDMA. Ra dio on fibre technology, Fibre optic access networks.

Reference Book(s):

1. Optical Fiber Communications: Principles & Practice - John M. Senior- Prentice Hall of India.
2. Fiber Optic Communications - D C Agrawal- Wheeler Publishing.
3. Fiber Optic Communication System - Gerd Keiser- McGraw-Hill International.
4. Optical Communication System - John Gower- Prentice Hall of India.
5. Modern optical Engineering the Design of Optical Sys. – J. Smith- SPIE Press McGraw-Hill.

ICT- 4212 3 hours in a week, 1.50 Cr.

Optical Networks Lab

Laboratory will cover topics from ICT-4211

ICT-4213 3hours in a week, 3.00 Cr.

Optical Wave guide theory and Photonics

Introduction: Overview of fiber communication technology and its major enabling components (modulators, transmitters, receivers, fibers, and amplifiers).

Electromagnetic theory of optical waveguides: Symmetric and asymmetric slab dielectric waveguides, TE and TM modes, radiation modes; Optical fibers, pulse propagation, group velocity

dispersion, modal dispersion, chromatic dispersion, fiber birefringence and polarization.

Numerical methods in photonics: Beam propagation modeling, finite-difference time-domain techniques. Software tools.

Optical coupling in waveguides: Waveguide transitions and junctions, directional coupler, splitters, routers, combiners, integrated Mach-Zehnder interferometers, signal multiplexing & demultiplexing, add-drop components.

Optical transmitters and receivers: Solid-state and semiconductor lasers, Bragg lasers, distributed feedback lasers, VCSELs, fiber lasers, tunable lasers, semiconductor photodetectors, methods of radiation modulation.

Optical amplifiers: Semiconductor optical amplifier, rare-earth doped fiber amplifiers, gain and amplified spontaneous emission modeling, optical noise in amplifiers, Raman amplifiers.

Wave descriptions: spectrum, superposition, interference effects, photon effects: photoelectric effect, momentum, interaction with matter.

Characteristics of light: polarization, coherence, monochomaticity; The LED and laser diode, p-n junction, heterojunction and stripe geometries.

Reference Book(s):

1. Optical Waveguides – Maria L. Calvo- CRC Press
2. Guided Wave Photonics – Le Nguyen Binh – CRC Press
3. Fundamental of Optical Waveguides – Katsunari Okamoto – AP Press

ICT4214 3 hours in a week, 1.50 Cr.

Optical Wave guide and theory and Photonics Lab

Laboratory will cover topics from ICT-4213

ICT- 4215 3hours in a week, 3.00 Cr.

Radio Communication and Engineering

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 channel, parameters of multipath channel, type of small scale fading, Rayleigh and Ricean and Distribution; Media Access Control: FDMA, TDMA, and CDMA, Aloha, CSMA, MACA.

Reference Book(s):

1. Modern wireless communication- Simon Haykin – Pearson Education
2. Fundamental of Wireless Communication- David Tse, Pramod Viswanath- Cambridge.

ICT-4216 3 hours in a week, 1.50 Cr.

Radio Communication and Engineering Lab

Laboratory will cover topics from ICT-4215

ICT-4217 3hours in a week, 3.00 Cr.

Information Theory and Coding

Basics: Introduction to Information system, the nature of information and use in managerial decision making. Technical Foundation of IS: Brief introduction to Computer hardware, software, telecommunication and network, database design & management, client server computing.

Business applications of IS: Decision support systems & executive IS; artificial intelligence, expert systems & neural network; Office automation; business IS. 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, review of probability theory, entropy, mutual information, data compression ; Coding: principles encoding, audio, video, and images at low bit rates. Huffman coding, Source coding techniques, scalar and vector quantization, orthogonal transforms, and linear prediction are introduced and performance analyzed theoretically, asymptotic equipartition property, universal source coding, channel capacity, differential entropy, block codes and convolutional codes.

Reference Book(s):

1. Fundamentals in Information Theory and Coding- Monica Borda- Springer.
2. Information Theory and Coding- Varun Goyal- Katson Book
3. Management Information Systems- Uma G. Gupta -Galgotia Publications Private Ltd.

ICT-4218 3 hours in a week, 1.50 Cr.

Information Theory and Coding Lab

ICT-4219 3hours in a week, 3.00 Cr.

Multimedia Communication

Introduction; Coding and Compression Standards; Operating Systems issues in multimedia - Real-time OS issues, Synchronization, Interrupt Handling; Database issues in Multimedia - Indexing and Storing multimedia Data, Disk placement, Disk scheduling, Searching for a Multimedia document; Networking issues in multimedia, Versions of passive optical network PON, GPON, ONU, Quality-of-service guarantees, resource reservation, traffic specification, shaping, and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions; partial encryption schemes for video streams; Multimedia applications - audio and video conferencing, video on demand, voice over IP; Hypermedia, immersion, narrativity, cybernetic system, hands-free tracking system, business modeling for multimedia, business modeling of values, operations and objects, specifying requirements; multimedia case studies, evaluation methods, evaluation of structure, evaluation of the interaction, evaluation of the usability, evaluation of the productivity; multimedia database, inquiry, ISO report: conceptualization, general concept and definitions, constraints and rules or law, classification, generalization; service models, integrated services, differentiated services, security definitions, security metrics, security parameters.

Reference Book(s):

1. Multimedia – Robert Burnett, Anna Brunstrom – Wiley
2. Wireless Multimedia Communication System – K.R. Rao – CRC Press

ICT-4220 3 hours in a week, 1.50 Cr.

Multimedia Communication Lab

Laboratory will cover topics from ICT-4219

ICT-4221 3hours in a week, 3.00 Cr.

Advanced Telecommunication Engineering

Introduction: Principle, evolution, networks, exchange and international regulatory bodies. Telephone apparatus: Microphone, speakers, ringer, pulse and tone dialing mechanism, side -tone mechanism, local and central batteries and advanced features. Switching system: Introduction to basic of switching system, manual switching system, analog system,step-by-step switching system, design parameters, 100-line switching system, 1000-line blocking exchange, 10,000-line exchange, combination switching, three-stage combination switching, n-stage combination switching, digital

switching systems – space division switching, blocking probability and multistage switching, time division switching and two dimensional switching; simple telephone communication; major telecommunication network, stored program control, software architecture, application software, enhanced services, two-stage networks, three-stage networks; Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. Modern telephone services and network: Internet telephony, facsimile, integrated services digital network, asynchronous transfer mode and intelligent networks. Introduction to cellular telephony and satellite communication.

Reference Book(s):

1. Digital Switching Systems - Syed R. Ali- McGraw Hill international.
2. Digital Telephony - John Bellamy- John Wiley & Sons, Inc.
3. Telecommunication Switching Systems and Networks – Thiagarajan Viswanathan- Prentice Hall of India.
4. Telephones and Telegraphy – S.F. Smith- Oxford University Press.

ICT-4222 3 hours in a week, 1.50 Cr.

Advanced Telecommunication Engineering Lab

Laboratory will cover topics from ICT-4221

ICT-4223 3hours in a week, 3.00 Cr.

Network Planning and Spectrum Management

Concepts of network operating system, streaming technology, inter process communication (IPC) between application programs, Abstract Syntax Notation ,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. Spectrum Management: spectrum engineering fundamentals, legal basis and regulatory frame works of spectrum management, spectrum monitoring, type's approval of equipment, spectrum monitoring for different systems and services, socio economic impact of spectrums regulation.

Reference Book(s):

1. Radio Network Planning and optimization – Jaana Laiho, Achim Wacker- Wiley.
2. Network Management – Mani Subramanian- Pearson.

ICT-4224 3 hours in a week, 1.50 Cr.

Network Planning and Spectrum Management Lab

ICT-4225 3hours in a week, 3.00 Cr.

ICT Project Management

Reference Book(s):

ICT-4226 3 hours in a week, 1.50 Cr.

ICT Project Management Lab

Laboratory will cover topics from ICT-4225

ICT-4227 3 hours in a week, 3.00 Cr.

Wireless Sensor Network

Introduction: applications; Localization and tracking: tracking multiple objects; Medium Access Control: S-MAC, IEEE 802.15.4 and ZigBee; Geographic and energy-aware routing; Attribute-Based Routing: directed diffusion, rumor routing, geographic hash tables; Infrastructure

establishment: topology control, clustering, time synchronization; Sensor tasking and control: task-driven sensing, information-based sensor tasking, joint routing and information aggregation; Sensor network databases: challenges, querying the physical environment, in-network aggregation, data indices and range queries, distributed
hierarchical aggregation; Sensor network platforms and tools: sensor node hardware, sensor network programming challenges; Other state-of-the-art related topics.

Reference Book(s):

1. Wireless Sensor Network- Feng Zhao, Leonidas Guibas- MK Education.
2. Al- Sakib Khan Pathan, Nabil Ali Alrajeh- CRC Press.

ICT- 4228 3 hours in a week, 1.50 Cr.

Wireless Sensor Network Lab

Laboratory will cover topics from ICT-4227

ICT-4229 3 hours in a week, 3.00 Cr.

Antenna and Propagation

Introduction of dimensions and units, fundamental and secondary units, symbols and notation, dimensional analysis, the electromagnetic spectrum and radio frequency band; Antenna basics: basic antenna parameters, patterns, beam area, radiation intensity, directivity and resolution, antenna apertures, effective height, radio communication link, fields from oscillating dipole, antenna field zones, shape-impedance considerations, linear, elliptical and circular polarization, the polarization ellipse and the Poincare sphere, signal-to-noise radio, antenna temperature, antenna impedance, front-to-back ratio, antenna theorems. Dipole/monopole, wire antennas, loop antennas, slot antennas, horn antennas, patch antennas, reflector antenna, lens antennas, helical antennas , wide band antennas, antenna arrays, dipoles and slots, flat-sheet reflector antennas, end-fire antennas, broad bandwidth antennas, the patch antenna, patch array and grid array; Vector analysis: scalars and vectors, vector algebra, vector components, unit vectors, vector field, dot product, cross product; Electric field law, field of a line charge, field of a sheet of charge, streamlines and sketches of fields, electric flux density, gauss's law, application of gauss's law, divergence, line integral, potential difference and potential, potential field of a point charge; Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of image, semiconductors, nature of dielectric materials, boundary conditions, capacitance, capacitance of a two-wire line, current analogies; Force on a moving charge, force on a differential current element, force and torque on a closed circuit.

Reference Book(s):

1. Antenna and Propagation- J.D Kraus –McGraw Hill.
2. Engineering Electromagnetics – W. H. HaytJr& John A. Buck- McGraw Hill.
3. Fields and Waves in Communication Electronics - Simon Ramo;
4. Fundamentals of Engineering Electromagnetic - D.K. Cheng – Pearson Education

ICT-4230 3 hours in a week, 1.50 Cr.

Antenna and Propagation Lab

Laboratory will cover topics from ICT-4229