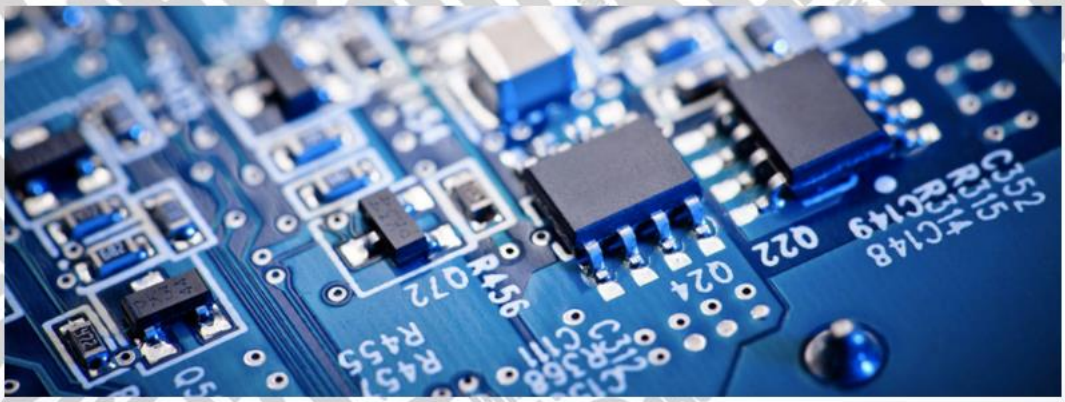
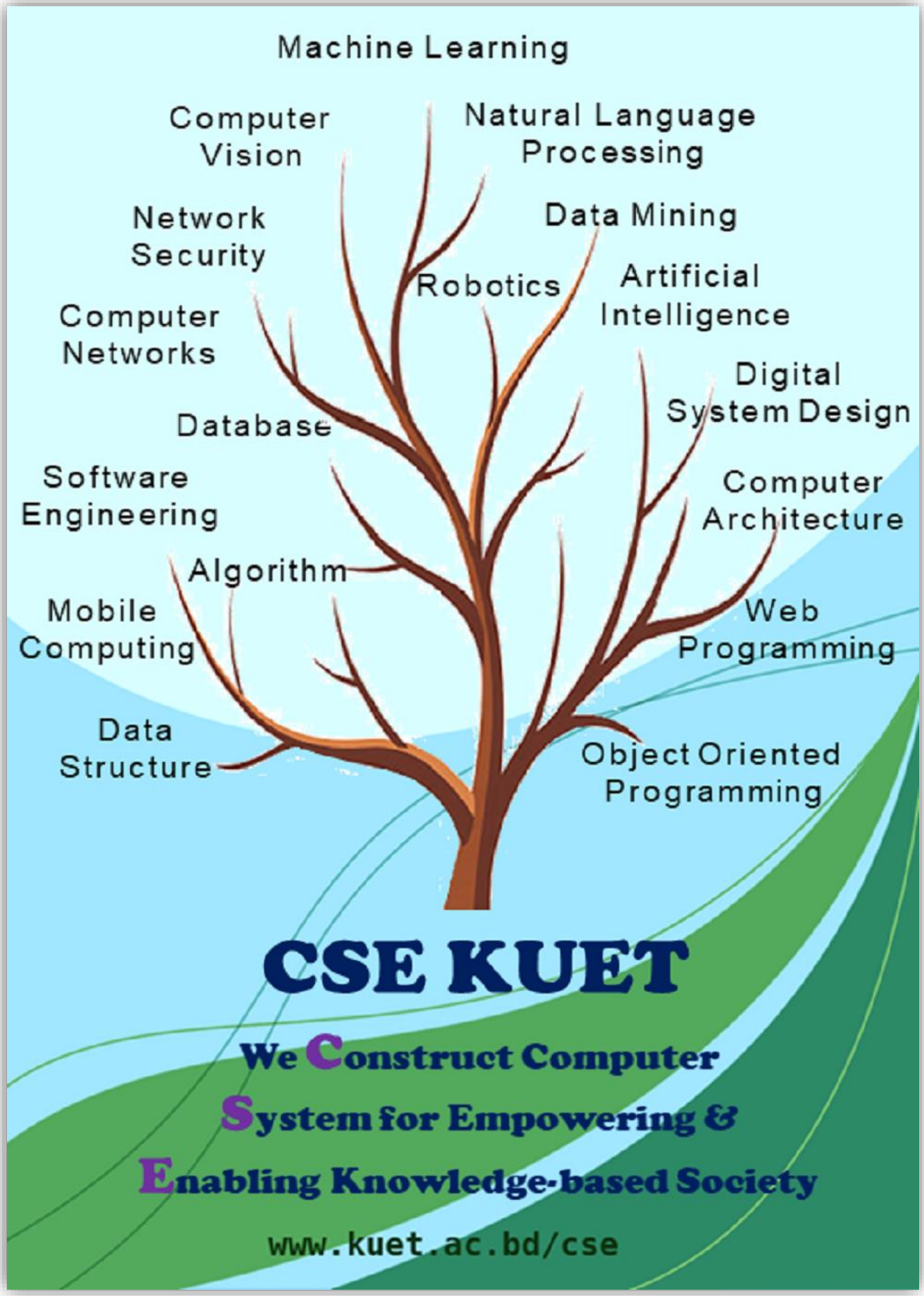
Department of Computer Science and Engineering

INFORMATION BOOKLET



Khulna University of Engineering & Technology


Machine Learning
Computer Vision
Natural Language Processing
Network Security
Data Mining
Robotics
Artificial Intelligence
Computer Networks
Digital System Design
Database
Software Engineering
Computer Architecture
Algorithm
Mobile Computing
Web Programming
Data Structure
Object Oriented Programming
CSE KUET
We Construct Computer System for Empowering & Enabling Knowledge-based Society
www.kuet.ac.bd/cse

CSE KUET at a Glance

- **Degrees Offered**: B. Sc. Eng., M.Sc. Eng. and Ph. D.
- **Undergraduate Program:** UG started on September, 1999 with 60 yearly intake which was increased to 120 from 2016.
- **Postgraduate Programs:** PG (M.Sc. and Ph.D.) started on 2009 with 20 yearly intake which was increased to 40 from 2018.
- **UG Syllabus Editions:** 1st Edition (1999 to 2006), 2nd Edition (2007 to 2014), 3rd Edition (2015 to Present).
- **Functional Bodies:** Departmental Monitoring Committee, Academic Committee for Undergraduate Studies, Academic Committee for Postgraduate Studies, Student Adviser and Course Coordinator.
- **Research and Consultancy:** Research in Distinctive CSE Fields, Research based Collaboration, System Automation, Requirement Analysis of Automation, Database Design, Large Scale Network Design, etc.
- **Co-Curricular Activities:** Hardware Acceleration Club of KUET, Special Group Interested in Programming Contest, Bit to Byte, etc.
- **CSE Association:** Student Association to Organize Programming Contests and Arrange Tournaments, Cultural Activities, etc.
- **Other Activities:** Cisco Networking Academy Program, Training, Workshop, Seminar, etc.

Department of Computer Science and Engineering

Information Booklet

Khulna University of Engineering & Technology

Published by the Department of Computer Science and Engineering
Khulna University of Engineering & Technology
Khulna-9203, Bangladesh
Telephone: +880-41-774318
Fax: +880-41-774318
E-mail: head@cse.kuet.ac.bd, Website: www.kuet.ac.bd/cse/
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Editorial Committee
Dr. M. M. A. Hashem
Dr. K. M. Azharul Hasan
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Mr. Sunanda Das

Cover Design
Shariful Islam Mubin (CSE'14 Batch)
Tawhid Joarder (CSE'14 Batch)

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Disclaimer

The information contained in this booklet are intended to provide a guidance to those concerned with undergraduate and postgraduate studies in the Department of Computer Science and Engineering (CSE), No responsibility will be borne by the Department of Computer Science and Engineering or Khulna University of Engineering & Technology (KUET), if any inconvenience or expenditure is caused to any person because of the information of this booklet or any error in quoting the rules and regulations described herein. Also, the information contained here are subject to change at any time without any prior notification.

Preface

This Information Booklet is published for the guidance of undergraduate and post graduate students of the Department of Computer Science and Engineering (CSE) who will follow the Course Credit System at Khulna University of Engineering & Technology (KUET), Khulna, Bangladesh. This Booklet provides valuable information to the Faculty Members, Students Advisers, and Interested Persons.

In this booklet individual gets the integrated form of general information about this University, its historical background, faculties, departments, administration, and list of Faculty members in the Department of CSE. It introduces the different aspects of the Course Credit System such as rules and regulations relating to admission, credit structure, course offering instructions, attendance, teacher-student interaction, grading system, performance evaluation, requirement for degrees, etc. This Booklet also provides the detail course outline and courses offered in different terms for the students of the Department.

The information herein may be altered or modified from time to time by the proper authority of this University to meet the modernization of science and technology. Such changes or modifications will be informed to the students by the authority of the University. However, the students are stoutly advised to be in touch with their respective advisers regarding any enquiry of this booklet and modifications or changes that may be introduced by the authority afterwards.

This edition contains the updated information about different courses according to the decisions of the 55th and 60th meeting of Academic Council. Finally, we hope that the information provided in this brochure will be huge valuable to undergraduate, postgraduate students and to all other interested.

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Khulna University of Engineering & Technology (KUET)

Prelude

Khulna University of Engineering & Technology (KUET) is one of the technological universities in Bangladesh. It was established as Khulna Engineering College in 1974, it was later converted to a degree awarding autonomous institution called Bangladesh Institute of Technology (BIT), Khulna in 1986. With a view to providing more opportunity and autonomy for the improvement in the quality of higher education and research in engineering and technology, the Institute was upgraded and renamed as Khulna University of Engineering & Technology (KUET) in 2003. Its campus extends over an area of 101 acres. Tastefully laid out with beautiful plantation and with buildings of various nature and stature, clean and wide roads, the campus presents a spectacle of harmony in architecture and natural beauty. KUET combines traditional focus on excellent teaching and research with a desire to seek new ways of developing standardized education and intellectuals. Its mission is to flourish application of engineering knowledge through teaching, research and artistry. Its vision is to be perceived and acknowledged as the outstanding public university to the nation. KUET strives to be a community of scholars and a center for learning and developing knowledge-based capabilities which will promote academic achievements and research excellence. With such mission and vision, it is advancing to be a leading engineering university that educates students to identify and develop their individual talents for successful lives.

Location and its Surroundings

The campus is located at Fulbarigate, about 13 km north from the Khulna City near the Khulna-Dhaka highway. Govt. B. L. College is located 4 km away from this campus to the southern side of it. Teacher's Training College, Technical Training Center etc. are located at the western side and the Jahanabad Cantonment is located at the northern side of KUET campus. The Khulna-Dhaka highway is passing through the eastern side of the campus.

Faculties and Teaching Departments

Currently the University has twenty (20) teaching departments under three faculties. All departments, with the exception of the department of Humanities, offer degree programs. However, some of them offer Postgraduate (PG) degrees only and other offers both Undergraduate (UG) as well as PG degrees. Faculty wise list of the departments with the status of the degree offered is given below

Faculty of Civil Engineering

Dept. of Civil Engineering	Both UG and PG
Dept. of Urban and Regional Planning	Both UG and PG
Dept. of Building Engineering and Construction Management	UG only
Dept. of Architecture	UG only
Dept. of Physics	PG only
Dept. of Chemistry	PG only
Dept. of Mathematics	PG only
Dept. of Humanities	---

Faculty of Electrical and Electronic Engineering

Dept. of Electrical and Electronic Engineering	Both UG and PG
Dept. of Computer Science and Engineering	Both UG and PG
Dept. of Electronics and Communication Engineering	Both UG and PG
Dept. of Biomedical Engineering	Both UG and PG
Dept. of Materials Science and Engineering	UG only

Faculty of Mechanical Engineering

Dept. of Mechanical Engineering	Both UG and PG
Dept. of Industrial Engineering and Management	Both UG and PG
Dept. of Energy Science and Engineering	Both UG and PG
Dept. of Leather Engineering	Both UG and PG
Dept. of Textile Engineering	UG only
Dept. of Chemical Engineering	UG only
Dept. of Mechatronics Engineering	UG only

Academic Program

Undergraduate Program	Four (04) years Bachelor of Science in Engineering degree
Postgraduate Program	Master of Science in Engineering (M. Sc. Eng.) or Master of Philosophy (M. Phil) and Doctor of Philosophy (Ph. D.)

The postgraduate courses are designed to meet the growing needs of engineering professions as well as further development of different specialized subjects of the above-mentioned areas.

Language of Instruction

Official language of instruction and examination is English. However, teachers may use native language. Bengali occasionally if no international students are present in the class.

Academic Facilities

To support the excellent and high quality academic environment, KUET maintains a number of academic units.

Central Computer Center

The Central Computer Center (CCC) has served over the years as the hub for computer related services in the campus. With the commissioning of the University-wide network, the CCC is in a unique position in providing computing and network facilities to the campus to serve the University. Now it has strong IT infrastructure with sufficient bandwidth, a router for routing, a firewall for Internet security, nine high configuration servers as Mail server, Proxy server, Database server, DNS server, Web server, seven midlevel configuration of workstations for other servers and backup server, a core switch, several manageable and unmanageable switches for intranet connectivity. At present there are about 600 network nodes through LAN connection. Internet service is also available to specific users through Wi-Fi. CCC maintains campus wide optical fiber backbone network which provides connectivity to all Faculties, Institutes, Departments, Centers, and Main Administrative Building, Web-based Email that enables all the faculty members and officers to access their mailbox from anywhere via the Internet. The CCC provides services daily from 9:00 am to 9:00 pm except weekends (Fridays & Saturdays) and holidays, though some services are available until late hours.

Library Facility

The library subscribes huge journals and materials. KUET operates two types of library system, General Library and Reference Library. The General Library provides in house reading and short duration borrowing opportunity of book and other reference material to the students and faculties. The Reference Library provides the in place reading. All students and faculties can enjoy these facilities for more than 10 hours in every working day. Audio-visual systems are available for studying audio and video documents. Right now the General Library System has more than 53,342 books and 3,126 Journals and periodicals in its collection. The library operations are full automated by KOHA integrated library system. Moreover, Central Library enriches every year by collecting recent books and journals. Besides the general library system, each academic department maintains rent-based library from which students can borrow textbooks at a nominal rate for one semester. There is a digital library access center at the library to access e-journals and materials with modern computers, servers and switches.

Campus Life

The university has 101 acres large campus with nice green landscape blended with beautiful architectural constructions. The Khulna City is the third largest metropolitan city of Bangladesh having population around 1.5 million. The city is surrounded by nice countryside and the river Rupsha. Newly constructed Khan Jahan Ali bridge connected the city with Mongla port and south-west region of Bangladesh. Sundarbans, the world's largest mangrove forest, is prevailing near the city. The city has also housed with some of the major industries of Bangladesh.

Climate

Being a part of tropical climate region, Bangladesh has warm and humid weather. The three main seasons prevailing in this country are winter (November-February), summer (March-June) and rainy (July-October). However, there are three more seasons available in between these seasons namely spring, autumn and late autumn, but their effects are not predominant. The warmest days in Khulna region are between April and June with temperature ranging from 30°C to 37°C. Winter temperatures usually vary between 8°C to 20°c. Humidity is high (70-90%) in summer and rainy seasons but moderate in winter (50-70%).

Accommodation

Six nice residential halls can accommodate more than 2000 male students and one female hall can accommodate 400 female students in the campus. Four students have to share a large room and common rest room in the residential halls. Each residential hall is equipped with modern recreational facilities like Cable TV connection, common room, reading room, library and a well-equipped guestroom. Social, cultural and other co-curriculum activities are scheduled throughout the semester/term to offer breaks in tedious study routine. One Provost and one/more Assistant Provost are appointed from the faculty members to look after the administration of each hall.

Sports and Entertainment

Both indoor and outdoor sports facilities are available for refreshment of the students. The physical education section of the university under the control of Director of Students Welfare (DSW) arranges central indoor and outdoor sports competition annually. The university also organizes annual cultural competitions and occasional cultural programs on some special events like celebration of different national days, university foundation day, New Year’s Eve etc. Besides, a number of cultural and social groups like theater group, debating society etc. are also active in the campus. The university team also attends different national level sports and cultural competitions and shows excellent performance.

Transportation
For the convenience of the students, faculty members, officers and staffs, KUET operates its own Shuttle Bus Service between Khulna city and the campus. In weekends special services are also provided to meet the weekend recreational and other needs.

Student Union
The Student Union of KUET is a student organization to promote the interests and welfare of the student body. All full-time students are members of the student union who vote for the office bearers of it. The DSW is the President of the Student Union as ex-officio appointed by the university authority from the senior faculty members. One more faculty member is appointed by the university authority as the treasurer of the student union. Moreover, a strong student welfare committee is also available for looking after the students' facilities in some special cases. Sports, cultural and social activities, indoor and outdoor games are organized regularly to keep the students' campus life pleasing.

Medical Center
The university operates a medical center for meeting the needs of students' health care and medical facilities. The center is equipped with necessary medical equipment, a modern ambulance and full time experienced medical doctors, nurses and assistance. Mostly medical counseling and in some cases, medicine are supplied to the students free of cost.

Food and Stationeries
Each residential hall has its own cafeteria, which serves two meals per day. Each hall authority maintains the cafeteria. Students are also involved in their daily menu. Special menus are provided in different occasions in the hall cafeteria. One annual grand dinner is also arranged in each hall in honor of outgoing students. Besides these a large central cafeteria and a fast food shop offers breakfast, meals and snacks etc. Moreover, in Khulna city, there are number of nice restaurants which serve a wide variety of food including oriental and western flavor. Any sorts of alcohol or alcoholic drinks are completely forbidden in the campus. A Departmental Store is also housed in the campus for the benefit of all.

Other Facilities
In the campus there is a water treatment plant to treat the water. There is also a large Mosque, a bank and a post office in the campus. To provide uninterrupted power supply an electrical substation is located in the campus. There are also Gymnasium and a large well-equipped auditorium.

Admission
The admission process of Khulna University of Engineering & Technology emphasizes to identify students who will be able to successfully complete the degree requirements of various disciplines of engineering as well as contribute to the social and techno-economical environment of the nation.

Undergraduate Admission
Applicants for the undergraduate program must pass the Higher Secondary Certificate (H.S.C.) or equivalent examination from any education board with science and must obtain a required minimum CGPA in Physics, Chemistry and Mathematics courses. The candidates who have completed a-level examination can also apply. The applicants have to go through a rigorous entry examination to be qualified for admission. The entry examination named as Admission Test consists of MCQ questions and short questions which covers current syllabus of Higher Secondary level Physics, Chemistry, Mathematics and English. The undergraduate admission is conducted once in each academic session.

Postgraduate Programs
Applicants for the masters programs must have B.Sc. Eng. degree or equivalent in the relevant field from a recognized University/Institute with good academic records. Students who have higher research aptitude are welcome to the program. KUET invites application twice in a year (January Term and July Term). The respective departments arrange an interview at a suitable time to select candidates for this program. The selected candidates have to take admission by depositing prescribed amount of money to the bank. Full-time and part-time students are there in this program. For full time meritorious students financial help can be provided. A part-time student must have consent from his employer to pursue postgraduate studies.

International Applicants
International applicants for both undergraduate and postgraduate program can apply throughout the year. Application materials and other information are available in the admission office. Inquires can be directed to the Registrar. According to the present policy of KUET, international student does not have to go through the entry examination procedure. However, they should have an excellent high school record or equivalent to be qualified for admission. The admission committee and equivalence committee (if necessary) takes decision about the eligibility of admission of the applicants. KUET always encourage international students to maintain wide cultural and social diversity in its campus. Students from SAARC (India, Pakistan, Nepal, Bhutan, Sri Lanka and Maldives) countries can apply through their concern ministries to the Ministry of

Education of Bangladesh to avail the special quotas, which are reserved under SAARC countries educational and cultural contract. These positions are limited. However, students from these countries can also apply independently. International applicants are required to submit two copies of official credentials and certificates along with two copies of passport size photographs. The completed application and above-mentioned documents should be reached to the Registrar's office along with $20 application-processing fee. For the postgraduate program applicants also have to submit two letters of recommendation. Inquires can be directed to:

Registrar
Khulna University of Engineering & Technology (KUET)
Khulna 920300, Bangladesh.
Tel: +880 41 774403, Fax: +880 41 774403

Administration

The university Syndicate is the supreme body for policymaking and other operational procedures. The syndicate forms different policy under the recommendation of different committees namely the Academic Council, Planning and Development Committee and the Finance Committee. Nationally and internationally recognized academicians, planners, and economists as well as distinguished faculties from KUET form these committees. The Vice-Chancellor is the administrative and academic head of the university. A non-formal advisory executive committee and advisory committee, formed by the senior faculties of different academic disciplines and hall provosts, helps the Vice-Chancellor in various decisions making. For the proper operation of different administrative services, the office of the Vice-Chancellor maintains various administrative sections namely Academic Section, Engineering Sections (maintenance and repairs), Establishment section, Accounts section, Security section, Procurements Section etc. Registrar is the custodian of records, the properties, the common seal and such other property of the university as the Board may commit to his charges. The Vice-Chancellor and the Comptroller control the fund of the university.

Department of Computer Science and Engineering (CSE)

The department of CSE provides an outstanding opportunity for students to get a quality education in Computer Science and Engineering. It started its academic activities from 26th September 1999 with 60 yearly intake which was increased to 120 from 2016. The department started postgraduate programs (M.Sc. and Ph.D.) in 2009 with 20 yearly intake which was increased to 40 from 2018. From the beginning, the department has been widely recognized for its excellent research and teaching capabilities. Students are enrolled in this department through a highly competitive entrance exam and only top rank students of the country get the change to admit.

The department maintains several functional bodies which are Departmental Monitoring Committee, Academic Committee for Undergraduate Studies, Academic Committee for Postgraduate Studies, Student Adviser and Course Coordinator. All the functional bodies work actively to enhance research and education quality of this department. The graduates from the department are heavily recruited by both academia and industry of home and abroad.

The department provides an outstanding research environment. Research outcomes of this department regularly publish in world-recognized journals/conferences. The major areas of research include Soft Computing, Robotics, Artificial Intelligence, Speech Processing, Natural Language Processing, Image Processing, Embedded Systems, Data Mining, Machine Learning, Computer Networks and Security, Networks, etc. Besides theoretical research, faculty of the department also maintain strong ties with many reputed national and international institutions and are involved in a large number of projects in the forefronts of cutting edge technology.

There are different clubs and groups in CSE department for co-curriculum activities such as Hardware Acceleration Club of KUET, Special Group Interested in Programming Contest, Bit to Byte, etc. Students are actively involved in the clubs and groups to explore their proficiency in different branches of CSE nursing their academic knowledge. The co-curriculum activities are performed based on established rules and regulations of the department. Computer Science and Engineering Association, another student body of the department, is also active in organizing lecture series, practical demos, tournaments and cultural activities.

Besides, the department also provides different Consultation Services which include Requirement Analysis of Software or Hardware, Database Design, Large Scale Network Design, Development of Automation System, etc. Others activities of this department include Cisco Networking Academy Program, Training, Workshop, Seminar, etc.

Vision of the Department

One of the visions of the department is to emphasize on developing analytical ability along with technical skills of the students. The department also thrives constantly for acquisition of knowledge towards development of computer technology and nurture the spirit of innovation in design and development of computer systems with superior performance.

Mission of the Department

As a scholarly community, both teachers and students are continuously engaged in innovative research and development. We have a commitment to be pioneer in research community in the various fields of Computer Science and Engineering. Advanced Computer Architecture, Bioinformatics, Computer Vision and Graphics, Computer Networks, Database and Data Warehouse, Evolutionary Algorithms, Interconnection Networks, Pattern Recognition and Machine Intelligence, Photonic Switching Network, and so on, this will be helpful for all the research community, both national and international arena. We would like to open the new frontiers of Computer Science and Engineering. We always try for the development of a Research Quality Framework (RQF). The aim of the RQF initiative is to develop the basis for an improved assessment of the quality and an effective process to achieve this.

We maintain the highest standard of teaching both for theory and laboratory courses. To develop quality teaching materials, we effectively utilize various educational tools and technologies. We highly encourage the collaboration with other technical institutes and industries for sharing our expertise. We instill students with professional ethics and moral values, critical and independent thinking, sound judgment, prolonged thirst for lifelong learning, and communication ability.

Student Clubs and Groups

There are different clubs and groups in CSE department for co-curriculum activities. Students are actively involved in the clubs and groups to explore their proficiency in different branches of CSE nursing their academic knowledge. The co-curriculum activities are performed based on established rules and regulations of the department. Head of the department is the Chief Patron of all the clubs and groups and two/three teachers are involved as moderators in each group.

Special Group Interested in Programming Contest (SGIPC)

SGIPC arranges workshops and contests on a regular basis to develop the skills of the members. Moreover, it offers a platform to the Competitive Programming Community of KUET by training members on algorithms, data structure, mathematics, geometry, probability theory, game theory and different problem-solving paradigms which helps them in their academic and professional life.

Hardware Acceleration Club of KUET (HACK)

The aim of HACK is to develop skills in different aspects related to hardware especially in real-life hardware project development. HACK always encourages its members with essential guidelines to build up their career as an expert hardware engineer. It organizes hands-on workshops on robotics, embedded systems development and many more.

Bit to Byte (B2B)

The central perspective of B2B club is to encourage the members on software development. B2B arranges various sessions where members can learn the different tips and techniques for software development. It also organizes multiple workshops, boot camps and practice sessions related to programming and software development.

Internet of Things Club (IoTC)

IoTC helps its members understanding the underlying concept of the Internet of Things. This club shows how to start with IoT and how to proceed effectively. IoTC not only inspires members but also provides them with necessary suggestions and helps.

Animation and Game Development Club (AGDC)

AGDC assists members to develop a game successfully. It provides a guideline on how to design games and animations, how to make them more attractive and how to advertise for the game. It highly encourages members to build up their career in this challenging industry.

Machine Learning and Computing Intelligence Group (MLCIG)

MLCIG makes its members acquainted with machine learning and computer intelligence to address complex real world problems. It encourages members to build up their career through research and development intelligent systems.

Robotics and Artificial Intelligence Club (RAIC)

RAIC aims to support and foster interest in various aspects related to robotics. The main goal of this club is to understand the basic principles of robotics, its control and participating in the various competitions. RAIC provides necessary information about robotics and guidelines on how to build a robot in real life.

Cyber Security Club (CSC)

CSC focuses on developing skills on cyber security. It helps members to understand the underlying security standards and their implementation. It also provides members necessary resources to obtain the technical expertise.

English Speaking and Career Club (ESCC)

A considerable percentage of CSE graduates opt scholarships for higher education and jobs in abroad. With regular seminars and workshops, ESCC ensures that the members never lag with the fast-moving world. The club also provides necessary suggestions and helps for getting good IELTS or GRE score.

Departmental Contact

Tel : +880-41-774318
PABX : +880-41-769468-75, +880-1711-428800
Office Secretary : 350
Fax : +880-41-774318
E-mail : head@cse.kuet.ac.bd
Website : www.kuet.ac.bd/cse

Faculty Members (up to November, 2018)

1. **Dr. M. M. A. Hashem** **Professor**
   B.Sc. Engg. (EEE), KUET; M.Sc. Engg. (CSE), AIT; Ph.D. (Artificial Intelligence Systems), Japan.
   Fellow of IEB, Member of IEEE Computer Society, Life Fellow of BAAS.
   Research fields: Artificial/Computational Intelligence, Distributed Evolutionary Computations, Intelligent Computer/Sensor Networking, Grid/Cloud Computing, Security and Trust in Cloud Environment, Biomedical Instrumentations, Intelligent Robotics, Data/Text Mining using Big-Data Analytics.
   PABX Ext: 351 | **Mobile:** +880-1714-003949
   Email: hashem@cse.kuet.ac.bd, mma.hashem@gmail.com
   Website: www.kuet.ac.bd/cse/hashem

2. **Dr. K. M. Azharul Hasan** **Professor**
   B.Sc. Engg. (CSE), KU; M.Sc. Engg. (CSIM), AIT; Ph.D., Japan
   Member of IEEE, Fellow of IEB.
   Research fields: Big Data Analytics, High Performance Computing, GPU Computing and Natural Language Processing.
   PABX Ext: 355 | **Mobile:** +880-1714-087273
   Email: az@cse.kuet.ac.bd, azhasan@gmail.com
   Website: www.kuet.ac.bd/cse/azhasan

3. **Dr. Kazi Md. Rokibul Alam** **Professor**
   BB.Sc. Engg. (CSE), KU; M.Sc. Engg. (CSE), BUET; Ph.D., Japan
   Member of IEB.
   Research fields: Applied Cryptography, Information Security, Machine Learning and its Applications, Deep Learning
   PABX Ext: 365 | **Mobile:** +880-1714-087216
   Email: rokibcse@yahoo.com, rokib@cse.kuet.ac.bd
   Website: www.kuet.ac.bd/cse/rokib

4. **Dr. Muhammad Sheikh Sadi** **Professor**
B.Sc. Engg. (EEE), KUET; M.Sc. Engg., BUET; Ph.D. (Computer Systems Engineering), Australia
Member of IEB
Research fields: Soft Error Tolerance, Error Correction Coding Theory, Hardware Redundancy for Fault Tolerance, Humanitarian Technology, Internet of Things (IoT).
PABX Ext: 353 | **Mobile:** +880-1676-077989
Email: sadi@cse.kuet.ac.bd
Website: www.kuet.ac.bd/cse/sadi

5. **Dr. Md. Aminul Haque Akhand** **Professor**
B.Sc. Eng.(EEE), KUET; M. Eng. (AI), Japan; Ph.D. (Sys. Design), Japan
Member of IEEE, Member of IEB, Member of BCS.
Research fields: Machine Learning, Deep Learning, Swarm Intelligence, Pattern Recognition and Bioinformatics.
PABX Ext: 363 (Off.) / 364 (Res.) | **Mobile:** +880-1714-087205
Email: akhand@cse.kuet.ac.bd, akhandkuet@yahoo.com
Website: www.kuet.ac.bd/cse/akhand

6. **Dr. Pintu Chandra Shill** **Professor**
B.Sc. Engg. (CSE), KUET; M.Sc. Engg., Italy; Ph.D., Japan
Member of IEB.
Research fields: Fuzzy System, Evolutionary Algorithm, Genetic Algorithm and Artificial Intelligence.
PABX Ext: 375 | **Mobile:** +880-1716-078655
Email: pintu@cse.kuet.ac.bd, pintu98cse@yahoo.com, lpintucskuet@yahoo.com
Website: www.kuet.ac.bd/cse/pintu

7. **Dr. Sk. Md. Masudul Ahsan** **Professor**
B.Sc. Engg. (CSE), KUET; M.Sc. Engg., KUET; Ph.D., Japan
Member of IEEE, Member of IEB.
Research fields: Computer Vision, Image Processing, Deep Learning, Motion Estimation, High-dimensional Database Systems.
PABX Ext: 8369 (Off.) / 8370 (Res.) | **Mobile:** +880-1714-087283
Email: smahsan@cse.kuet.ac.bd, masudul.ahsan@gmail.com
Website: www.kuet.ac.bd/cse/smmasudul

8. **Mr. Md. Abdus Salim Mollah** **Assistant Professor**
B.Sc. Engg. (CSE), KUET; M.Sc. Engg., BUET
Member of IEB.
Research fields: Artificial Intelligence, Pattern Recognition and Machine Intelligence and Digital System Design.
PABX Ext: 357 | Mobile: +880-1714-087258
Email: salim9326@yahoo.com
Website: www.kuet.ac.bd/cse/salim9326

9. **Mr. Md. Kowsar Hossain** **Assistant Professor**
B.Sc. Engg. (CSE), KUET; M.Sc. Engg., Canada
Member of IEB.
Research fields: Evolutionary Algorithm, Wireless Sensor Networks (WSNs) and Vehicular Adhoc Networks (VANETs).
PABX Ext: / | **Mobile:** +880-1717-283379
Email: auvikuet@yahoo.com
Website: www.sites.google.com/site/khossaincse

10. **Mr. G. M. Mashrur-E-Elahi** **Assistant Professor**
B.Sc. Engg. (CSE), KUET
Member of IEB
Research fields: Computer and Wireless Mobile Networks, Database Systems, Evolutionary Computing, Bangla Language Processing and Multi-Objective Optimization.
PABX Ext: / | **Mobile:** +880-1716-887921
Email: ranju2k4cse_kuet@yahoo.com
Website: www.kuet.ac.bd/cse/melahi

11. **Mr. Al-Mahmud** **Assistant Professor**
B.Sc. Engg. (CSE), KUET; M.Sc. Engg. (CSE), KUET
Member of IEB.
Research fields: Soft Computing, Natural Language Processing and Bio-inspired Computing.
PABX Ext: 367 | **Mobile:** +880-1924-332593, +880-1723-593626
Email: mahmud@cse.kuet.ac.bd, rocky_cse_05@yahoo.com
Website: www.kuet.ac.bd/cse/mahmud

12. Bishnu Sarker **Assistant Professor**

B.Sc. Engg. (CSE), KUET; M.Sc. Engg., France
Member of IEB.
Research fields: Computational Biology, Bioinformatics, Network Science, AI.
PABX Ext: / | **Mobile:**+880-1793-188385
Email: bishnu.sarker@inria.fr
Website: www.kuet.ac.bd/cse/bishnu

13. Ms. Mehnuma Tabassum Omar **Assistant Professor**

B.Sc. Engg. (CSE), KUET; M.Sc. Eng. (CSE), KUET
Member of IEB.
Research fields: Database, Data Mining, Scalable Data Structure, Tensor Computation.
PABX Ext: 361 | **Mobile:** +880-1720-119028
Email: tabassum@cse.kuet.ac.bd, misty2409@gmail.com
Website: www.cse.kuet.ac.bd/mehnumatabassumomar

14. Mr. Saifuddin Mahmud **Assistant Professor**

B.Sc. Engg. (CSE), KUET
Member of IEB.
Research fields: Embedded Systems, Computer Networks.
PABX Ext: / | **Mobile:**+880-1719-407098
Email: smahmud@cse.kuet.ac.bd, smahmud07@yahoo.com
Website: www.kuet.ac.bd/cse/smahmud

15. Mr. Sk. Imran Hossain **Assistant Professor**

B.Sc. Engg. (CSE), KUET
Member of IEB.
Research fields: Machine Learning and Signal Processing.
PABX Ext: 379 | **Mobile:** +880-1534-735887
Email: imran@cse.kuet.ac.bd, imranhrana@gmail.com
Website: www.kuet.ac.bd/cse/imran

16. Mr. Jakaria Rabbi **Assistant Professor**

B.Sc. Engg. (CSE), KUET
Member of IEB.
Research fields: Machine Learning, Big Data and Data Mining.
PABX Ext: 377 | **Mobile:** +880-1912-818546
Email: jakaria.rabbi@yahoo.com, jakaria_rabbi@kuet.ac.bd
Website: www.kuet.ac.bd/cse/jakaria

17. Mr. Md. Abdul Awal **Assistant Professor**

B.Sc. Engg. (CSE), KUET
Member of IEB.
Research fields: Image Processing, Data Mining and Machine Learning.
PABX Ext: 373 | **Mobile:** +880-1815-940362
Email: awal.kuet@yahoo.com, awal@cse.kuet.ac.bd
Website: www.sites.google.com/site/abdulawal2k8

18. Mr. Mahtab Ahmed **Lecturer**

B.Sc. Engg. (CSE), KUET; M.Sc. Eng. (CSE), KUET
Member of IEB.
Research fields: Deep Learning, Natural Language Processing, Reinforcement Learning, Neural Network.
PABX Ext: / | **Mobile**: +880-1731-232163
Email: mahme255@uwo.ca, navidcse@gmail.com
Website: www.linkedin.com/in/mahtab-ahmed

19. Mrs. Jarin Firose Moon **Lecturer**

B.Sc. Engg. (CSE), KUET
Member of IEB.
Research fields: Cyber Security, Software and System Security, Machine Learning, Cloud Computing.
PABX Ext: / | **Mobile:**
Email: jarinfirose@cse.kuet.ac.bd, jfmoon@cs.stonybrook.edu
Website: www.kuet.ac.bd/cse/jarinfirose

20. Mr. Animesh Kumar Paul **Lecturer**

B.Sc. Eng. (CSE), KUET; M.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Machine Learning, Reinforcement Learning, Bioinformatics.
PABX Ext: / |Mobile: +880-1731-969551
Email: animesh.paul@cse.kuet.ac.bd, animesh10kuet@gmail.com
Website: www.kuet.ac.bd/cse/animesh

21. Mr. Mohammad Insanur Rahman Shuvo **Lecturer**

B.Sc. Eng. (CSE), KUET
Member of IEB.
Research fields: Machine Learning, Bio-Inspired Computing, Natural Language Processing.
PABX Ext: 8357| **Mobile:** +880-1671-685418
Email: insan_shuvo@cse.kuet.ac.bd, shuvokuet09@gmail.com
Website: www.kuet.ac.bd/cse/insanur

22. Mr. Md. Shamimur Rahman **Lecturer**
B.Sc. Eng. (CSE), KUET
Research fields: Computer Vision, Machine Learning and Embedded System.
PABX Ext: 8359| **Mobile:** +880-1723-165856, +880-1674-734822
Email: md.rahman@cse.kuet.ac.bd
Website: www.kuet.ac.bd/cse/shamimur

23. Mr. Md. Milon Islam **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Embedded System, Computer Vision, Machine Learning, Bio-inspired Computing and Solve Real Life Problems with the Concept of Computer Science.
PABX Ext: 8361| **Mobile:** +880-1718-586174, +880-1571-712405
Email: milonislam@cse.kuet.ac.bd, miloncsekuet@gmail.com
Website: www.kuet.ac.bd/cse/milonislam

24. Mr. Shaikh Akib Shahriyar **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields*:* Deep Learning, Machine Learning, Computational Intelligence, Computer Security and Reliability.
PABX Ext: 8371 | **Mobile:** +880-1917-828888
Email: akib.shahriyar@cse.kuet.ac.bd
Website: www.kuet.ac.bd/cse/akibshahriyar

25. Mr. Abdul Aziz **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Machine Learning, Artificial Intelligence, Database Systems.
PABX Ext: 8373 | **Mobile:** +880-1753-258105, +880-1521-453235
Email: abdulaziz@cse.kuet.ac.bd, mdabdulazizsorkar@gmail.com
Website: www.kuet.ac.bd/cse/abdulaziz

26. Mr. H. M. Abdul Fattah **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Machine Learning, Data mining, Natural Language Processing.
PABX Ext: 8353 | **Mobile:** +880-1751-151728
Email: hussainfattah@cse.kuet.ac.bd, hussainfattah59@gmail.com

27. Mr. Md. Masum Al Masba **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Machine Learning, Data Mining
PABX Ext: 8363 | **Mobile:** +880-1770-900052
Email: masba@cse.kuet.ac.bd

28. Mr. Prottoy Saha **Lecturer**
B.Sc. Eng. (CSE), BUET
Associate Member of IEB.
Research fields: Machine Learning, Pattern Recognition, Networking.
PABX Ext: 8365 | **Mobile:** +880-1762-086775
Email: prottoy@cse.kuet.ac.bd, prottoysaha99@gmail.com

29. Mr. Sunanda Das **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Machine Learning, Deep Learning, Image Processing and Computer Vision, Internet of Things (IoT).
PABX Ext: 8375 | **Mobile:** +880-1762-583358
Email: sunanda@cse.kuet.ac.bd, sunandadas.cse@gmail.com

30. Ms. Nazia Jahan Khan Chowdhury **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Image Processing, Computer Vision, Machine Learning.
PABX Ext: 8351 | **Mobile:** +880-1682-039899
Email: naziajkc@cse.kuet.ac.bd, naziajkc@gmail.com

31. Mr. Mahmudul Hasan **Lecturer**
B.Sc. Eng. (CSE), KUET
Associate Member of IEB.
Research fields: Artificial Intelligence, Deep Learning, Machine Learning, Natural Language Processing, Internet of Things and Cloud Computing.
PABX Ext: 8355 | **Mobile**: +880-1716-015607
Email: mahmudul@cse.kuet.ac.bd

Laboratory Facilities

The department has eight laboratories which are well equipped and getting more resourceful day by day. Those are:

Computer Language & Computing Laboratory	Networking & Multimedia Laboratory
Software & Web Engineering Laboratory	Mobile Games & Apps Development Center
Computer Hardware & Interfacing Laboratory	VDI Multi-Purpose Laboratory
Digital Systems & VLSI Laboratory	Mobile Computing Laboratory

Computer Language & Computing Laboratory

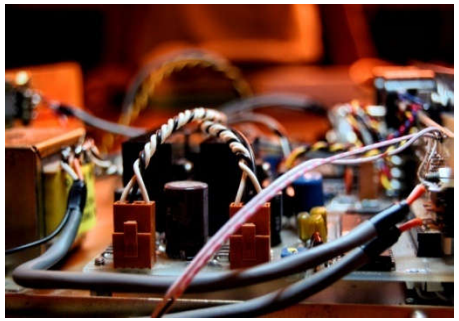
Computer Language & Computing Laboratory provides computing facility to the students. This Laboratory consists of a Windows 2012 Server and thirty client machines

which are configured in both windows and Linux operating systems. These machines have high speed Intel processors. All clients are connected to Internet facility. Software like Java (JDK), JSP, Visual Basic, Visual C++, CodeBlocks, Prolog, PHP, ASP and RDBMS like Oracle and SQL Server are installed in this Laboratory.

Software & Web Engineering Laboratory

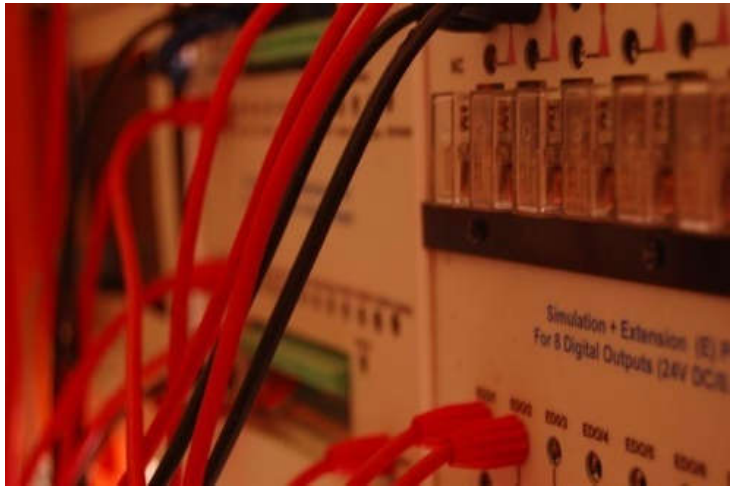
The purpose of Software & Web Engineering Laboratory is to develop students' knowledge about software engineering which involves computer-assisted method to organize and control the development of software, especially on large, complex projects. For this purpose this laboratory consists of a Windows 2012 Server and thirty clients which are connected by Local Area Networks and Internet facility. The clients are Dell brand machines model Optiplex-380 having Intel Core 2 duo Processors. Software installed in this Laboratory are Java (JDK), JSP, Visual Basic, Visual C++, CodeBlocks, Prolog, PHP, ASP and RDBMS like Oracle and SQL Server.

Computer Hardware & Interfacing Laboratory



Computer Hardware & Interfacing Laboratory is equipped with different latest tools to accomplish various hardware related design, testing and interfacing peripherals with microprocessors/ microcomputers. This laboratory has a rich collection of such devices for that purpose. The main equipment of this laboratory includes Microprocessor Trainer Kit 8088 (MTS-88C K&H), Microprocessor Trainer Kit 8086 (MDA-8086), Basic Computer Interface Control (C10-100),Scope Multimeter (DMM-740), Stepper Motor (MDA-012), AD/DA Experimental Board, Multi I/O Lab Card, Power Supply Unit Experimental System (AT-700), Oscilloscope, Analog Multimeter (ST-505), Digital Multimeter, Electronic Sensors Trainer, Portable EPROM Eraser, Function Generator, Digital Function Generator, Portable EPROM Programmer, Digital Portable Oscilloscope, DCA/ACA Clamp Meter (ST 3600), AC/DC Labtype Voltmeter (MSMB-3), Digital Earth Tester (4105), Fiber Optic Power Meter (EFO-1102), Scope Card (Model 2100) , Data Acquisition Card etc. This laboratory also has a Server and twenty workstations connected by Local Area Network.

Digital Systems & VLSI Laboratory



The purpose of Digital Systems & VLSI Laboratory is to design and implement digital circuits and to gain adequate knowledge about digital systems. This Laboratory is equipped with a variety of modern tools which helps the students to experiment different digital systems.

The main equipment of this Laboratory includes Scope Multimeter (DMM-740), Digital Experimental Trainer Kit (LT-1000), Portable Digital IC Tester, Portable Linear IC Tester, Digital Signal Processing Controller (MDA-DSP), Power Supply Unit Experimental System (AT-700), Oscilloscope (AL210), Logic Probe (LP-2800), Analog Multimeter (ST-505), Digital Logic Circuit Trainer (K&H-OLS-2000), Portable EPROM Eraser, Logic Pulsar, Function Generator, Digital Function Generator, Digital LCR Meter, Portable EPROM Programmer, Digital Storage Oscilloscope, Digital Multimeter, Frequency Counter, Digital Earth Tester, EPROM Programmable. Besides, there are a huge number of ICs, Diodes, Capacitors, Resistor, to implement different digital circuits.

Networking & Multimedia Laboratory

Networking & Multimedia Laboratory is one of the most resourceful Laboratories of this department. This Laboratory consists of two COMPAQ Proliant ML550 Servers and Intranet Backbone Fiber Optic switch Model 3 COM Superstack 4900 by which the whole university is connected together.

There are a number of CISCO equipment in this laboratory. These equipment enable advanced networking facility to this laboratory. It includes CISCO 10/100 Ethernet Routers (model 2600), CISCO Dual 10/100 Ethernet Routers, CISCO Catalyst Switches, Transceivers etc.

Besides, the laboratory has a good number of tools like RJ45 Crimp Tools, Punch Down Tools, Wire Strippers, Side Cutters, LAN Cable Testers etc. and some networking software which helps student to gain knowledge and to develop advance networking based projects.

Mobile Games & Apps Development Center

Mobile Games & Apps Development Center is one of the most resourceful laboratories of this department. The main focus of this center is to build new apps, games and test them in different environment. This lab consists of 12 HP desktop computer, 8 iMAC, 2 Samsung VR Gear, 1 iPad pro, Iphone 8 plus, Android Tab, Android Phone, 5 Wacom Intuos Pro Medium, Oculus Rift, Xbox One, Sony Play Station 4 Pro, Nintendo Entertainment System, Smart TV (Android) and many other things. The lab can accommodate 32 students.

VDI Multi-Purpose Laboratory

VDI Multi-Purpose Laboratory provides programming facility for students. This Laboratory consists of a Vnopn Server and sixty client machines which are configured in windows. All clients are connected to Internet facility. The clients can be monitored using Vnopn Server. The lab consists of 10 Raspberry Pi. Software like Java (JDK), JSP, Visual Basic, Visual C++, CodeBlocks are installed in this Laboratory.

Mobile Computing Laboratory

Mobile Computing Laboratory studies design principles and evaluation methodologies for understanding and building systems supports mechanisms for mobile computing systems including mobile ad hoc and sensor networks for achieving the goal of anytime, anywhere computing in wireless mobile environments. The primary research focuses of the lab are in mobility management, data and service management, security and dependability aspects in mobile computing environments. This lab consists of 12 MACs and other highly configuration PCs.

Khulna University of Engineering & Technology
Academic Ordinance for Undergraduate Studies

(Effective from 2nd Term of Session 2011-2012)
(Approved by 38th meeting of Academic Council on 08/07/12 & 15/07/12 and confirmed by 39th meeting of Academic Council on 13/11/12 & 15/11/12)

1. Definitions

1.1. 'University' means the Khulna University of Engineering & Technology.
1.2. 'Syndicate' means the Syndicate of the University.
1.3. 'Academic Council' means the Academic Council of the University.
1.4. 'Vice-Chancellor' means the Vice-Chancellor of the University.
1.5. 'Dean' means the Dean of a Faculty of the University.
1.6. 'Head of the Department' means the Head of a Department of the University.
1.7. 'Central Equivalence Committee' means the Central Equivalence Committee of the University.
1.8. 'Academic Committee' means the Academic Committee for Undergraduate Studies (ACUG) of a degree awarding department of the University.
1.9. 'Degree' means the degree of Bachelor of Science in Engineering or Bachelor of Urban & Regional Planning offered by the University.
1.10. 'Senior most Head/Dean' means the most senior teacher among Heads/Deans.

2. Departments

2.1. Degree Awarding Departments:
The University shall have the following degree awarding departments:

i) Department of Civil Engineering
ii) Department of Electrical and Electronic Engineering
iii) Department of Mechanical Engineering
iv) Department of Computer Science and Engineering
v) Department of Electronics and Communication Engineering
vi) Department of Industrial Engineering and Management
vii) Department of Urban and Regional Planning
viii) Department of Leather Engineering
ix) Department of Textile Engineering
x) Department of Building Engineering and Construction Management
xi) Department of Biomedical Engineering
xii) Department of Energy Science and Engineering
xiii) Department of Architecture
xiv) Department of Material Science and Engineering
xv) Department of Chemical Engineering
xvi) Department of Mechatronics Engineering

Any other department to be instituted by the Syndicate on the recommendation of the Academic Council from time to time.

2.2. Teaching Departments:
The University shall have the following teaching departments:

i) Department of Civil Engineering
ii) Department of Electrical and Electronic Engineering
iii) Department of Mechanical Engineering
iv) Department of Computer Science and Engineering
v) Department of Electronics and Communication Engineering
vi) Department of Industrial Engineering and Management
vii) Department of Energy Science and Engineering
viii) Department of Biomedical Engineering
ix) Department of Urban and Regional Planning
x) Department of Leather Engineering
xi) Department of Textile Engineering
xii) Department of Building Engineering and Construction Management
xiii) Department of Architecture
xiv) Department of Materials Science and Engineering
xv) Department of Chemical Engineering
xvi) Department of Mechatronics Engineering
xvii) Department of Mathematics
xviii) Department of Chemistry
xix) Department of Physics
xx) Department of Humanities

Any other department that may be instituted by the Syndicate on the recommendation of the Academic Council from time to time.

3. Degrees Offered

The University shall offer courses leading to the award of the following degrees:

i) Bachelor of Science in Civil Engineering, abbreviated as B. Sc. Eng. (CE)
ii) Bachelor of Science in Electrical & Electronic Engineering, abbreviated as B. Sc. Eng. (EEE)
iii) Bachelor of Science in Mechanical Engineering, abbreviated as B. Sc. Eng. (ME)
iv) Bachelor of Science in Computer Science & Engineering, abbreviated as B. Sc. Eng. (CSE)

v) Bachelor of Science in Electronics & Communication Engineering, abbreviated as B. Sc. Eng. (ECE)
vi) Bachelor of Science in Industrial & Production Engineering, abbreviated as B. Sc. Eng. (IPE)
vii) Bachelor of Urban & Regional Planning, abbreviated as BURP
viii) Bachelor of Science in Leather Engineering, abbreviated as B. Sc. Eng. (LE)
ix) Bachelor of Science in Textile Engineering, abbreviated as B. Sc. Eng. (TE)
x) Bachelor of Science in Building Engineering and Construction Management, abbreviated as B. Sc. Eng. (BECM)
xi) Bachelor of Science in Biomedical Engineering, abbreviated as B. Sc. Eng. (BME)
xii) Bachelor of Science in Energy Science and Engineering, abbreviated as B. Sc. Eng. (ESE)
xiii) Bachelor of Architecture, abbreviated as BArch
xiv) Bachelor of Science in Materials Science and Engineering, abbreviated as B. Sc. Eng. (MSE)
xv) Bachelor of Science in Chemical Engineering, abbreviated as B. Sc. Eng. (Chemical)
xvi) Bachelor of Science in Mechatronics Engineering, abbreviated as B. Sc. Eng. (Mechat)

Any other degree that may be awarded by a department on the recommendation of the Academic Council and approval of the Syndicate from time to time.

4. Students Admission

4.1 The four academic years of study for the degree of Bachelor of Science in Engineering (B. Sc. Eng.)/ Bachelor of Urban & Regional Planning (BURP) **and five years of study for** Bachelor of Architecture (BArch) shall be designated as first year, second year, third year, fourth year **and fifth year** class in succeeding higher levels of study. Students shall generally be admitted into the first year class.

4.2 An Admission Committee shall be formed in each academic year/session by the Academic Council for admission into first year B. Sc. Eng./ BURP/**BArch** class consisting of the following members:

i) One of the Deans in order of seniority (as Professor) for each year by rotation — Chairman
ii) All other Deans — Member
iii) Five senior most Heads of the Departments — Member
iv) Registrar — Secretary

The Committee is empowered to co-opt member/members (if required) not below the rank of a professor.

4.3 A candidate for admission into the first year class must have passed the H.S.C. Examination from an Education Board in Bangladesh (after 12 years of schooling) with Physics, Chemistry and Mathematics as his/her subjects of examination in Higher Secondary level or examination recognized as equivalent thereto, and must also fulfill all other requirements as may be prescribed by the Academic Council on the recommendation of the Admission Committee. In case of confusion regarding the equivalence the case may be referred to Central Equivalence Committee.

4.4 The rules and conditions for admission into different departments shall be framed by the Academic Council on the recommendation of the Admission Committee in each year.

4.5 All candidates for admission into the courses of B. Sc. Eng./BURP/**BArch** must be citizens of Bangladesh unless the candidature is against the seats those are reserved for foreign students. Candidates for all seats except the reserved ones, if any, shall be selected on the basis of merit. The rules for admission into the reserved seats shall be framed by the Academic Council on the recommendation of the Admission Committee.

4.6 No student shall ordinarily be admitted in the first year class after the start of the corresponding classes or after the call goes out for the admission whichever is later. The date of commencement of classes for the newly admitted students will be announced in advance.

4.7 Admission of a newly admitted student in the first year class will be cancelled if he/she remains absent without prior permission of the Registrar through the Head of the Department for first 2 (two) consecutive weeks after the start of class. If any student fails to report due to unavoidable circumstances within the stipulated first two weeks, he/she may appeal within the next 2 (two) weeks to the Academic Council through the Head of the Department. The decision of the Academic Council will be final.

4.8 Prior to admission to the University every student shall be examined by a competent medical officer as prescribed in the admission rules.

5. Admission on Transfer

5.1 There shall be no admission on transfer in the first year class. In special cases, students may be admitted into a higher class.

5.2 A student may be allowed to transfer a maximum of 50% of the required theory courses of this University completed by the student at other public universities/institutions. The candidate must have a minimum CGPA of 3.0 without any F grade in any course and there should not be any discontinuity of study.

5.3 A candidate seeking admission on transfer from other public university should apply to the Registrar of this University. The Registrar will refer the case to the Head of the Department concerned and also to the Central Equivalence Committee. On receiving the opinions of the Departmental Monitoring Committee, the Central Equivalence Committee will consider the matter and it will be placed before the Academic Council. The decision of the Academic Council will be final and it will be communicated to the Head of the Department and the candidate.

5.4 Central Equivalence Committee

The Central Equivalence Committee will be formed as follows:

i)	One of the Deans (by rotation CE, EEE and ME) of this University	Chairman
ii)	All other Deans	Member
iii)	All Heads of the Undergraduate Departments	Member
iv)	Deputy Registrar (Academic) of this University	Secretary

Duration of Chairman of this committee will be 2 (two) years.

6. Academic Calendar

6.1 The academic year shall ordinarily be divided into two regular Terms, each ordinarily having duration of not less than 13 (thirteen) weeks of classes.

6.2 There shall be a final examination at the end of each Term and the examination will be conducted as per Academic regulations.

6.3 The Head of the Department will announce the academic schedule for each Term ordinarily before the start of the class subject to the approval of the Academic Council.

6.4 Academic schedule may be prepared according to the following guidelines based on two regular Terms:

Term I	**No. of weeks**
Classes	13
Recess before examination/Preparatory leave	1.3*
Term Final Examination	3.1*
Publication of results including Term break	2.3*
Sub-Total:	**20**

Term II	
Classes	13
Recess before examination/Preparatory leave	1.3*
Term Final Examination	3.1*
Publication of results including Term break	2.3*
Sub-Total:	**20**
Recess	**1****
Vacations throughout the session	**11**
Total:	**52 Weeks**

* The digit after the decimal point indicates number of days.

** This recess may be utilized near the mid position of a Term when no vacation of minimum 7 (seven) days will be available during 13 (thirteen) week classes in that Term.

7. Duration and Credit of Courses

7.1 The B. Sc. Eng./BURP courses shall be extended over a period of four academic years and that for BArch shall be five academic years, each with a normal duration of one calendar year. Each academic year will be divided into two Terms for the purpose of academic programs and conducting of examinations.

7.2 The curricula of the B. Sc. Eng./BURP/BArch degree in the different departments shall be as proposed by the concerned ACUG through the Executive Committee of the concerned Faculty and approved by the Academic Council.

7.3 The ACUG may review the curricula once in every academic year and put forward suggestions to the Academic Council through the Executive Committee of the concerned Faculty.

7.4 Teaching for the courses is reckoned in credits and the credits allotted to various courses will be determined by the ACUG with the following guidelines:

Type of Course	**Contact Hour (in a Term)**	**No. of Credit**
i) Theory/Lecture	: 1 hour/week	1.00
ii) Tutorial	: 1 hour/week	1.00
iii) Independent Lab/ Sessional/ Design/Studio/Seminar/Special Study /Project / Thesis	: 3/2 hours/week	0.75
iv) Field work	: 2 weeks of field work	1.00

7.5 The minimum number of credits that a student has to complete successfully for the award of B. Sc. Eng./ BURP degree will be 160 and that for BArch degree will be 200 of which a maximum of 150 credits and 185 credits, respectively to be assigned as core courses.

7.6 The total contact hours for students including lecture, tutorial and laboratory/sessional should be around 30 periods per week, each period being of 50 minutes duration.

7.7 A course plan for each course proposed by the course teacher with the consultation of the Head of the Department showing details of lectures is to be announced at the start of each Term.

7.8 Project/Thesis should preferably be of 1.5 to 3.0 credits in each Term. Credit in any theory course should not exceed 4.0 and that in sessional/laboratory course should not exceed 3.0 and for studio should not exceed 10.

8. Course Designation and Numbering System

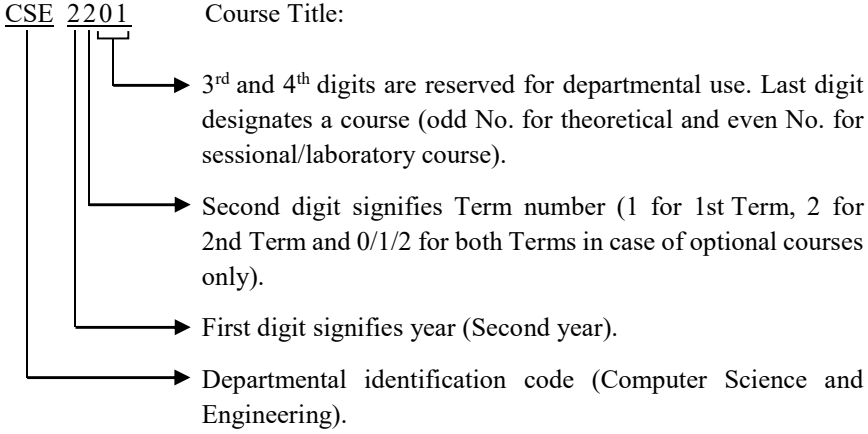
Each course is designated by a two to four letter code (e.g. CE, EE, ME, Hum, Math, Ch, Ph, etc) identifying the course offering department followed by a four-digit number with the following criteria:

8.1 The first digit will correspond to the year in which the students normally take the course.

8.2 The second digit will correspond the Term (1 for 1st Term, 2 for 2nd Term and 0/1/2 for both Terms in case of optional courses only) in which the course is normally taken by the students.

8.3 The third and fourth digits will be reserved for departmental use, of which the last digit will be odd for theoretical and even for sessional/laboratory course.

8.4 The course designation system is illustrated by the following example:



N.B.: There will be one blank space after departmental identification code.

8.5 Project/thesis courses for B.Sc. Eng/BURP shall be designated by the departmental identification code followed by 4000 (Example: CE 4000) applicable for both the Terms. For BArch the code shall be 5000.

9. Classification of Courses

The courses included in undergraduate curricula are classified as follows:

9.1 Core Courses

In each department a number of courses will be identified as core courses which form the nucleus of the respective Bachelor's degree program. A student has to complete all the designated core courses for his/her degree.

9.2 Pre-requisite Courses

Some of the core courses are identified as pre-requisite courses. A pre-requisite course is one which is required to be completed/appeared at the examination before some other course(s) can be taken. Any such course, on which one or more subsequent courses built up, may be offered in each of the two regular Terms (if possible).

9.3 Optional Courses

Apart from the core courses, a student will have to take a number of courses which he/she can choose from a specified group/number of courses to complete the credit requirements.

9.4 Non Credit Courses

Non credit course(s) may be offered to a student to improve his/her knowledge in some specific fields. The credits in these courses will not be counted for GPA and CGPA calculation but will be reflected in the transcript as satisfactory (S)/unsatisfactory (U). Non-credit course(s) may be offered under the following circumstances:

If a student's Thesis/Project supervisor feels that the study/design is highly related to course(s) offered by any department for their students, he can recommend to the concerned Head of the Department for participation of the student(s) in the course(s). Such registration of course(s) will not affect the normal course registration of the student.

9.5 Backlog Courses

The course(s) which a student registered in a Term but after Term final examination he/she obtained 'F' grade in that course(s) and also the withdrawal courses as defined by Article 23.1(ii).

9.6 Withdrawal Courses

The courses which were withdrawn by a student due to some reasons as mentioned in Article 11.8.

9.7 Incomplete Courses

The unregistered course(s) and the course(s) that a student has registered but cancelled according to Article 11.3 will be defined as incomplete course(s).

10. Departmental Functional Bodies

10.1 Departmental Monitoring Committee

Each degree-awarding department will form a Departmental Monitoring Committee with Head of the Department as Chairman and 4 (four) senior most teachers of the department as members. The Committee may propose any change and modifications time to time needed for upgrading/changing the Undergraduate Course Curriculum to ACUG. The Committee will also nominate Course Coordinator and Advisers for the student.

10.2 Student Adviser

An Adviser (normally not below the rank of Assistant Professor) will be nominated for one or more students for the entire period of study by the Departmental Monitoring Committee. He/She will advise each student on the courses to be taken in a Term. However, it is the student's responsibility to keep contact with the Adviser who will review and eventually approve the student's specific plan of study and monitor on subsequent progress of the student.

For a student of second and subsequent Terms, the type of courses for which he/she can register will be decided on the basis of his/her academic performance during the previous Term. The Adviser will advise the students to register the courses during the next Term within the framework of the guidelines in respect of minimum/maximum credit hours limit. He/She may advise the student to change one or more courses among the offered courses based on student's academic performance.

10.3 Course Coordinator

In each degree-awarding department, one of the Teachers (normally not below the rank of Assistant Professor) nominated by the Departmental Monitoring Committee, will act normally for 2 (two) Terms as Course Coordinator and Member Secretary to the ACUG.

11. Course Registration for Regular/Incomplete/Withdrawal Course(s)

11.1 Pre-condition for Registration

A student will be allowed to register courses, depending upon his/her performance. If a student fails in a pre-requisite course in any term, he can register for a course which builds on the pre-requisite course provided his attendance does not fall below 60%. A student having outstanding dues to the University or a Hall of Residence shall not be permitted to register.

11.2 A regular student can register a maximum of 5 (five) theoretical courses in addition to sessional/project/thesis/ field work/seminar/sessional related courses in a Term those offered in that Term in any Year. No student will be allowed to register courses from different Terms in any Term (For example: In case of registration for 1st Year 1st Term, a student can register maximum five theoretical courses in addition to sessional courses/sessional related courses among the offered courses for 1st Year 1st Term only). No student can register any backlog course along with the regular courses in a Term. The total number of credit hours shall generally be between 15 to 24 credits in a Term. However, a student may be allowed to register less than 15 (fifteen) credits in a Term if–

i) the number of credits required for graduation is less than 15 (fifteen) in that Term and

ii) he/she cannot find appropriate courses for registration.

11.3 If a student fails to attend 60% of the classes of any registered course in a Term whatever be the reasons, then the registration will be cancelled for that course and the course be treated as Incomplete course.

11.4 Registration Procedure

The date and time for registration will be announced in advance by the Registrar's office. Students will register his/her courses in a Term according to following guidelines:

i) A student must pay Hall dues before the course registration of a Term.

ii) The student must pay the course registration fees as per rule.

iii) The student will finalize courses to be taken in consultation with his/her Adviser from the courses offered by the respective Department

iv) The student will complete the registration and respective Adviser and Head of the Department will confirm it.

The Registrar's office will distribute course-wise list of registered students to the concerned department and Controller of examinations.

11.5 Registration Deadline

A student must register for the courses to be taken within first 8 (eight) working days of class of each Term. However, late registration will be permitted within next 7 (seven) working days of class on payment of late registration fee. No registration will be accepted after first 15 (fifteen) working days of class of each Term.

For the newly admitted first year students, relaxation up to a maximum of 10 (ten) working days of class from the beginning of the Term may be allowed. Late registration of first year student will not be accepted after these days unless the student submits a written appeal to the Registrar through the concerned Head of the Department and can document extenuating circumstances such as medical problems (Physically incapacitated and not able to be present) or some other academic commitments which precluded enrolling prior to the last date of registration. Proper certificates from concerned authorities must be submitted along with the application.

11.6 Penalty for Late Registration

Students who fail to register within the specified dates for registration will be charged a late registration fee (an amount as may be decided by the authority). This extra fee will not be waived whatever be the reason for late registration.

11.7 Course Adjustment Procedure

A student would have some limited options to add or delete courses from his/her registration list. Addition of course is allowed within the 10 (ten) working days of class from the beginning of the Term. Dropping of a course is allowed within 15 (fifteen) working days of class from the beginning of the Term. Adjustment of initially registered courses in any Term can be done only by duly completing the Course Adjustment Form.

Any student willing to add or drop courses will have to fill up a Course Adjustment Form in consultation with his/her Adviser. The original copy of the Course Adjustment Form will be submitted to the Registrar's office through the Adviser and Head of the Department.

11.8 Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to illness, accident or any other valid reason, etc. he/she may apply in prescribed form to the Registrar through his/her Adviser and Head of the Department for total withdrawal from the Term within 7 (seven) working days after the end of the Term final examination. However, he/she may choose not to withdraw any laboratory/sessional/design/Studio course if the grade obtained in such a course is 'D' or better and that he/she has to indicate clearly in his/her withdrawal application. In case of illness the withdrawal application must be supported by a medical certificate from University Medical Officer. The Academic Council will take final decision about such an application

12. Striking off the Names and Readmission

12.1 The names of the students shall be struck off and removed from the rolls on the following grounds:

i) Non-payment of University fees and dues within the prescribed period.

ii) Forced to discontinue his/her studies under disciplinary rules.

iii) Withdrawal of names from the rolls of the University on grounds acceptable to the Vice-Chancellor of the University after having cleared all dues.

iv) A student failing to earn a minimum of 36 (thirty six) credits in the first 4 (four) consecutive Terms or 54 credits in the first 6 (six) consecutive Terms will cease to be student of this University. However, any student forced to discontinue his/her studies under Article 12.6(iii), the period of discontinuance should be excluded in calculating the time (4 consecutive Terms or 6 consecutive Terms).

v) Could not earn required credits for graduation as outlined in the respective curriculum and/or fulfill CGPA requirement within the maximum allowed time of 7 (seven) consecutive academic years.

12.2 Every student whose name has been struck off from the rolls by exercise of the clause (ii) of Article 12. 1 seeking readmission after expiry of the period for which he/she was forced to discontinue his/her studies, shall submit an application to the Head of the Department in the prescribed form before the commencement of the session to which he/she seeks readmission. The Head of the Department shall forward the application to the Vice-Chancellor of the University with his remarks. In case the readmission is allowed, the student will be required to get him/her-self admitted on payment of all dues not later than one week from the date of permission given by the Vice-Chancellor. All re-admission should preferably be completed before the Term starts.

12.3 No student who has withdrawn his/her name under clause (iii) of Article 12.1 shall be given readmission.

12.4 A student, whose name has been struck off from the rolls by exercise of clause (v) of Article 12.1, is not eligible to seek readmission.

12.5 In case a student whose name has been struck off from the rolls under clause (i) of Article 12.1 seeks readmission before the start of the next Term he/she shall be readmitted on payment of all arrear fees and dues (excluding course registration fees). But if he/she seeks readmission in any subsequent year the procedure for his/her readmission will be the same as described in Article 12.2

12.6 Readmission for discontinuance of studies

A student will be considered to discontinue his studies under the following conditions:

i) Non-payment of University fees and other dues for Terms concern

ii) Withdrawal from a Term/absent in the Term final examination.

iii) Forced to discontinue under disciplinary rules.

The maximum allowable period of discontinuance is 4 (four) regular Terms during his/her whole studentship whatever may be the reason as specified above and at the same time s/he will have to fulfill the conditions of Article 12.1 (iv). A student seeking readmission within the allowable period of discontinuance may be readmitted after payment of all arrear fees and dues.

12.7 In case any application for readmission is rejected, the student may appeal to the Academic Council for re-consideration. The decision of the Academic Council shall be final.

13. Grading System and Calculation of GPA and CGPA

13.1 Grading System

The letter grade system shall be used to assess the performance of the student and shall be as follows:

Numerical Grade	Letter Grade		Grade Point
80% or above	A+	A plus	4.00
75% to less than 80%	A	A	3.75
70% to less than 75%	A-	A minus	3.50
65% to less than 70%	B+	B plus	3.25
60% to less than 65%	B	B	3.00
55% to less than 60%	B-	B minus	2.75
50% to less than 55%	C+	C plus	2.50
45% to less than 50%	C	C	2.25
40% to less than 45 %	D	D	2.00
Less than 40%	F		0.00
Continuous assessment	X		
(For courses extended over two regular Terms, such as project/thesis/design, etc.)			
Withdrawal	W		
Incomplete	I		
Non Credit Course	S/U (Satisfactory/Unsatisfactory)		

13.2 Calculation of GPA and CGPA

Grade point average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student in a Term. 'F' grades will not be counted for GPA calculation. GPA of a Term will be calculated as follows:

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

where n is the total number of courses passed by the student, C_i is the number of credits allotted to a particular course i and G_i is the grade point corresponding to the grade awarded for i-th course.

Cumulative Grade Point Average (CGPA) gives the cumulative performance of the student from first Term up to any other Term to which it refers and is computed by dividing the total weighted grade points ($\sum C_i G_i$) accumulated up to the date by the total credit hours ($\sum C_i$)

Both GPA and CGPA will be rounded off to the second place of decimal for reporting.

14. Distribution of Marks

14.1 The distribution of marks for a given course will be as follows:

i) Theory courses:

Class participation, attendance and assignments	10%
Class tests, Quizzes, Spot test, etc.	20%
Term Final Examination (3 hours duration)	70%
Total:	100%

ii) Independent laboratory/design/ Studio/ field work courses:

Class participation and attendance	10%
Quizzes, Viva-Voce conducted in lab class	20%
Viva-Voce conducted centrally	20%
Performance and reports	50%
Total:	100%

iii) Project/thesis: (Continued for two Terms)

a) At the end of 1st term of 4th year B.Sc. Eng./BURP and 5th year BArch : 30% of total marks to be evaluated as follows:

Presentation and viva-voce (conducted by a viva voce committee)	10%
Supervisor	20%

b) At the end of 2nd term of 4th year B.Sc.Eng/ BURP and 5th year BArch 70% of the total marks to be evaluated as follows:

Presentation and viva-voce (conducted by a viva voce committee)	20%
Supervisor	40%
External examiner (any other teacher of the Department/a member of examination committee)	10%
Total (in two Terms):	100%

14.2 Attendance

i) Eligibility for Scholarship/stipend/grant

The students whose percentage of attendance will fall short of 75% in any of the theory, lab/sessional/Studio courses for which he/she has registered in any Term of an academic year shall not be eligible for the award of any type of scholarship/stipend/grant for the following academic year.

ii) Basis for awarding marks for attendance will be as follows:

Attendance	Marks (%)
90% and above	100%
85% to less than 90%	90%
80% to less than 85%	80%
75% to less than 80%	70%
70% to less than 75%	60%
65% to less than 70%	50%
60% to less than 65%	40%

15. Class Tests, Quiz and Spot Test

15.1 For theory courses 3 class tests will be taken. Normally no more class tests will be taken on any course.

15.2 The class teacher will assign problems to the students and take spot test and quiz examination for assessment.

15.3 The date of class tests/quiz shall be fixed by the course teacher in consultation with the Head of the Department.

15.4 Duration of class tests should be 20-30 minutes and quizzes and spot tests should be 10-20 minutes.

15.5 All class tests shall ordinarily be of equal value. The result of each individual class test shall be posted for information of the students preferably before the next class test is held.

16. Earned Credits, Backlog and CGPA Improvement

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credits calculation. A student who obtains an 'F' grade in any core course in any Term, he/she will have to repeat the course. If a student obtains an 'F' in an optional course he/she may choose to repeat the course or take a substitute course, if available. F grades will not be counted for GPA calculation but will stay permanently on the grade sheet and transcript. When a student will repeat a Backlog course in which he/she previously obtained 'F' grade, he/she will not be eligible to get a grade better than B+ (B plus) in such a course.

A student obtaining D grade in a course, will be allowed to repeat the course for the purpose of grade improvement if CGPA of the student falls below 2.20 In such case he/she will be awarded the new grade thus he/she obtains or retains his/her previous grade if he/she fails. A student obtaining 'C' or a better grade in a course will not be allowed to repeat the course for the purpose of grade improvement if CGPA of the student falls below 2.20. Absence in Term final examination will result 'F' grade unless he/she has withdrawn from the Term as per Article 11.8.

17. Performance Evaluation

The minimum CGPA requirement for obtaining a B. Sc. Eng./BURP/BArch degree is 2.20. The performance of a student will be evaluated in terms of two indices, viz. GPA and CGPA. Students will be considered to be making normal progress toward a degree if their CGPA for all courses passed is 2.20 or more. Students whose GPA will fall below 2.20 will have to appeal to the Head of the Department through his Adviser for the course registration so that the necessary remedial measures can be taken.

18. Honors, Dean's List and University Gold Medal

18.1 Honors

Candidates for Bachelor's degree will be awarded the degree with Honors if their CGPA is 3.75 or better.

18.2 Dean's List

In recognition of excellent performance, the names of students who maintains an average GPA of 3.75 or above in two regular Terms of an academic year may be published in the Dean's List in each Faculty and he/she will be given a certificate from respective Dean as recognition. Students who have received an 'F' grade in any course during any of the two consecutive regular Terms will not be considered for Dean's List in that year.

18.3 University Gold Medal

University Gold Medal for outstanding graduates will be presented to the students who secure the 1st position in each Department and whose CGPA is above or equal to 3.75. The student must have completed his/her undergraduate course work within four consecutive academic years for B.Sc. Eng./BURP and five consecutive academic years for BArch with no 'F' grades and have a satisfactory attendance to his credit.

19. Student Classification

Regular students of the University are normally classified according to the number of credit hours earned from first admission in the University. The following year wise classification applies to the students.

Year	**Earned Credits**
First Year	> 0 to 30
Second Year	> 30 to 60
Third Year	> 60 to 90
Fourth Year	> 90 For B.Sc. Eng./BURP
	> 90 to 120 for BArch
Fifth year	> 120 for BArch

20. Probation and Suspension

Students who fail to maintain minimum GPA of 2.20 and could not complete the minimum credit requirements may be placed on academic probation.

The status of academic probation is a reminder/warning to the student that satisfactory progress towards graduation is not being made. A student may be placed on academic probation when either of the following conditions exists:

i) The GPA falls below 2.20, or
ii) The CGPA falls below 2.20

Students on probation are subjected to such restrictions with respect to courses and extracurricular activities as may be imposed by the respective Head of the Department. The minimum period of probation is one Term, but the usual period is one academic year. A student must improve himself during this period and will be required to pass the backlog courses. Any student who doesn't improve himself/herself during probation period may be suspended on receiving report from the Head of the Department.

A student on academic probation who fails to maintain a GPA of at least 2.20 during two consecutive academic years may be suspended from the University. A student who has been suspended may apply for consideration to the Vice-Chancellor.

Petitions for reinstatement must indicate clearly the reasons for the previous unsatisfactory academic record. It must describe the improved conditions that have been created to prevent the recurrence of such work. Each such petition will be considered individually on its own merits.

After consideration of the petition and after consultation with the student Adviser and the respective Head of the Department, the Vice-Chancellor in some cases may reinstate the student if this is the first suspension. However, a second suspension case will be placed before the Academic Council for final decision.

21. Measures to complete Backlog courses

The following provisions will be made as far as possible to help the students to enable them to complete their studies within the maximum period of seven consecutive years (fourteen Terms) for B.Sc. Eng./BURP and Eight consecutive years (Sixteen terms) for BArch. In this context, the students may be allowed to take backlog courses subject to the approval of his/her Adviser and Head of the Department based on the following rules:

i) The Backlog examination will be held once in an academic year.

ii) A student can register backlog courses normally during 6th to 8th weeks of classes of each even Term from 1st Year 2nd Term to 4th year 1st term for B.Sc. Eng./BURP and 1st year 2nd term to 5th Year 1st Term for BArch as self-study (i.e., retaining the already obtained marks of class tests and class attendance with class performance & assignments).

iii) A student can register maximum 12 (twelve) credits among the backlog courses of previous all Terms and the name of backlog examination is Backlog Examination with the year of examination same as regular examination.

iv) The backlog examination will be started after 10 (ten) days from the last examination of the regular even Term courses of the concerned department and the interval between the backlog courses will be same as regular examination.

v) The date and time for registration will be announced in advance by the Registrar's office.

22. Special Backlog Examination

The Special Backlog Examination on only backlog courses may be conducted for the students who have participated in their 4-year (up to 4th year 2nd Term) for B.Sc. Eng./ BURP and five-year (up to 5th year 2nd term) for BArch degree course and have a shortage of maximum 12 (twelve) credits to obtain Bachelor degree. The special backlog examination will be arranged in a convenient time by the Head of the Department after 30 (thirty) days of publication of results of the 4th Year 2nd Term for B. Sc. Eng./BURP and 5th year 2nd Term for BArch regular examination. The evaluation system will be the same as backlog with self-study. The students willing to appear at the special backlog examination have to apply to the Head of the Department and with his permission must register within 7 (seven) working days of publication of 4th Year 2nd Term for B. Sc. Eng/BURP and 5th year 2nd Term for BArch and Backlog examination results (whichever is later). A student who has failed in the special backlog examination will register the course(s) in the regular Terms

23. Rules for Backlog/Withdrawal/Incomplete Courses

In addition to that mentioned in Article 21 students having Backlog/Withdrawal/Incomplete courses may register the courses according to the following rules. Any Backlog course (theory) will be registered as self-study or backlog; but in sessional/sessional related Backlog/Withdrawal/ Incomplete course(s) he/she must attend the classes and secure minimum 60% attendance.

23.1 Students having Withdrawal/Incomplete Courses

i) If any student withdraws all the courses or only theoretical courses in any Term, he/she may be allowed to register all the withdrawal courses or theoretical courses in any subsequent Term when those courses are offered for regular students.

ii) If any student fulfilled the attendance requirement of 60% in any withdrawal course, in that particular case, he/she may be allowed to register those courses as backlog courses with the evaluation system same as backlog courses.

iii) If any student has Incomplete courses and the number of courses is more than 2 (two), he/she may be allowed to register the courses in any Term as mentioned in 23.1(i).

23.2 Students having Backlog/Withdrawal/Incomplete Courses after participating 4th year 2nd Term for B.Sc. Eng./BURP and 5th year 2nd Term for BArch.

i) A student can register maximum 5 (five) theory courses from the backlog courses in addition to sessional/other sessional related backlog courses of all previous 1st Terms in any 1st Term or of all previous 2nd Terms in any 2nd Term with a total maximum credit hour limit of 24.0. In no situation, courses of both (1st & 2nd) Terms can be registered in any Term.

ii) A student will not be allowed to register any withdrawal or incomplete course as self-study in any Term. He/She can register one or more withdrawal or incomplete courses from the courses as mentioned in 23.2(i).

iii) He/She will follow the rules for registration of regular students as mentioned in Article 11.4.

23.3 Final Examination for the Backlog/Withdrawal/Incomplete courses

Final examination for the backlog/withdrawal/incomplete courses should be conducted with the regular students in the same question paper and on the same date and time, if possible. Otherwise, final examination for the backlog/ withdrawal/incomplete courses will be arranged by the respective Head of the Department as soon as possible at an interval not more than the interval given for regular examination.

24. Minimum Earned Credits and GPA Requirements for Obtaining Degree

The credit requirements for the award of Bachelor degree will be decided by the respective ACUG following Article No.7.5. The minimum CGPA requirement for obtaining a Bachelor degree is 2.20.

A student may take additional courses with the consent of his/her Adviser in order to improve CGPA, but he/she may take a maximum of 15 (fifteen) such additional credits beyond respective credit requirements for the degree during his/her entire period of study.

25. Time Limit for Completion of the Degree

A student must complete his studies within a maximum period of 7 (seven) consecutive academic years (fourteen regular Terms) for B.Sc. Eng./BURP and 8 (eight) consecutive years (sixteen regular terms) for BArch for completion of the degree.

26. Industrial/Professional Training Requirements

Depending on each Department's requirement a student may have to complete a prescribed number of days of industrial/professional training in addition to minimum credit and other requirements, to the satisfaction of the concerned Department.

27. Absence during Term

A student should not be absent from quizzes, class tests, and spot tests etc. during the Term. Such absence will naturally lead to reduction in points/marks that count towards the final grade. Absence in Term final examination will result in 'F' grades.

A student who has been absent for short periods, up to a maximum of 3 (three) weeks due to illness or participating in extra-curricular activities outside of the University (sent by the University authority) should approach to the course teacher(s) on the recommendation of his Adviser and Head of the Department for a make-up class tests, quizzes, spot tests, sessional classes or assignments immediately on returning to the classes. Such request should be supported by medical certificate from University Medical Officer or the relevant office order. The medical certificate issued by a registered medical practitioner and endorsed by University Medical Officer will also be acceptable only in those cases where the student has valid reason for his/her absence from the University. The course teacher will take necessary measures.

28. Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for the degree will have to apply to the Controller of Examinations through his/her Adviser and Head of the Department for graduation. Degree will be awarded on completion of the minimum Credit and CGPA requirements subject to the approval of the Academic Council.

29. Grade Conversion

CGPA of any student may be converted into percentage of marks using following rules:

$$\% \text{ of Marks} = 79+80 \times (\text{CGPA} - 3.75) \quad \text{for } 3.75 \leq \text{CGPA} \leq 4.00$$

and

$$\% \text{ of Marks} = 44+20 \times (\text{CGPA} - 2.00) \quad \text{for } 2.20 \leq \text{CGPA} < 3.75$$

Syllabus for Undergraduate Study
Department of Computer Science and Engineering (CSE)

Summary of 1st Year 1st Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 1100	Introduction to Computer Systems			3	1.5
CSE 1107	Discrete Mathematics		3		3.0
EEE 1107	Basic Electrical Engineering		3		3.0
EEE 1108	Basic Electrical Engineering Laboratory			3	1.5
HUM 1107	English and Human Communication		3		3.0
HUM 1108	English Skills Laboratory			3/2	0.75
MATH 1107	Differential and Integral Calculus		3		3.0
PHY 1107	Physics		3		3.0
PHY 1108	Physics Laboratory			3	1.5
Total			15	10.5	20.25

Weekly Contact Hour = 15L+10.5P= 25.5 Hrs/week

Syllabus of 1st Year 1st Term Courses

CSE 1100: Introduction to Computer Systems

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Introduction to Computers: Types and generation of computers, Basic organization and functional units of computers.

Number Systems: Binary, Octal, Hexadecimal, Codes and arithmetic operations, Complements and its applications.

Hardware: Operations and functions of processor, Memory, I/O devices.

Software and its Applications: Types of software and concept of operating systems, System software, Algorithms and flow charts, Programming algorithms, Flow chart construction and Intranet.

Basic Programming: Basic concepts and techniques of programming.

Program Development Stages: Flow charts and pseudo code.

Programming Constructs: Data types, Operators, Expressions, Statements.

Computer Security Issues: Viruses, Trojans and Passwords.

CSE 1107: Discrete Mathematics

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Review of sets and functions, Relations, Sequences and summations, Number theory, Combinatorics, Recurrence relations and Generating functions.

Algebraic Structures: Semi groups, Groups and Permutation groups, Ring, Field, Prepositional calculus and Predicate calculus,

Mathematical Reasoning: Induction, Contradiction and recursion.

Graph Theory, **Trees**.

EEE 1107: Basic Electrical Engineering

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Direct Current: Voltage and current, Resistance and power, Laws of electrical circuits and methods of network analysis, Principles of D.C. measuring apparatus.

Alternating Current: Instantaneous and r.m.s. current, Voltage and power, Average power for various combinations of R, L, and C circuits, Phasor representation of sinusoidal quantities, Introduction to three phase circuits.

Magnetism: Laws of magnetic fields and methods of solving simple magnetic circuits**.**

Electrical Machines: DC generators and alternators, Introduction to transformer and its operating principles; Operating principles of DC and stepper motors.

EEE 1108: Basic Electrical Engineering Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on EEE 1107

HUM 1107: English and Human Communication

Credits: 3.0 Prereq.: Nil Contact Hours: *3L+0P Hrs/Week*

Introduction: Vocabulary building, Rules of syntax, Grammatical principles, Sentence structure, Correction of errors, Transformation of sentences, Phrases and idioms, Prefixes and suffixes, notions/functions of language, classes, antonyms and synonyms.

Written Communication: Comprehension, Construction of paragraphs on scientific and other themes, Precis writing, Technical and official correspondence, Technical report writing, Research paper writing, Tender notice, Free composition, Personal filing system.

Oral Communication: Listening skills, Oral presentation, Audio-visual communication, Interviewing skills.

HUM 1108: English Skills Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Grammar: Tense, Article, Preposition, Subject-verb agreement, Clause, Conditional and sentence structure.

Vocabulary Building: Correct and precise diction, Affixes, Level of appropriateness, Colloquial and standard, informal and formal.

Developing Reading Skill: Strategies of reading – skimming, scanning, predicting, Inferring, analyzing and interpreting variety of texts, Practicing comprehension from literary and nonliterary texts.

Developing Writing Skill: Sentences, Sentence variety, Generating sentences, Clarity and correctness of sentences, Linking sentences to form paragraphs, Writing paragraphs, essays, reports, formal and informal letters.

Listening Skill and Note Taking: Listening to recorded texts and class lectures and learning to take useful notes based on listening.

Developing Speaking Skill: Oral skills including communicative expressions for personal identification, life at home, giving advice and opinion, instruction and directions, requests, complaints, apologies, describing people and places, narrating events.

MATH 1107: Differential and Integral Calculus

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Differential Calculus: Limit, Continuity and differentiability, Significance of derivatives, Successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem, Mean value theorem, Taylor's theorem in finite and infinite forms, Maclaurin's theorem in finite and infinite forms, Partial differentiation of different multi-variable functions, Evaluation of indeterminate forms, Tangents, Normals, Subtangents and subnormals in cartesian and polar coordinates, Determination of maximum and minimum values of functions, Points of inflection with applications, Curvature and radius of curvature, Asymptotes, Curve tracing.

Integral Calculus: Definitions of integration, Integration by the method of substitution, Integration by parts, Integration by the method of successive reduction, Definite integrals, Definite integral's properties and use in summing series, Walli's formulae, Improper integrals, differentiation and integration under sign of integration, Beta function and gamma function, Jacobian, multiple integrals and their applications.

PHY 1107: Physics

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Quantum Mechanics: Inadequacy of classical concepts, History of quantum mechanics, Planck's quantum theory, Photoelectric effect, Compton effect, Wave-particle duality, De-Broglie waves, Uncertainty principle and its applications, Sommerfeld relativistic atomic model, Orbital angular momentum, Spin angular momentum, Total angular momentum, Orbital magnetic quantum number and spin magnetic quantum number, Magnetic moment of an electron, Pauli's exclusion principle, Time-dependent and time independent Schrödinger equation, Interpretation of wavefunction, Expectation values, Probability density and probability current density, Energy eigen values and eigen functions, Stationary states.

Optics: Aberrations: Spherical aberration, Coma, Distortion, Astigmatism, Curvature of the field, Chromatic aberration and dispersion, Interference of light, Huygens principle and construction of wavefront, Young's double slit experiment, Fresnel's bi-prism, Interference due to multiple reflections, Newton's rings.

Solid State Physics: Crystal Structure: Periodic array of atoms, Fundamental types of lattices, Miller indices, Reciprocal lattices: Diffraction of waves by crystals, Scattered wave amplitude, Brillouin Zones, Fourier analysis of basis, Phonon: Vibration of Crystal with monoatomic basis, Phonons and heat capacity, Thermal inductivity, Enharmonic crystal interactions, Quantum theory of the harmonic crystal: High and low temperature specific heat, Models of Debye and Einstein, Comparison of lattice and electronic specific heat, Free Electron Fermi gas: Energy levels in 1 – D, Fermi – Dirac distribution, Heat capacity of the electron gas, Electrical conductivity and Ohm's law, Motion in magnetic field, Thermal conductivity of metals, Breakdown of classical theory of conductors: Mean free path, Specific heat of solids, Construction of Fermi surfaces, Electron orbits, Hole orbits and open orbits, Wigner-Seitz method, Fermi surface of Copper, Velocity of electron according to Band theory, LASER Physics: History of LASER, Population inversion and stimulated emission, Generation of coherent radiation, Time coherence, Spatial coherence, Ruby LASER, Model of Ruby LASER, Gas LASER, He-Ne LASER, Semiconductor LASER, Applications of LASER.

PHY 1108: Physics Laboratory

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on PHY 1107

Summary of 1st Year 2nd Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 1201	Structured Programming		3		3.0
CSE 1202	Structured Programming Laboratory			3	1.5
CSE 1203	Digital Logic Design		3		3.0
CSE 1204	Digital Logic Design Laboratory			3	1.5
CHEM 1207	Chemistry		3		3.0
CHEM 1208	Chemistry Laboratory			3/2	0.75
EEE 1217	Analog Electronics	EEE 1107	3		3.0
EEE 1218	Analog Electronics Laboratory			3/2	0.75
MATH 1207	Coordinate Geometry and Differential Equations		3		3.0
ME 1270	Computer Aided Design Laboratory			3/2	0.75
Total			15	10.5	20.25

Weekly Contact Hour = 15L+10.5P= 25.5 Hrs/week

Syllabus of 1st Year 2nd Term Courses

CSE 1201: Structured Programming

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Programming Concepts and Structured Programming Language: Data types, Variables, Operators, Type of expressions, Control structures.

Functions and Program Structures: Function basics, Parameter passing conventions, Scope rules and storage classes, Recursion, Header files, Preprocessor, Arrays.

String and Pointers: Pointers and memory addressing, Arrays and pointer arithmetic, Strings, algorithms.

User Defined Data Type: Structure, Structure bit fields, Structure padding, Unions, Enumeration.

Input and Output: Standard input and output, Formatted input and output, File access, Dynamic memory allocation, Valgrind, Garbage collection, Variable length argument list, Command line parameters, Error handling, Introduction to graphics routines, Compiling, Makefile, Debugging.

CSE 1202: Structured Programming Laboratory

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on CSE 1201

CSE 1203: Digital Logic Design

Credits: 3.0 **Prereq.: Nil** **Contact Hours: *3L+0P Hrs/Week***

Introduction: Digital systems, Codes, Code Conversion, Boolean algebra and switching theory. Boolean functions, Canonical forms, Minimization of Boolean functions, Different types of logic gates.

Combinational Circuits: Combinational circuit design Issues, Adder, Subtractors, Arithmetic and data handling logic circuits, Decoders, Encoders, Multiplexers and demultiplexers, Binary parallel adder, ROM, EPROM and PLA, PAL design, Digital display, Fan-in, Fan-out, Propagation delay, Power Dissipation, Hazards in combinational circuit.

Sequential Circuits: Flip flops, State diagram, Timing diagrams, Mealy and Moor machines, State minimization and assignments, Design of Counters, Register and the memory unit, Asynchronous counters and synchronous counters and their applications, Synchronous and asynchronous logic circuit design, Combinational logic with MSI and LSI, Race around problems and races in sequential circuits.

CSE 1204: Digital Logic Design Laboratory

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on CSE 1203

CHEM 1207: Chemistry

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Crystal Symmetry: Different methods for the determination of structure of crystals, Structures of the metallic elements and certain compounds with three dimensional lattices, Defects in solid, Structures of Si, Ge, N, and P**.**

Chemical Bonding: Valence bond theory, Molecular orbital theory, Metallic bonding, Theory of resonance.

Electrochemistry: Electrolytic Solution, Nernst theory of electrode potential, Nernst Equation, Electrode potentials, EMF, Measurement of EMF, Polarization and over potential, Transport number, Electrical double layer, Mechanism of electrode reactions, Lithium ion battery, Ni-battery.

Spectroscopy: Quantization of energy, Basic elements of spectroscopy.

Photochemistry: Laws of photochemistry, Quantum yield, Photosensitized reaction.

Chemistry of Polymerization: Polymerization reaction, some synthetic and natural polymers and their electrical and electronic properties, Polymers used as engineering materials, Conducting polymer and fiber, Synthesis, Structure and properties of polymer.

CHEM 1208: Chemistry Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CHEM 1207

EEE 1217: Analog Electronics

Credits: 3.0 **Prereq.: EEE 1107** **Contact Hours: *3L+0P Hrs/Week***

Introduction to Semiconductors: P-n Junction diode characteristics, Diode applications: half and full wave rectifiers, Regulated power supply.

Bipolar Junction Transistor: Operation principles, Characteristics, Small-signal low frequency h-parameter model, Hybrid pie model, Amplifiers, Switches, Darlington pairs,

Field Effect Transistor (FET): Introduction to different FETs such as JFET, MOSFET, NMOS, PMOS and CMOS, Biasing and applications.

Operational Amplifiers: Gain, Input and output impedances, Offset null adjustment, Frequency response and noise, Introduction to Oscillators, Rectifiers, Active filters, Regulated power supply, Stabilizer and UPS, Basic ideas about IC fabrication techniques, Linear and Nonlinear applications of Op-Amps.

Power Semiconductor Devices: SCR, TRIAC, DIAC, UJT and their applications.

EEE 1218: Analog Electronics Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on EEE 1217

MATH 1207: Coordinate Geometry and Differential Equations

Credits: 3.0 **Prereq.: None** ***Contact Hours: 3L+0P Hrs/Week***

Co-ordinate Geometry of Two Dimensions: Translation and rotation of axes, Identification of conics with their properties.

Co-ordinate Geometry of Three Dimensions: Cartesian, Cylindrical polar and Spherical polar coordinates, Distance of two points, Section formula, Projection, Direction cosines and direction ratios, Angle between two lines, Distance of a point from a line, Planes: different forms of the equation of a plane, Distance of a point from a plane, Equations of bisector of planes, Straight line: different forms of equations of straight line, Angle between a line and plane, Coplanar lines, Shortest distance between two lines, Sphere: general equation of the sphere, Tangent plane, Angle of intersection of two spheres, Cone: equation with vertex at origin, Standard equations of central conicoid.

Ordinary Differential Equations: Order and degree of ordinary differential equations, Formation of differential equations, Solutions of first order first degree differential equations by various methods, Solutions of general linear equations of second and higher orders with constant coefficients, Solution of linear homogeneous equations.

Partial Differential Equations (PDE): Linear PDE with constant coefficients, Solution by separation of variables.

Series Solution: Solution of differential equations in series by the method of Frobenius, Bessel's and Legendre's differential equations and their solutions.

ME 1270: Computer Aided Design Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Introduction, Scale drawing, Isometric views, Orthographic view, Missing line, Solidworks, Project on engineering drawing and CAD using AutoCAD or contemporary packages.

Summary of 2nd Year 1st Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 2101	Object Oriented Programming	CSE 1201	3		3.0
CSE 2102	Object Oriented Programming Laboratory			3	1.5
CSE 2105	Data Structures and Algorithms		3		3.0
CSE 2106	Data Structures and Algorithms Laboratory			3	1.5
CSE 2113	Computer Architecture		3		3.0
EEE 2113	Digital Electronics	EEE 1217	3		3.0
EEE 2114	Digital Electronics Laboratory			3	1.5
MATH 2107	Fourier Analysis and Linear Algebra	MATH 1207	3		3.0
Total			15	9	19.50

Weekly Contact Hours = 15L+9P = 24 Hrs/week

Syllabus of 2nd Year 1st Term Courses

CSE 2101: Object Oriented Programming

Credits: 3.0 Prereq.: CSE 1201 ***Contact Hours: 3L+0P Hrs/Week***

Introduction: Philosophy of object oriented programming (OOP), Features of OOP, Advantages of OOP over structured programming, Classes and objects, Array of objects, Object references, Memory allocation of objects, Constructors, Destructors and different types of constructors, Function overloading, Operator overloading and type conversion of objects.

Inheritance: Types of inheritance, Composition and Aggregation.

Polymorphism: Abstract classes, virtual and pure virtual functions overriding, Interface, Runtime type identification (RTTI), Exception handling, Template functions and classes, Generics, Namespace, Package, Standard template library.

CSE 2102: Object Oriented Programming Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on CSE 2101

CSE 2105: Data Structures and Algorithms

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Internal data representation, abstract data types.

Elementary data structures: Arrays, Linked lists, Stacks, Queues and its variants, Recursion.

Trees and its variants, graphs.

Advanced data structure: Heaps, Fibonacci heaps, Multiway-tree, AVL and splay trees, Sorting, Searching, Hash techniques; Memory management.

CSE 2106: Data Structures and Algorithms Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on CSE 2105

CSE 2113: Computer Architecture

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Organization and architecture, Structure and function, Importance of studying computer architecture and organization.

A Top-Level View of Computer Function and Interconnection: Computer function, Interconnection structure, Bus interconnection.

Cache Memory: Cache memory principle, Elements of cache design.

Internal Memory: Semiconductor main memory, Error correction.

External Memory: Magnetic disk, RAID, Optical memory.

Input/Output: I/O modules, Programmed I/O, Interrupt-driven I/O, Direct memory access, Input/output processor, Universal serial bus (USB).

Computer Arithmetic: Arithmetic and logic unit, Integer representation, Floating-point representation.

Instruction Sets: Characteristics and functions, Addressing mode and formats.

CPU Structure and Function: Processor organization, Register organization, Instruction cycle, Instruction pipelining.

Reduced Instruction Set Computers: Reduced instruction set architecture, RISC pipelining, RISC versus CISC.

Instruction-Level Parallelism and Superscalar: Basic view, design issues.

Control Unit Operation: Micro-operations, Control of the processor.

Micro Programmed Control: Basic concepts, Microinstruction sequencing and execution.

Introduction to High Performance Techniques: Multiple processor organization, Multithreaded architectures, Architectures of multi-core processors and Vector supercomputers.

EEE 2113: Digital Electronics

Credits: 3.0 Prereq.: EEE1217 Contact Hours: *3L+0P Hrs/Week*

Logic Gates: Diode logic gates, Transistor gates, MOS gates.

Logic Families: TTL, ECL, IIL and CMOS logic with operation details, Propagation delay, Product and noise immunity, Open collector and high impedance gates, Electronic circuits for flip-flops, Counters and register, Memory system, PLAs, PLDs, ADC, DAC design with applications, S/H circuits, LED, LCD and optically coupled oscillators.

Wave Shaping: Diode wave shaping techniques, Clipping and clamping circuits, Comparator circuits, Switching circuits; Pulse transformers, pulse transmission, Pulse generation, Monostable, Bistable and Astable multivibrators, Schmitt trigger, Blocking oscillators and Time base circuit; Timing circuits; Simple voltage sweeps, linear current sweeps.

Instruments: Digital meters, DMM, VTVM, Q meters, Statistical methods in measurements.

EEE 2114: Digital Electronics Laboratory

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on EEE 2113

MATH 2107: Fourier Analysis and Linear Algebra

Credits: 3.0 **Prereq.: MATH 1207** **Contact Hours: *3L+0P Hrs/Week***

Fourier Analysis: Fourier series and Fourier co-efficient, Dirichlet's condition and Fourier expansion, Convergence of Fourier series, Exponential form of Fourier series, Change of interval, Half range series, Parseval's identity, Fourier integrals.

Fourier Transforms: General transforms, Fourier sine and cosine transforms and their use in boundary value problems.

Z-transform: Discrete transform and definition of Z-transform, Properties, Stability, Causality, Region of convergence, Inverse Z-transform.

Linear Algebra: Matrix Operations: Field and matrices over a field, Product of matrices by partitioning, Symmetric, Diagonal and other special types of matrices with their properties, Elementary transformations and equivalent matrices, Rank, Inverse of a square matrix by elementary row operation.

Systems of Linear Equations: Solutions of systems of homogeneous linear equations, Existence of nontrivial solutions of set of homogeneous linear equations, Consistency of system of linear equations, Solution of non-homogenous equations using matrix.

Vector Spaces: General vector spaces, Column, row and null Spaces, Basis and Dimension.

Eigen Systems: Eigen values and Eigen vectors, Estimation of the size of Eigen values.

Inner-Product Vector Spaces: Inner-Product Spaces, Orthogonality.

Summary of 2nd Year 2nd Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 2200	Advanced Programming			3	1.5
CSE 2201	Algorithm Analysis and Design	CSE 2105	3		3.0
CSE 2202	Algorithm Analysis and Design Laboratory	CSE 2105		3	1.5
CSE 2203	Microprocessors and Microcontrollers		3		3.0
CSE 2204	Microprocessors and Microcontrollers Laboratory			3	1.5
CSE 2207	Numerical Methods	MATH 1207	3		3.0
CSE 2208	Numerical Methods Laboratory	MATH 1207		3/2	0.75
HUM 2207	Economics and Accounting		3		3.0
MATH 2207	Complex Variable, Vector Analysis and Statistics		3		3.0
Total			15	10.5	20.25

Weekly Contact Hours = 15L+10.5P=25.5 Hrs/week

Syllabus of 2nd Year 2nd Term Courses

CSE 2200: Advanced Programming

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Object oriented design, Graphical user interface(GUI), Layout, Animation, Custom view, Scalable user interface, Localization, User experience(UX), Multithreading, Socket programming, Activity, Services, Broadcast receiver, Content provider, Basic networking, Database manipulation and advanced APIs, Parsing (JSON, XML etc.). Students will submit individual small projects using advanced programming knowledge.

CSE 2201: Algorithm Analysis and Design

Credits: 3.0 **Prereq.: CSE 2105** **Contact Hours: *3L+0P Hrs/Week***

Analysis of Algorithms: Time and space complexity analysis, Correctness and loop invariants, Algebraic simplification and transformations; Lower bound theory, NP-completeness, NP-hard and NP-complete problems.

Algorithmic Techniques: Divide-and-conquer, greedy method, dynamic programming, backtracking, branch and bound; Flow algorithms; Approximation Algorithms; Introduction to parallel and randomized algorithms.

Search and Traversal Techniques: Basic search and traversal techniques, Topological sorting, Connected components, Spanning trees, Shortest paths.

CSE 2202: Algorithm Analysis and Design Laboratory

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on CSE 2201

CSE 2203: Microprocessors and Microcontrollers

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Introduction: Microprocessors, Microcomputers and microcontrollers, Different types of microprocessors and its applications.

Microprocessors: 8086 internal architecture, Processor status and flag registers. **Machine and Assembly Language Programming:** Instruction format, Instruction sets, Opcode, Addressing modes, Branching and looping, Traps and interrupts, I/O operation, Interrupt controller, An overview of Intel 80186, 80286, 80386 and Pentium processors, RISC processors, Parallelism in microprocessor, Bit-slice processor.

Co-processors and DMA: Arithmetic co-processor, I/O processor, Programmable timer, DMA data transfer, DMA Controller.

Microcontrollers: Introduction to micro-controllers, Overview/review of microcontroller architecture, Data representation and memory usage, Microcontroller programming.

Microcontroller Based System Design: Hardware design, Building, Debugging, Testing and linking program modules, Hardware implementation and I/O support. **Analysis of Application Examples:** Recursion and stack usage, Traffic light controller, Input / Output architecture, Analysis of timing and memory requirements, Real time operation.

CSE 2204: Microprocessors and Microcontrollers Laboratory

Credits: 1.5 **Prereq.: None** **Contact Hours: *0L+3P Hrs/Week***

Laboratory works based on CSE 2203

CSE 2207: Numerical Methods

Credits: 3.0 **Prereq.: MATH 1207** **Contact Hours: *3L+0P Hrs/Week***

Numbers and Errors: Significant figures, Absolute and relative error, Rounding error in functional evaluation, Propagation of error in arithmetic process and Truncation errors (Taylor's series).

Single Non-linear Equation: Method of iteration, Bisection method, False position method, Secant method, Fixed point method, Newton Raphson method convergence.

Interpolation: Difference tables, Newton forward and backward interpolation formula with error, Divided difference and central difference formula, Lagrange's interpolation formula, Curve fitting by least squares, Cubic spline, Chebyshev polynomials and Min-max properties.

Solution of Systems of Linear Equations: Gaussian elimination, Gauss elimination with pivoting, Gauss-Jordan method.

Numerical Differentiation and (Numerical) Integration: Trapezoidal rule, Simpson's rule, Romberg rule with error and Weddle's method.

Solution of Differential Equations: Modified Euler method, Euler's method, Picard's method, Runge–Kutta method, Predictor corrector method, Linear algebraic systems, Direct and iterative methods, Matrix inversion.

Solution of Partial Differential Equations: Introduction to partial differential equation, Geometric interpretation, Elliptic, Parabolic and hyperbolic partial differential equation.

Least Squares Approximation of Functions: Linear and polynomial regression, Fitting exponential and Trigonometric functions.

CSE 2208: Numerical Methods Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 2207

HUM 2207: Economics and Accounting

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Economics: Nature of the economics theory, Applicability of economic theories to the problem of developing countries, Some basic concepts - supply, Demand and their elasticities, The relationship among average, Margin and total and their derivation, Equilibrium - stable, Straight and Dynamic equilibrium, Producer's equilibrium-isoquant, Production-factors of production, Production possibility curve-equilibrium of a firm, Fixed cost and variable cost, The short run and the long run, The cost curves and supply curves, Law of returns, Internal and external economics and diseconomies, Economics of development and planning, Basic concept-saving, Investment, GNP, NNP, Per capita income, Growth rate, Policy instruments of development, Fiscal policy, Monetary policy and trade policy and their relative applicability in Bangladesh, Inflation and unemployment cost-benefit analysis, International trade and comparative advantage.

Accounting: Introduction: Definition of accounts, its need and importance, Accounting and its environment, Users of accounting information, Generally accepted accounting principles (GAAP), Relationship of accounting with engineering education, Business transactions, Step in the recording process, Rules of debit and credit, Double entry system of accounting, The journal, The ledger, Cash book, The trial balance, Financial statement.

Cost Accounting: Concept of cost, Classification of cost, Statement of cost, Operating and service costing, Salary and wages/payroll account.

MATH 2207: Complex variable, Vector Analysis and Statistics

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Complex Variable: Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, Analytic functions, Complex differentiation, Sufficient condition for analyticity and Cauchy Riemann equations, Harmonic functions and conjugate harmonic functions, Construction of analytic functions when either part is given (Milne-Thomson method), Different types singularities, Line integral of a complex function, Cauchy's integral theorem and converse of Cauchy's theorem.

Vector Analysis: Transformation of vectors on a plane: Scaling, Rotation, Translation, Linear dependence and independence of vectors, Scalar and vector fields, Differentiation of vectors together with elementary applications, Gradient, Divergence and curl of point functions and related forms, Green's, Stokes' and Gauss' theorem and their applications.

Statistics: Moment, Skewness and kurtosis, Random variables, Probability mass functions and probability density functions.

Expectation: Expected value and variance with their properties.

Discrete Probability Distributions: The Bernoulli and Poisson process, Binomial and Poisson probabilities, Distribution and properties.

Continuous Probability Distributions: Normal variate and normal distribution, Properties of normal distribution, Standard normal variate and standard normal distribution, Properties of standard normal distribution, Uniform distribution and it's properties.

Summary of 3rd Year 1st Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 3100	Web Programming Laboratory			3	1.5
CSE 3101	Theory of Computation		3		3.0
CSE 3103	Peripherals and Interfacing	CSE 2203	3		3.0
CSE 3104	Peripherals and Interfacing Laboratory			3/2	0.75
CSE 3109	Database Systems		3		3.0
CSE 3110	Database Systems Laboratory			3	1.5
CSE 3119	Software Engineering and Information Systems		3		3.0
CSE 3120	Software Engineering and Information Systems Laboratory			3	1.5
ECE 3115	Data Communication	EEE 2113	3		3.0
ECE 3116	Data Communication Laboratory			3/2	0.75
Total			15	12	21.00

Weekly Contact Hours: 15(L) +12(P) =27 Hrs/Week

Syllabus of 3rd Year 1st Term Courses

CSE 3100: Web Programming Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Internet communication protocols such as TCP/IP, FTP, SMTP and HTTP, Basic networking concepts, Advanced Web page development with Dynamic HTML, JavaScript, AJAX, jQuery, and Cascading Style Sheets, Server-side development technologies such as Perl, PHP, ASP.net, Java Servlets, JSP and JSP.net, Basic SQL for database interaction.

CSE 3101: Theory of Computation

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Formal language theory, Formal proof, Inductive proofs and Central concepts of automata theory.

Finite Automata: Deterministic finite automata, Nondeterministic finite automata, Finite automata with ε-transitions, Equivalence and conversion of deterministic and nondeterministic finite automata.

Regular Expressions and Languages: Regular expressions, Algebraic laws for regular expressions, Regular languages, Pumping lemma, Closure and Decision properties of regular languages.

Context Free Grammar and Languages: Context free grammars, Parsing (or derivation) and parse trees, Ambiguity in grammars and languages, Normal forms for

context-free grammars, Pumping lemma for CFL's, Closure and Decision properties of CFL's.

Push Down Automata: Push down automata, Acceptance by empty store and final state, Equivalence between pushdown automata and context-free grammars, Deterministic push down automata.

Turing Machines: Turing machines, The church-Turing machine, Techniques for Turing machine construction, Configurations, Computing with Turing machines, Restricted Turing machines, Turing machines and computers, Combining Turing machines.

Undecidability: Recursively enumerable language, The undecidability of the halting problem, Undecidable problems about Turing machines, Post's correspondence problem.

Complexity Theory: The classes P, NP, examples of problems in these classes. P versus NP question. NP completeness, Polynomial time reducibility, The Cook-Levin theorem. Examples of NP complete problems: Vertex cover problem, Hamiltonian path problem. Approximation algorithm, Probabilistic algorithms.

CSE 3103: Peripherals and Interfacing

Credits: 3.0 Prereq.: CSE 2203 Contact Hours: *3L+0P Hrs/Week*

Introduction: Basics of Peripherals and Interfacing, General purpose peripherals and Special purpose peripherals, I/O techniques: Simple I/O, Strobe I/O, Handshake I/O, DMA controlled I/O, Hardware and software interfacing in microcomputer system design, Multi-processor configurations.

Memory Interfacing: Compatibility between memory and MPU system bus, Address space partitioning, Standard versus system memories, Restriction imposed by MPU architecture.

Data Transfer Techniques and Their Implementation: Programmed data transfer, DMA mode of data transfer, I/O port and Serial modes of data transfer.

Common Peripherals and their Interfacing: Interfacing I/O devices - Floppy disk, Hard disk, Solid state disk, CDROM and other optical memory, Keyboard, Mouse, Display devices, etc., Interfacing with USB.

Programmable Peripheral Interface: Intel 8255 pin configuration, Internal structure of a port bit, Modes of operation, Bit SET/RESET feature, Programming, ADC and DAC chips and their interfacing.

Programmable Interval Timer: Intel 8254 pin configuration, Internal block diagram of counter and modes of operation, Counter read methods, Programming.

I/O Devices for Process Control and Instrumentation: Transducers, Operational Amplifier, Optocouplers, Relays, AD and DA converters.

Microprocessor in Scientific Instruments and Other Applications: Display, Protective relays, Measurements of Electrical quantities, Temperature monitoring system, Water level indicator, Motor speed controller, Traffic light controller, etc.

CSE 3104: Peripherals and Interfacing Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 3103

CSE 3109: Database Systems

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Database System Concepts: Data Models, Schemas and Instances, DBMS Architectures.

Relational Model: Entity Relationship model, Keys, Relationships, ER diagrams, Design issues, ER to Relational mapping.

Relational Algebra: Basic relational algebra Operations, Additional relational operations. SQL, QBE, Query processing and optimization, Triggers and cursors.

Relational Constraints, Functional Dependencies: Relational constraints and relational database schema, Functional dependencies.

Normalization: Normal form based on primary keys, General definitions of second and third normal form, Boyce-Codd normal form.

Database Indexing and Index Structures: Types of single level ordered index, Multilevel indexes, Dynamic multilevel indexes, Dynamic multilevel indexes using B-trees and B^+ trees, Indexes on multiple keys.

Transaction Processing and Management: Introduction to transaction processing, Transaction and system concepts, Properties of transaction, Schedules and recoverability, Serializability of schedules.

Concurrency Control Techniques: 2PL, Serializability and recoverability, Lock management, Lock conversions, Dealing with deadlocks, Specialized locking techniques, Concurrency control without locking.

Database Security and Authorization: Introduction to database security, Access control, Discretionary access control, Mandatory access control, Security for internet applications.

Information Retrieval and XML Data: Introduction to information retrieval**,** Indexing for text search**,** data model for XML, Querying XML data, Evaluation of XML queries.

CSE 3110: Database Systems Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on CSE 3109

CSE 3119: Software Engineering and Information Systems

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Information System Concepts: Different types of information, Quality of information, System Development Life Cycle, Information gathering tools, Structured analysis tools, System design, Project planning tools, Feasibility analysis, Cost/Benefit analysis.
Design Patterns: GRASP patterns with general principles, GoF design patterns.
Software Testing Techniques and Strategies: White box and Black box testing, Basis path testing, Cyclomatic complexity, Unit testing, Mutation, Regression, Integration, System testing, Error seeding, Stress testing, Behavior driven test, Test automation, Debugging approaches.
Software Reliability and Quality Assurance: Reliability metrics, Growth modeling, Software Quality, Quality management system, Release Planning, Tools for software release ISO 9000, SEI CMM, Comparison between SEI CMM and ISO 9000.
Security: Disaster, Recovery and ethics in system development.
Concepts of Software and Software Engineering: Software process models, Software project management, Requirement engineering.
Design and Analysis: Object-oriented analysis and models, SRS documentation, Design concepts and principles, Architectural design, Object-oriented design, Use Case, UML diagrams, Software case tools.
Cost Model: Cost estimation techniques, Algorithmic cost modeling, COCOMO.
Software Metrics: Function-oriented metrics, Size-oriented metrics. Risk analysis and management, Software maintenance.

CSE 3120: Software Engineering and Information Systems Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on CSE 3119

ECE 3115: Data Communication

Credits: 3.0 Prereq.: EEE 2113 Contact Hours: *3L+0P Hrs/Week*

Data and Signals: Analog signals, Digital signals, Transmission impairment, Data rate limits, Performance measures.
Analog Transmission: Digital-to-Analog conversion: ASK, FSK, PSK, QAM. Analog-to-Analog conversion: Amplitude modulation, Frequency modulation, Phase modulation.
Digital Transmission: Digital-to-Digital conversion: Line coding. Analog-to-Digital conversion: Pulse code modulation, Delta modulation, Transmission modes: Parallel and serial transmission.

Transmission Media: Guided media: Twisted-pair cable, Coaxial cable, Fiber-optic cable. Unguided media: Radio waves, Micro waves, Infrared.
Bandwidth Utilization: Multiplexing: Frequency-division multiplexing, Wave division multiplexing, Synchronous time-division multiplexing, Statistical time-division multiplexing. Spread spectrum: Frequency hopping spread spectrum, Direct sequence spread spectrum.
Switching Networks: Circuit switched networks, Datagram networks and Virtual-circuit networks.
Telephone Networks for Data Transmission: Telephone networks, Dial-up modems, and Digital subscriber line: ADSL, HDSL, SDSL, VDSL, Cable TV networks.
Error Detection and Correction: Block coding, Linear block codes, Cyclic codes, Checksum.
Data Link Control: Fixed-size and variable-size framing, HDLC.

ECE 3116: Data Communication Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on ECE 3115

Summary of 3rd Year 2nd Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 3200	System Development Project			3	1.5
CSE 3201	Operating Systems		3		3.0
CSE 3202	Operating Systems Laboratory			3	1.5
CSE3207	Applied Statistics and Queuing Theory		3		3.0
CSE 3211	Compiler Design	CSE 3101	3		3.0
CSE 3212	Compiler Design Laboratory			3/2	0.75
CSE 3217	Mobile Computing		3		3.0
CSE 3218	Mobile Computing Laboratory			3/2	0.75
HUM xxxx	Course from Optional-I Group		3		3.0
Total			15	9	19.50

Weekly Contact Hours: 15(L) + 9(P) =24 Hrs/Week

Summary of Optional-I Courses

Course No.	Course Title	Theory Hrs./Week L	Lab. Hrs./Week P	Credit
HUM 3207	Sociology and Government	3		3.0
HUM 3217	Business and Industrial law	3		3.0
HUM 3227	Professional Ethics and Moral Thoughts	3		3.0
HUM 3237	Occupational Psychology	3		3.0

Syllabus of 3rd Year 2nd Term Courses

CSE 3200: System Development Project

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Students will work in groups or individually to develop a term project. It may include I/O drivers, operating systems modules, or some practical problems. Students will develop the software using recent technologies/programming with proper documentation.

CSE 3201: Operating Systems

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Fundamental concepts, The role of an operating system in computer systems, Operating system structure and operation.

Process Management: Process concept, Process scheduling, Process state, Process management, Co-operating processes, Inter-process communication (IPC), Kernel.

Threads: Basics concept, Multithreading models, Threading issues.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithm, Algorithm evaluation.

Process Synchronization: Critical-section problem, Synchronization hardware, Semaphores, Classic problems of synchronization.

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock Detection, Recovery from deadlock.

Storage Management: Basic concepts, Swapping, Contiguous memory allocation, Paging, Segmentation, and segmentation with paging.

Virtual Memory: Basic concepts, Demand paging, Page replacement, Thrashing.

File Concept: File support, Access methods, Allocation methods, Directory systems, File protection, Free space management.

Distributed Systems: Types of distributed operating system, Communication protocols.

Distributed File Systems: Naming and transparency, Remote file access.

Protection and Security: Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, The security problem, User authentication, Security system and facilities.

Case Studies: Study of a representative operating system.

CSE 3202: Operating Systems Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on CSE 3201

CSE 3207: Applied Statistics and Queuing Theory

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Elementary Concepts, Laws of Probability, Conditional probability And Bay's theorem, Random variables.

Distribution of Sampling Statistics: Sample, Population, Sample mean & variance, Distribution of Sample mean, Markov inequality, Chebyshev's inequality, Central Limit theorem.

Correlation and Analysis of Variance: Correlations, Rank correlation, One-way analysis of variance, and Two factor analysis of variance: Parameter estimation and hypothesis testing.

Regression: Simple linear regression model, Estimation of the regression parameters, Method of least squares, Error of random variable, Regression to the mean, Coefficient of determination, Sample correlation coefficient hypothesis testing, Tests of independence and goodness of fit.

Parameter Estimation: Estimation of population mean, Interval estimators & lower-upper bounds of population mean using known and unknown variance.

Hypothesis Testing: Test concerning the mean of a normal population, Testing Equality of Means of Two Normal Populations, Test concerning the variance of normal population, Statistical significance, T-Tests, Chi-Square Tests, Chi-Square Test of goodness-of-fit.

Markov Chains: Discrete Time Markov Chains, Continuous Time Markov Chains, Birth-Death Process, Embedded Markov Chain.

Queuing Models: M/M/1, M/M/C, M/G/1, M/D/1, G/M/1, Open and Closed Queuing Network, Network of exponential servers, Phase-dependent arrival and Service application of queuing models.

CSE 3211: Compiler Design

Credits: 3.0 Prereq.: CSE 3101 Contact Hours:*3L+0P Hrs/Week*

Introduction to Compiler: Phases of compilation and overview. Compiling techniques including parsing, Semantic processing, and Optimization, Complier- Compliers and translator writing systems.

Lexical Analysis: The ROLE of the lexical analyzer, Specification And recognition of tokens, Lexical analyzer generator.

Syntax Analysis (Parser): Top-Down Parsing, Bottom-Up Parsing, Operator-precedence parsing, Ambiguity, LL and LR parsers.

Semantic Analysis: Attribute grammar, Syntax directed definition, Evaluation and flow of attribute in a syntax tree.

Type Checking: Syntax directed translation, Error management, Error detection and recovery.

Symbol Tables: Data structures for symbol tables.

Run-Time Storage Management and Run Time Support: Parameter passing mechanisms, Stack storage organization and templates, Heap storage management, memory allocation and scope.

Intermediate Code Generation: Translation of different language features. Different types of intermediate forms, languages, declarations and assignment statements.

Code Improvement: Analysis: control-flow, data-flow dependence etc., Code improvement local optimization, global optimization, Garbage Collection, loop optimization, Peep-hole optimization etc. Architecture dependent code improvement: Instruction scheduling, Loop optimization etc.

Code Generation: Register allocation and target code generation.

CSE 3212: Compiler Design Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 3211

CSE 3217: Mobile Computing

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Mobile Computing Overview: Mobile technologies, Anatomy of a mobile device, Survey of mobile devices, Applications of mobile computing.

Application Design: Context, Information architecture, Design Elements, Mobile web versus native applications.

Development Environments: Introduction to Objective-C, The Model-View-Controller model, The Delegate pattern, The iPhone, Android, & Blackberry SDKs.

Application Environments: Limited resource computing, Memory management, Low power computing, Fault tolerance and persistence, Security issues.

Wireless Communication Technologies: Cellular networks, Wireless (802.11), TCP/IP in the mobile setting, Geo-location and Global Positioning System (GPS).

User Experience: The small screen problem, The unified look and feel paradigm, The iPhone Human Interface Guidelines, The Blackberry user interface guidelines, Common user interface guidelines.

Distributed Computing: Consistency and reliability, Security issues, Ad hoc Networks, Sensor Networks.

Future of Mobile Computing: Upcoming technologies, Convergence of media and communication devices.

CSE 3212: Mobile Computing Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 3217

Syllabus of Optional-I Courses

HUM 3207: Sociology and Government

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Sociological Perspective: Definition, Nature, Scope and importance of sociology, Social structure of Bangladesh.

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.

Social Organization: Family, Forms and functions of family, Functions of family in modern industrial society, Marriage, Forms of marriage, Functions of marriage, Urbanization and industrialization.
Social Change: Change-evolution-progress-development, Factors in social change,
Society and Population: Human migration, Population and resources.
Some Current Social Problems: Crime, deviance, juvenile delinquency, youth unrest.
Technology and Society: Effects of technological factors on social life. Basic concepts of government and politics. Functions, organs, and forms of modern state and government, Citizenship. Socialism, Capitalism, Feudalism, Political importance of Feudalism, UNO, Fascism, Marxism. Government and politics of Bangladesh. Some major administrative systems of developed countries. Local self-government. Some major aspects of international politics.

HUM 3217: Business and Industrial law

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Administration, Management and organization, Authority and responsibility, Scientific management, Organization structure, Organization chart, Span of control, Selection and recruitment of employees, Training and its types, Promotion, Wage system and incentive, Job-evaluation and merit rating, Plant layout, Layout of physical facilities, Transportation and storage, Material handling, Maintenance, Maintenance policy, Production control in intermittent and continuous manufacturing industry, Functions of production control, Purchasing procedures : Inventory-need and methods of control, Factors affecting inventory building-up, Economic lot size and reorder point.
The Nature and Sources of Law: Meaning and necessity for the law, Classifications of the law, Historical development of the law, Sources of written law. Criminal law: Classification: Felonies, Misdemeanors, Infractions, Penalties, Youthful offenders.
Civil Law: Types of torts, Remedies, Responsibility of a minor for his torts, The Court system: Federal, state, and local court systems, Steps in litigation.

HUM 3227: Professional Ethics and Moral Thoughts

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Meaning of ethics, Professional ethics codes, Psychological basis of ethics, Religion and ethics, Egoism and relativism, Utilitarianism and rational utilitarianism, Ethics and other branches of knowledge, Intuitionism, Standard as values.
Concept of moral thoughts and moral judgment, Bases of human behavior, Moral development and reasoning, Morality and social institution, Moral rights and duties, Interpersonal moral sentiment, Occupational culture and ideology, Occupational stress, Morality and religion, organizational commitment, Morality in international context.

HUM 3237: Occupational Psychology

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Personnel Selection and Assessment: Theory and context of personnel assessment, Models of selection, Validity, Reliability and Fairness, Equal opportunities, Selection interview, Psychometric tests, Assessment centers, Work samples, Personality inventories, Ethical issues in candidate assessment, Assessment of managerial aptitude and other specific abilities, Feedback skills, Performance appraisal, Career development, Counseling and personal development.
Organizational Behavior and Health: Training and development in organizations, Training needs analysis, Models of training evaluation. Employee relations, The psychological contract at work, Motivation theories, Models and applications, Job satisfaction and performance, Job satisfaction and quality of working life, counseling at work, Age and work, The impact of unemployment.
Human Factors and Ergonomics: Job demands and job design, Ergonomics, Person-centered and job-centered approaches, Person-machine interface, Human-computer interaction, Psychological well-being at work, Stress management, Repetitive strain injury, Organizational health assessment, Human error, Shift-work.
Assessing People for Work: Organization design, Organization structure and performance, Organization development and change, Psychological bases of resistance to change, Culture and climate in organizations, Leadership style and models of leadership, Work groups and team effectiveness at work, Team building models and validation evidence, Inter-group co-operation and conflict in organizations, Business strategy at work, Organizations and their environments.
Multivariate Theories and Methods in Occupational Psychology: Topics selected from: Principles of factor analysis, Methods of factoring and rotation, Factor analytic models of ability and personality, Multivariate analysis of variance, Multivariate classification procedures, Profile analysis, Typologies, Nature of typologies, Measurement of similarity, Making predictions and testing hypotheses involving several measures, Fitting and testing models about categorical data, General approaches to prediction, Measurement and control in psychological investigations.
Research Design and Analysis: Basic concepts in research design, Variables and definitions, Populations and samples, Reliability and validity, Meta-analysis, Experimental methods, Quasi-experimental design, Quality of life in the workplace, Social indicators, Evaluation research, Observation methods and survey research, Questionnaires and modular survey design, Survey research, Comparison groups and norms, New paradigms, Ethics in research, Applying research methods to small groups in organizations.

Summary of 4th Year 1st Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 4000	Project / Thesis			3	1.5
CSE 4105	Computer Networks	CSE 3201	3		3.0
CSE 4106	Computer Networks Laboratory			3	1.5
CSE 4109	Artificial Intelligence	CSE 2201	3		3.0
CSE 4110	Artificial Intelligence Laboratory			3/2	0.75
CSE 4120	Technical Writing and Seminar			3/2	0.75
CSE xxxx	Course from Optional-II (3.00 + 0.75)		3	3/2	3.75
CSE xxxx	Course from Optional-II (3.00 + 0.75)		3	3/2	3.75
IEM 4127	Industrial Management		3		3.0
Total			15	12	21.00

Weekly Contact Hours = 15L+12P=27 Hrs/week

Summary of Optional-II Courses

Optional-II should be selected from the following courses:

Course No.	Course Title	Theory Hrs./Week L	Lab. Hrs./Week P	Credit
CSE 4103	VLSI Design	3		3.0
CSE 4104	VLSI Design Laboratory		3/2	0.75
CSE 4107	Digital Signal Processing	3		3.0
CSE 4108	Digital Signal Processing Laboratory		3/2	0 .75
CSE 4111	Machine Learning	3		3.0
CSE 4112	Machine Learning Laboratory		3/2	0.75
CSE 4115	Computer and Network Security	3		3.0
CSE 4116	Computer and Network Security Laboratory		3/2	
CSE 4117	Modeling and Simulation	3		3.0
CSE 4118	Modeling and Simulation Laboratory		3/2	0 .75
CSE 4131	Pattern Recognition	3		3.0
CSE 4132	Pattern Recognition Laboratory		3/2	0.75
CSE 4127	Image Processing and Computer Vision	3		3.0
CSE 4128	Image Processing and Computer Vision Laboratory		3/2	0 .75
CSE 4129	Ubiquitous Computing	3		3.0
CSE 4130	Ubiquitous Computing Laboratory		3/2	0 .75

Syllabus of 4th Year 1st Term Courses

CSE 4000: Project / Thesis

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Study and solution of a problem in the field of Computer Science and Engineering.
N.B.: The project/thesis topic selected in this term is to be continued in the next term.

CSE 4105: Computer Networks

Credits: 3.0 Prereq.: CSE 3201 Contact Hours: *3L+0P Hrs/Week*

Introduction: Definition of internet, The network edge, Network code, Network access and physical media, ISPs and internet backbones, Delay and loss in packet-switched networks, Protocol layers and their service models.
Application Layer: Principles of application layer protocols, Web and HTTP, File transfer protocol (FTP), Electronic mail, SMTP, POP3, IMAP, DNS, P2P, Socket programming with TCP and UDP.
Transport Layer: Transport layer services, Multiplexing and demultiplexing, Connectionless transport and UDP, Principles of reliable data transfer, Connection oriented transport and TCP, Principles of congestion control, Congestion and flow controls with TCP.
Network Layer and Routing: Network layer services, Routing principles, Hierarchical routing, Internet Protocol: IP4 addressing, IPv6, ICMP, DHCP and NAT, Routing, Distance vector and link state routing algorithms, Multicast routing, Router architecture.
Link Layer and Local Area Networks: Link layer services, Error detection and correction techniques, Multiple access protocols, CSMA, CSMA/CD, Slotted ALOHA, LAN address and ARP, Ethernet, Hub, Bridge and switch, Wireless links, Wi-Fi and WLAN architecture, Bluetooth, PPP, ATM, Frame relay.
Security in Computer Networks: Security issues in computer networks, Principles of cryptography: Symmetric key cryptography and public key encryption, Message integrity and digital signatures, End-point authentication, Operational security, Firewalls and intrusion detection systems.

CSE 4106: Computer Networks Laboratory

Credits: 1.5 Prereq.: None Contact Hours: *0L+3P Hrs/Week*

Laboratory works based on CSE 4105

CSE 4109: Artificial Intelligence

Credits: 3.0 Prereq.: CSE 2201 Contact Hours: *3L+0P Hrs/Week*

Introduction: Definition, AI technique, Application.

Intelligent Agent: Introduction, Structure of intelligent agent, Agent programs, Goal-based agents, Environments.

Problem Solving: Solving problem by searching, Problem solving by agent, Formulating problems, Toy problems, Search strategies, Breadth-First, Uniform cost, Depth-First, Depth-limited and iterative deepening search, Informed search methods**,** Best-First, Greedy and A* search, Heuristic functions, IDA* search, Iterative improvement algorithms, Hill-Climbing search, Simulated annealing, Introduction to game playing, Perfect decisions in two person games, Imperfect decisions, Alpha-Beta pruning, State-of-the-Art games programs: Chess, Checkers, Backgammon.

Knowledge and Reasoning: Knowledge-Based agent, Representation, Reasoning and logic, Propositional logic.

First-Order Logic: Syntax and semantics, Terms, Atomic and complex sentences, Quantifiers, Equality, Extensions and notational variations, Higher-order logic, Using first-order logic, Axioms, Definitions and theorems.

Inference in First-Order Logic: Inference rules involving quantifiers, Generalized modus ponens, Canonical form, Unification, Forward and backward chaining, Completeness, Resolution inference rule, Canonical forms for resolution, Resolution proofs, Conversion to normal form.

Uncertain Knowledge and Reasoning: Uncertainty**,** Acting under uncertainty, Basic probability notation, Conditional probability, Axioms of probability, Bayes rules and its use, Normalization.

Probabilistic Reasoning Systems: Representing knowledge in an uncertain domain, Knowledge engineering for uncertain reasoning, Default reasoning, Rule-based methods for uncertain reasoning, Dempster-Shafer theory, Fuzzy sets and fuzzy logic.

Communicating, Perceiving, Planning and Acting: Natural language understanding: Syntactic processing, Ambiguity resolution, Text understanding.

Action: The situation calculus, A simple solution to the framework problem, Complex actions, Planning: Planning in the situation calculus, The STRIPS representation, Planning as a reasoning task.

CSE 4110: Artificial Intelligence Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 4109

CSE 4120: Technical Writing and Seminar

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Reading, writing and summarizing technical papers, Citation methodologies, Plagiarism issues, Presentation guidelines and techniques, Summarization and presentation of technical papers.

Syllabus of Optional-II Courses

CSE 4103: VLSI Design

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Introduction's design methodology, Introduction to microelectronics and CMOS technology, Brief overview of fabrication process, Basic electrical properties of CMOS and BiCMOS circuits.

Hardware Modeling: Logic networks, state diagrams, Data flow, behavioral optimization. Introduction to GaAs technology: Ultra-fast VLSI circuits and systems.

CMOS and BiCMOS Design Process: Stick diagram and lambda-based design rules, Subsystem design processes.

Subsystem Design Layout: Gate logic, Combinational design, Clocked sequential circuits, Bus designs.

Design of Computational Elements: ALU sub-system, Adder, Multipliers, Memory, Registers and aspects of system timing, Architectural Synthesis: Circuit specification, Architectural optimization, Data-path synthesis, Control unit synthesis, Synthesis and testing of VLSI circuits, Various CAD tools for design, Simulation and verification: Introduction to hardware description languages (VHDL and Verilog),Design style: FPGA and CPLDs.

CSE 4104: VLSI Design Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 4103.

CSE 4107: Digital Signal Processing

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Representation of discrete-time signals and systems, Sampling of continuous-time signals, Discrete Fourier transform (DFT), Computation of DFT, the z-transform, Spectral analysis of signals using DFT. Introduction to filter design, Digital filter Structure, Infinite Impulse Response filter design techniques, Finite impulse response filter design techniques, Applications of DSP in audio, Image, and Video processing.

CSE 4108: Digital Signal Processing Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 4107

CSE 4111: Machine Learning

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Aspects of machine learning, Supervised, Unsupervised, Semi-supervised and Reinforcement learning, Evaluation of hypothesis, Practical applications of machine learning.

Artificial Neural Networks: Neurons and biological motivation, Perceptron and solving Boolean functions, Feed forward and recurrent networks, Single layer and multilayer networks, Back-propagation training method, Radial basis function networks, Associative memory, Ensemble methods.

Support Vector Machines: Linear maximal margin classifier, Linear soft margin classifier; Nonlinear classifier.

Decision Trees: Recursive induction, Splitting attribute selection, Entropy and information Gain, Overfitting and pruning, ID3 and C4.5 algorithms.

Genetic Algorithms: Motivation from natural evolution, Genetic operators, Fitness function, Genetic algorithms for optimization.

Swarm Intelligence: Features of natural swarms, Swarm based methods for optimization: Ant colony optimization, Particle swarm optimization, Bee colony optimization.

Clustering and Unsupervised Learning: Learning from unclassified data, Clustering, Hierarchical agglomerative clustering, K-means partitional clustering.

Dimensionality Reduction: Curse of the dimensionality, Empty space phenomenon, Linear and nonlinear techniques for dimensionality reduction.

CSE 4112: Machine Learning Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 4111.

CSE 4115: Computer and Network Security

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction and Mathematical Foundations: Introduction, Overview of modern cryptography, Number theory, Probability and information theory.

Cryptography: Mechanisms and cryptanalysis of classical cryptosystems, Shannon's theory, Symmetric key cryptography including AES and DES, Asymmetric key cryptography including RSA and ElGamal cryptosystems, Digital signature including ElGamal and DSA, Hash functions including MD and SHA, Message authentication codes.

Security Protocols: Key Exchange, Authentication, Authentication and key exchange, Secret splitting and secret sharing.

Program Security: Attacks, Malware, Viruses and other malicious codes, Controls against program threats.

Networks Security: Network protocols, Kerberos, Pretty good privacy (PGP), Secure socket layer (SSL), Threats in networks, Network security controls, Firewalls, Intrusion detection system, Secure E-Mail, Web security.

Access Control: Security models and access policies, Access control in operating systems and databases.

CSE 4116: Computer and Network Security Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 4115.

CSE 4117: Modeling and Simulation

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Basic Simulation Modeling: Systems, models and simulation, Classification of simulation models, Steps in a simulation study.

Concepts in Discrete-event Simulation: Event-scheduling vs. process-interaction approaches, Time-advance mechanism, Organization of a discrete-event simulation models, Continuous simulation models, Combined discrete-continuous models, Monte Carlo simulation, Simulation of queuing systems.

Building Valid and Credible Simulation Models: Validation principles and techniques, Statistical procedures for comparing real-world observations and simulated outputs, Simulation and analytical methods for analysis of computer systems and practical problems in industry, Introduction to the development of simulation packages, Introduction to petri nets and their applications to computing systems.

CSE 4118: Modeling and Simulation Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 4117

CSE 4127: Image Processing and Computer Vision

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Digital Image Fundamentals: Different types of digital images, Sampling and quantization, Imaging geometry, Image acquisition systems, Image transformation.

Morphological Image Processing: Basic morphological concepts, Thinning, Thickening, Opening and closing operations.

Images Enhancement: Point processing, Spatial filtering, Frequency domain filtering, Multi-spectral image enhancement.
Image Restoration: Degradation and observation models, Inverse filtering, Geometric transformation.
Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region-oriented segmentation.
Image Compression: Lossy and lossless compression schemes, Predictive compression methods, Vector quantization, JPEG and MPEG image compression.
Image Perception and Physical Modeling: Human visual system, Light, Brightness, contrast, Color modeling and representation.
Recognition and Analysis: Object recognition, Edge detection, Linking and representation, 2D motion analysis, Stereo and multi-view analysis.

CSE 4128: Image Processing and Computer Vision Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 4127.

CSE 4129: Ubiquitous Computing

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

The Ubiquitous Computing Vision: Introduction, definition and scope of ubiquitous computing, Essential elements of ubiquitous networks, Visions and challenges in ubiquitous computing.
Architecture: Autonomic computing, Distributed computing, Cloud computing, Peer to Peer, Mobility, Mobile computation and agents, Smart places, Wearable computing, Service-Orientation, Sensors and actuators.
The Design and Evaluation of Different Ubicomputing Applications: Context-aware computing, Automated capture and access systems, Smart home, Healthcare and assistive applications, Energy monitoring and sustainability, Mobile social network software, Games and entertainment, Augmented reality.
Context Awareness: Surveillance, Monitoring, Navigation, GPS, Location and tracking, Ontologies, Reasoning.
Privacy: Problems of authentication, Confidentiality, Total information awareness, Credentials, Access control.

CSE 4130: Ubiquitous Computing Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 4129.

CSE 4131: Pattern Recognition

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Introduction: Basic concepts of pattern recognition, Importance of pattern recognition.
Statistical and Neural Pattern Recognition: Bayesian classifier, Bayes decision theory, Discriminator functions and decision surfaces, Parametric and non-parametric classification methods.
Linear Classifiers: Discriminating functions and decision hyper-planes, Perceptron algorithm and its variants, Kessler's construction.
Nonlinear Classifiers: Multilayer perceptron, Back-propagation algorithm and its variants.
Template Matching: Optimal path searching techniques, Dynamic programming methods, Correlation based matching and 2D log search algorithm for image matching.
Context Dependent Classification: Viterbi algorithm, Observable and hidden Markov models (HMMs), HMMs and their application in speech recognition.
Syntactic Pattern Recognition: Introduction to syntactic pattern recognition, Grammar-based approach, Parsing, Graph-based approach.
Unsupervised Classification: Basic concepts of clustering, Proximity measures, categories of clustering algorithms, Sequential clustering algorithms, Vector quantization, Feature extraction for representation and classification.

CSE 4132: Pattern Recognition Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours: *0L+3/2P Hrs/Week***

Laboratory works based on CSE 4119.

IEM 4127: Industrial Management

Credits: 3.0 **Prereq.: None** **Contact Hours: *3L+0P Hrs/Week***

Introduction: Basic theories of management, Management functions.
Organization: Theory and structure, Co-ordination, Span of control, Authority, Delegation, Centralization and decentralization.
Personnel Management: Need hierarchy, Motivation, Leadership, Performance appraisal, Wages and incentives, Organizational change and conflicts.
Cost and Financial Management: Elements of cost, Asset depreciation, Break event analysis, Investment analysis.
Operations Management: Demand forecasting, Inventory management systems, Master production schedule, MRP, Basic scheduling techniques, CPM and PERT, Plant location and layout, Maintenance management, Management Information System (MIS), Computer aided process planning (CAPP).

Summary of 4th Year 2nd Term Courses

Course No.	Course Title	Pre-Req.	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 4000	Project/Thesis			6	3.0
CSE 4207	Computer Graphics	MATH2207	3		3.0
CSE 4208	Computer Graphics Laboratory			3/2	0.75
CSE 4223	Digital System Design	CSE 1203	3		3.0
CSE 4224	Digital System Design Laboratory			3/2	0.75
CSE xxxx	Course from Optional-III (3.00)		3		3.0
CSE xxxx	Course from Optional-III (3.00)		3		3.0
CSE xxxx	Course from Optional-III (3.00)		3		3.0
Total			15	9	19.50

Weekly Contact Hours = 15L+9P=24 Hrs/week

NB: The Courses, CSE 4000 will be evaluated at the end of second term

Summary of Optional-III Courses

Optional-III should be selected from the following courses:

Course No.	Course Title	Theory Hrs./week L	Laboratory Hrs./Week P	Credit
CSE 4211	Algorithm Engineering	3		3.0
CSE 4213	Fault Tolerant System	3		3.0
CSE 4215	E-Commerce	3		3.0
CSE 4217	Principles of Programming Languages	3		3.0
CSE 4219	Distributed Database Systems	3		3.0
CSE 4221	Natural Language Processing	3		3.0
CSE 4233	Robotics	3		3.0
CSE 4225	Embedded Systems	3		3.0
CSE 4227	Human Computer Interaction	3		3.0
CSE 4231	Control Systems Engineering	3		3.0
CSE 4235	Multimedia Technology	3		3.0
CSE 4237	Computational Geometry	3		3.0
CSE 4239	Data Mining	3		3.0
CSE 4241	Biomedical Engineering	3		3.0
CSE 4243	Parallel and Distributed Processing	3		3.0
CSE 4247	Graph Theory	3		3.0

Syllabus of 4thYear 2ndTerm Courses

CSE 4000: Project / Thesis

Credits: 3.0 Prereq.: None Contact Hours: *0L+6P Hrs/Week*

CSE 4207: Computer Graphics

Credits: 3.0 Prereq.: MATH 2207 Contact Hours: *3L+0P Hrs/Week*

Graphics Hardware: Display devices, Input devices, Basic raster graphics algorithms for drawing 2D primitives, Polygon filling, Basic and composite transformations of 2D and 3D objects, viewing, clipping, and transformations, Normalization and projection.

Three Dimensional Object Representations: Polygon surface, Curves and surfaces, BSP trees, Fractal geometry methods, Illumination models.

Surface Rendering Methods: Polygon rendering, Ray tracing, Terrain visualization with height mapping, Modeling surface details with texture mapping, Color models, Computer animation.

CSE 4208: Computer Graphics Laboratory

Credits: 0.75 Prereq.: None Contact Hours: *0L+3/2P Hrs/Week*

Laboratory works based on CSE 4207.

CSE 4223: Digital System Design

Credits: 3.0 Prereq.: CSE 1203 Contact Hours: *3L+0P Hrs/Week*

Register Transfer Logic: Inter register transfer, Arithmetic, Logic and shift micro-operations, Conditional control statements, Fixed-point binary data, Overflow, Arithmetic shifts, Decimal data, Floating-point data, Non-numeric data, Instruction codes, Design of simple computer.

Processor Logic Design: Processor organization, Arithmetic logic unit, Finite state machine-design and implementation. Design of arithmetic circuit, Design of logic circuit, Design of arithmetic logic unit, Status register, Design of shifter, Processor unit, Design of accumulator, Introduction to hardware description languages (VHDL and Verilog).

Control Logic Design: Control organization, Hardwired control, Micro-program control, Control of processor Unit, PLA control, Micro-program sequencer.

Computer Design: System configuration, Computer instructions, Timing and control, Execution of instructions, Design of computer registers, Design of control, Register load and inter register transfer, Bus buffer and memory cycle of microcomputers.

Memories: ROMs, RAMs, Small TTL Memory.

Simple as Possible (SAP-1)Computer Design: Architecture, Instruction set, Programming, Fetch cycle, Execution cycle.

CSE 4224: Digital System Design Laboratory

Credits: 0.75 **Prereq.: None** **Contact Hours:** ***0L+3/2P Hrs/Week***

Laboratory works based on CSE 4223

Syllabus of Optional-III Courses

CSE 4211: Algorithm Engineering

Credits: 3.0 **Prereq.: None** **Contact Hours:** ***3L+0P Hrs/Week***

Randomized Algorithms: Las Vegas and Monte Carlo Algorithms.
Randomized Data Structures: Skip lists.
Amortized Analysis: Different methods.
N Approximation Algorithms: Approximation schemes, Hardness of approximation.
P-Completeness reOnline Algorithms: Competitive analysis, Online paging problem, Randomized online algorithms, Adversary models, Marker algorithm view Multithreaded algorithms, Van Emde Boas tree algorithms for massive data sets, External memory algorithms, Cache-Oblivious algorithms.
Quantum Algorithms: Quantum bits (Qbits), Quantum gates and circuits
Quantum algorithms, Quantum parallelism, Approximation algorithms, LP based approximation algorithms, Experimental algorithmic.

CSE 4213: Fault Tolerant system

Credits: 3.0 **Prereq.: None** **Contact Hours:** ***3L+0P Hrs/Week***

Introduction: Definition of fault tolerance, Redundancy, Applications of fault-tolerance.
Fundamentals of Dependability: Attributes: reliability, availability, safety, Impairments: faults, errors and failures, Means: fault prevention, removal and forecasting.
Dependability Evaluation Techniques: Common Measures: Failures rate, Mean time to failure, Mean time to repair, etc., Dependability model types, Dependability computation methods.
Hardware Redundancy: Redundancy allocation, Passive redundancy, Triple modular redundancy, Reliability evaluation, Voting techniques, N-modular redundancy, Active redundancy, Duplication, Standby sparing, Pair-and-a-spare, Hybrid redundancy, Self-purging redundancy, N-modular redundancy, Evaluation and comparison, Applications.

Information Redundancy: Coding Theory: Parity codes, Hamming codes, Cyclic codes, Checksum, M-of-N codes, Berger codes, Arithmetic codes, etc., Encoding and decoding techniques, Applications, Algorithm based fault tolerance.
Time Redundancy: Check-pointing and roll-back, Analysis and optimality, Alternating Logic.
Software Redundancy: Single-version techniques**,** Multi-version techniques, Software testing, Self-checking software.
Fault Detection in Cryptographic Systems: Overview of ciphers, Security attacks through fault injection: Fault attacks on symmetric key ciphers, Fault attacks on public (asymmetric) key ciphers, Countermeasures.
Fault-models: Layers of Reality, Stuck-at fault model and the Single fault assumption**,** Functional fault models.
Case Studies: Stratus systems**,** IBM Sysplex**.**
Soft Error: Overview of soft errors, Sources of soft errors, Soft error mitigation techniques.
Reading of Some of the State-of-the-Art Research Material.

CSE 4215: E-Commerce

Credits: 3.0 **Prereq.: None** **Contact Hours:** ***3L+0P Hrs/Week***

E-commerce: What is e-Commerce, Defining B2B, B2C and C2C Commerce, Advantages & Disadvantages of e-commerce, Tools for enabling e-commerce, Internet, Extranet, Intranet, WWW, Web Pages & their Design, HTML, XML, WML, WAP.
B2B Commerce: Electronic data interchange standards EDIFACT, ANSI X12, Value added network services, Security Issues in e-Commerce, Symmetric key encryption, Digital Encryption Standards (DES), Public key encryption, RSA system digital signature, Digital signature certification authority, MIME and MIME standards, PGP for e-mail.
B2C Commerce: Varieties of business, New business models, Electronic payment systems, Credit cards, Electronic funds transfer, Electronic cheque payments, Electronic cash, Issues in cash payment, Micro payments over the internet, Digital watermark, C2C commerce.
E-Governance: Introduction to e-governance, Understanding the relationship - governance and e-governance.
E-Government at Work: E-administration and E-services, E-Democracy, Local e-government, Joined-up government, National land & property gazetteer (NLPG) - meta-frameworks and interoperability in action - GIS systems, Pathfinder-Beacon councils.
Example: One stop shop, International perspectives on e-government - focus on Malaysia, US perspectives on e-government, Information security and privacy protection, Future directions of e-governance.

CSE 4217 Principles of Programming Languages

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Specification of Programming Languages: Syntax, semantics: operational semantics, Denotational semantics, Axiomatic semantics and attribute grammars.

Issues in Language Design: Names, Scope and binding, Types, Control flow, Subroutines and control abstraction, Modules, Mutation, Laziness, Polymorphism, Objects, Classes and inheritance in object-oriented languages.

Programming Language Paradigms: Data abstraction and object oriented, Programming, Non-imperative paradigms: Functional languages, Logic programming, Dynamic and scripting languages, Concurrent programming.

Runtime Management: Runtime structure and operating environment, Practical and implementation issues in run-time systems and environment.

Concurrency: Subprogram-level concurrency, Semaphores, Monitors, Message passing, Statement-level concurrency.

Exception Handling: Design issues, Evaluation of exception handling in C++ and Java.

CSE 4219: Distributed Database Systems

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction to distributed database management, Distributed architectures, Integrating data from distributed sources, Distributed database design, Distributed query processing and optimization, Distributed concurrency control, Distributed reliability protocols, Pervasive and mobile distributed database systems, Web data management, Interoperability and distributed recovery techniques.

CSE 4221: Natural Language Processing

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction to natural language processing, Regular expressions and automata, Morphology and FSTs, Phonetics, Phonology and text-to-speech, N-grams and machine learning, Word pronunciation and spelling, Automatic speech recognition, Word classes and POS tagging; CFGs for English, Basic parsing with CFGs, Parsing problems and some solutions, Probabilistic and lexicalized parsing.

Meaning representations and semantic analysis, Lexical semantics, Word sense disambiguation, Robust semantics and information retrieval, Hidden Markov and maximum entropy models.

Text coherence and discourse structure, Reference resolution, Information status, Spoken dialogue systems, Intonation in TTS systems, New approaches to story modeling for understanding, Generation and summarization, Machine translation, Summing Up: NLP applications.

CSE 4225: Embedded Systems

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Overview of Embedded Systems and Their Specific Requirements: (e.g. Robust design, Temporal constraints, Technological constraints, Developmental constraints), The product design cycle, Evaluation and justification of the available levels of system integration (Custom chip design through to turnkey-systems) and technological choice, Development of a system specification, Including case studies, Overview of the software and hardware design tools/techniques applicable to such systems such as UML, VHDL, Verilog, etc.

Software Issues: Real time operating systems, Software design methodologies pertinent to real-time embedded systems, Designing, implementing and testing software for embedded systems including multiprocessor and system-on-chip (SoC) devices, Verification strategies for embedded software development.

Hardware Issues: Choice of: processor, Memory, I/O, Level(s) of integration, Development environments, Hardware acceleration devices such as DSPs and FPGAs, Interfacing to commonly used I/O devices, Types of interconnection, Sensors for measuring physical phenomena, Output devices such as power actuators and motors.

Software/Hardware Co-design Issues: Design, Implementation and verification considerations for the simultaneous design of both hardware and software.

CSE 4227: Human Computer Interaction

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction and overview: Definition and Importance of HCI, Usability Requirements, Understanding users, Requirements analysis.

User Centered Design and Prototyping: System centered design, User centered design, Case studies, Participatory design, Design rationale, User interface prototyping, Paper-based prototypes, Software-based prototypes, Sensation.

Perception, Cognition: Psychophysics, Visual perception - low level, Visual perception - high level, Auditory perception, Haptic / kinesthetic perception, Attention, Motor behavior, Ergonomics.

Experimental Design and Analysis: A model of usability factors, Ethics, Experimental planning, Basic terminology, Experimental design, Statistical analysis (t-test, F-Test, correlation/regression), Anova, Non-parametric analysis.

Interaction Systems: Visual: eye movements, gesture recognition, Tabletop interfaces, Tangible interfaces, 3D interfaces, Virtual and augmented reality, Brain computer interface.

CSE 4231: Control Systems Engineering

Credits: 3.0 Prereq.: Nil Contact Hours: *3L+0P Hrs/Week*

Introduction to control systems, Dynamic systems modeling, Mathematical description of systems**:** taxonomy of systems, linear time invariant systems, discrete-time systems, Basic elements in control systems – open and closed loop systems, Block diagram and signal flow graph models, Transfer functions of linear systems, Mason's gain formula, Reduction of parameter variation and effects of disturbance by using negative feedback, Analysis and synthesis of continuous and sample data linear feedback control systems, Properties and advantages of feedback systems, Time domain and frequency domain performance measures, Stability and degree of stability of linear feedback systems, Frequency response methods and Nyquist stability, Root locus method, Compensation techniques.

CSE 4233: Robotics

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: History, Definitions, Robotic systems design, Applications.

Coordinate Systems: Cartesian coordinates, Degrees of freedom, Reference frames, orientation, Bi-dimensional and tridimensional transformation matrices, Relative and general transformations, Homogeneous transformations, Inverse transformations, Graphs.

Robots Systems and Structures: Robot architectures, Technical concepts of robotics, Actuation.

Robot Kinematics (position): Joints, Members, Reference frames, Amatrices, Direct and inverse kinematics, Trigonometric solution, Precision, Efficiency/complexity of kinematic solutions.

Robot Kinematics (velocity and acceleration): Derivatives, Velocity and acceleration of rigid bodies, Differential movement, Jacobian, Singularities.

Sensors and Perception: Internal and external sensors, Sensors hierarchy, Interfaces, data fusion, Classification, Localization, Machine vision, Applications.

Control: Classical approaches for robot control, Feedback loops, Position and force control, Compliance, Fuzzy logic control.

Task and Path Planning: Action-level planning, Modeling, Motion planning in R-space and C-space, Path tracking.

Different Types of Robots: Legged robots and Zero Momentum Point (ZMP), Humanoid robots, Robots, Middle sized and small sized soccer robots.

CSE 4235: Multimedia Technology

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Fundamentals: Media and data streams, Sound/audio, Image, Graphics, Video and animation, Color science and color models.

Data Compression: Coding requirements, Source, Entropy and hybrid coding, Lossless and lossy compression, JPEG, H.261, MPEG, MP3 and etc.

Computer Technology Issues: Communication architecture, Multimedia workstations, cache systems, Storage systems and optical storage.

Multimedia OS: Real-time operation, Resource management, Process management, file systems and multimedia networking.

Multimedia Synchronization: Presentation requirements, Reference model and synchronization techniques.

Multimedia Database: Data organization, indexing and retrieval.

Web Technologies Issues: Elements of web styling, Usability, Accessibility and information architecture and Content Management Systems (CMS).

Multimedia Applications: Digital libraries, System software, Toolkits, Conferencing paradigms, Structured interaction support and examples from video/audio/graphics conferencing.

CSE 4237: Computational Geometry

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Historical perspective, Algorithmic background, Geometric preliminaries, Models of computation, Geometric searching, Point location problem and range searching problems, Divide and conquer, Amortization, Multi-dimensional search, Space sweep, Polygon triangulation, Intersection and union of rectangles.

Proximity, Closest pair problem, Duality and randomization, Voronoi and Delaunay diagrams, Arrangements of lines and points, Geometry of rectangles, Hidden surface removal, Art gallery theorems, Shortest paths, and lower-bounds, Convex hulls: 2D& 3D proximity, Facility location and linear programming, Mobility of objects in space.

CSE 4239: Data Mining

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Introduction: Kinds of data and patterns to be mined, Basic statistical description of data.

Data Preprocessing: Data objects and attributes, Data similarity and dissimilarity, Data cleaning, Data integration, Data reduction, Data transformation and discretization.

Data Warehousing: Data warehouse modeling, Design issue, Implementation and usage, Data mining, Associations, Correlations, Mining methods, Pattern evaluation.

Data Classification: Decision tree induction, Classification methods, Evaluation and selection of classification, Classification accuracy.

Cluster Analysis: Partitioning, Hierarchy, Density and grid based clustering methods, evaluation of clustering methods, Cluster quality.

Outlier Detection: Outlier detection methods, Statistical approaches, Proximity based approaches, Clustering and classification based approaches.

CSE 4241: Biomedical Engineering

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Bioelectric Phenomena and Biosignals: Cell membrane, Resting potential, Action potential.

ECG, EEG, EMG, EOG and ERG: Origin, Characteristics and applications in medical diagnosis.

Physiological Measurement: Electrode: Working principle, Equivalent circuit and classifications.

Transducers: Characteristics, Classifications and applications.

Measurements: Body temperature, Blood pressure and heart rates.

Biosignal Processing: Instrumentation amplifiers, Signal conditioner, A/D and D/A converter, Computerized automatic analysis, Bio-telemetry.

Diagnostic Methods: Ultrasound, X-ray, CT, and MRI techniques: Principles, Merits, Demerits and applications, Applications of Laser and Optics in Diagnosis.

Biomedical Equipment: Surgical diathermy machines, Defibrillators, Pacemakers, Ventilators, Prosthesis and Prosthetic devices, ICU and CCU.

Electrical Safety: Physiological effects of electricity, Susceptibility parameters, Electrical shock hazards in safety aspects of biomedical instrumentation and Good grounding concepts.

CSE 4243: Parallel and Distributed Processing

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Motivation for Parallelism: Parallel Computing, Speed up, Moore's law, Grand challenge problems, Trends, The status and future of massively parallel processing.

Parallel and Distributed Computers: Flynn's taxonomy, Distributed memory multicomputers, Shared memory multiprocessors, Networks of workstations, Cluster and grid computing, PRAMs, Interconnection networks.

Performance Measures: Granularity, Speed up, Efficiency, Cost, Amdahl's law, Gustafson's law, Isoefficiency, Optical computing, Quantum computing.

Interconnection Networks: Interconnection networks for inter-processor communication, Permutation routing, Non uniform routing, Deadlock free routing and multicasting, Mapping and Embedding.

Distributed Processing: Distributed models and systems, Real time distributed systems.

Applications: Sorting, Searching, Matrix algorithms, Fourier transform, Finding the maximum, Image processing.

CSE 4247: Graph Theory

Credits: 3.0 Prereq.: None Contact Hours: *3L+0P Hrs/Week*

Graphs: Simple graphs, Digraphs, Subgraphs and complements, Vertex-degrees, Walks, Paths, Cycles and distance, Connectedness and components of a graph, Random graphs**,** Bridges and Blocks, Isomorphism and *2*-isomorphism.

Matrices of a graph: Incidence matrix, Cut matrix, Circuit matrix, Orthogonality relation.

Traversability: Eulerian graphs, Hamiltonian graphs, Chinese postman problem, Traveling salesman problem.

Graph Coloring: Vertex coloring and chromatic number, Chromatic polynomials, Edge coloring and chromatic index, Four-color problem, Vizing's theorem, Planar graphs.

Graph applications: Matching, Covering and Packing, Flow NETWORKS.

Trees: Trees, Spanning trees, *K*-trees, Spanning *k*-trees, Forests.

Khulna University of Engineering & Technology

Academic Ordinance for Post Graduate Studies

(Effective from July-2013 semester)

(Approved by 41th meeting of Academic Council on 18/02/13 and 25/02/13 and confirmed by 43th meeting of Academic Council on 12/09/13)

1. Definitions

1.1 'University' means the Khulna University of Engineering & Technology.

1.2 'Syndicate' means the Syndicate of the University.

1.3 'Vice-Chancellor' means the Vice-Chancellor of the University

1.4 'Academic Council' means the Academic Council of the University.

1.5 'CASR' means the Committee for Advanced Studies and Research of the University.

1.5.1. The CASR shall consist of the following members:

i)	Vice-Chancellor	Chairman
ii)	All Deans	Member
iii)	Three Professors to be nominated by the Syndicate	Member
iv)	Three teachers having research qualification and experience to be nominated by the Academic Council	Member
v)	Three experts, at least one from outside the University, to be nominated by the Vice-Chancellor	Member
vi)	The Director (Research and Extension)	Member-Secretary

1.5.2. The quorum for the meetings of the CASR shall be five.

1.5.3. The term of office of the nominated members shall be two years. But they will continue their duties until they are replaced by new members.

1.6 `EC' means the Executive Committee of any Faculty of the University.

1.6.1. The EC shall consist of the following members:

i)	Dean of the Faculty	Chairman
ii)	Head of the Departments under the Faculty	Member
iii)	All Professors and Associate Professors of the Departments under the Faculty	Member
iv)	Three teachers, not related to the subjects of the Faculty but closely related to the subjects according to the Academic Council, nominated by the Academic Council	Member
v)	Two persons, having special knowledge to one or more subjects of the Faculty and not serving in the University, nominated by the Academic Council	Member

1.6.2. At least one-third members will fulfil the quorum.

1.6.3. The term of office of the nominated members shall be three years.

1.7 'ACPG' means the Academic Committee for Post-Graduate studies in a degree-awarding department of the University.

1.7.1. The ACPG shall consist of the following members:

i)	Head of the Department	Chairman
ii)	All Professors and Associate Professors of the respective Department and all teachers who teach in the post-graduate classes	Member
iii)	One Professor from the relevant field from any other University to be nominated by the Vice-Chancellor	Member
iv)	One expert from the relevant field having experience in any industry, research or commercial organization to be nominated by the Academic Council	Member

1.7.2. The Chairman will nominate one of the members from (ii) to act as the Member-Secretary.

1.7.3. At least one-third members will fulfil the quorum.

1.7.4. The term of the office of the nominated members shall be three years.

1.8 'DSC' means the Doctoral Scrutiny Committee.

1.8.1. The DSC shall consist of the following members:

i)	Supervisor	Chairman
ii)	Joint Supervisor/Co-supervisor (if any)	Member
iii)	Head of the Department	Member
iv)	Not less than three experts of which at least one from outside the Department	Member

1.8.2. There shall be a DSC for each Ph. D. student proposed by the Head of the Department and approved by the CASR.

1.8.3. The committee should be formed within 3 (three) months from the date of the student's provisional admission in consultation with the supervisor.

1.8.4. The DSC will meet from time to time (at least on three occasions) on the request of the supervisor to review the progress of the student.

1.8.5. In special circumstances, the CASR may approve any addition and/or alteration in the DSC on the recommendation of the supervisor through the Head of the Department.

2. Degree Awarding Departments

The University shall have the following post-graduate degree awarding Departments:

i) Department of Civil Engineering

ii) Department of Electrical and Electronic Engineering
iii) Department of Mechanical Engineering
iv) Department of Computer Science and Engineering
v) Department of Electronics and Communication Engineering
vi) Department of Industrial Engineering and Management
vii) Department of Bio-Medical Engineering
viii) Department of Mathematics
ix) Department of Chemistry
x) Department of Physics
xi) Any other Department to be instituted by the Syndicate on the recommendation of the Academic Council from time to time.

3. Degrees Offered

The Post-Graduate degrees to be offered by the University under this ordinance are as follows:

3.1. Master of Science in Engineering
i) Master of Science in Civil Engineering abbreviated as M. Sc. Eng. (CE)
ii) Master of Science in Electrical & Electronic Engineering abbreviated as M. Sc. Eng. (EEE)
iii) Master of Science in Mechanical Engineering abbreviated as M. Sc. Eng. (ME)
iv) Master of Science in Computer Science & Engineering abbreviated as M. Sc. Eng. (CSE)
v) Master of Science in Electronics & Communication Engineering abbreviated as M. Sc. Eng. (ECE)
vi) Master of Science in Industrial Engineering & Management abbreviated as M. Sc. Eng. (IEM)
vii) Master of Science in Biomedical Engineering abbreviated as M. Sc. Eng. (BME)
viii) Master of Science in Energy Science and Engineering abbreviated as M. Sc. Eng. (ESE)
ix) Any such other degree as may be approved by the Syndicate on the recommendation of the Academic Council from time to time.

3.2. Master of Science
i) Master of Science in Mathematics abbreviated as M. Sc. (Math)
ii) Master of Science in Chemistry abbreviated as M. Sc. (Chem)
iii) Master of Science in Physics abbreviated as M. Sc. (Phy)
iv) Any such other degree as may be approved by the Syndicate on the recommendation of the Academic Council from time to time.

3.3. Master of Philosophy
i) Master of Philosophy in Mathematics abbreviated as M. Phil. (Math)
ii) Master of Philosophy in Chemistry abbreviated as M. Phil. (Chem)
iii) Master of Philosophy in Physics abbreviated as M. Phil. (Phy)
iv) Any such other degree as may be approved by the Syndicate on the recommendation of the Academic Council from time to time.

3.4. Doctor of Philosophy
i) Doctor of Philosophy in Civil Engineering abbreviated as Ph. D. (CE)
ii) Doctor of Philosophy in Electrical & Electronic Engineering abbreviated as Ph. D. (EEE)
iii) Doctor of Philosophy in Mechanical Engineering abbreviated as Ph. D. (ME)
iv) Doctor of Philosophy in Computer Science & Engineering abbreviated as Ph. D. (CSE)
v) Doctor of Philosophy in Electronics & Communication Engineering abbreviated as Ph. D. (ECE)
vi) Doctor of Philosophy in Industrial Engineering & Management abbreviated as Ph. D. (IEM)
vii) Doctor of Philosophy in Biomedical of Engineering abbreviated as Ph. D. (BME)
viii) Doctor of Philosophy in Mathematics abbreviated as Ph. D. (Math)
ix) Doctor of Philosophy in Chemistry abbreviated as Ph. D. (Chem)
x) Doctor of Philosophy in Physics abbreviated as Ph. D. (Phy)
xi) Any such other degree as may be approved by the Syndicate on the recommendation of the Academic Council from time to time.

4. Admission Requirements

4.1. Master of Science in Engineering

For admission to the courses leading to the award of the degree of M. Sc. Eng. in any department, a candidate must have obtained a B.Sc. Eng. or an equivalent degree with at least a CGPA of 2.65 in the scale of 4.00 or its equivalent from any recognized University/Institution in the relevant field/branch and must have obtained at least a CGPA of 3.50 in the scale of 5.00 or its equivalent both in SSC and HSC levels

4.2. Master of Science

For admission to the courses leading to the award of the degree of M. Sc. in any department, a candidate must have obtained a 4 years B.Sc. (Hon's) or an equivalent degree with at least a CGPA of 2.65 in the scale of 4.00 or its equivalent from any recognized University/Institution in the relevant field/branch and must

have obtained at least a CGPA of 3.50 in the scale of 5.00 or its equivalent both in SSC and HSC levels.

Or

A candidate having B.Sc. Engineering degree with good academic records from relevant field/branch, as decided by the ACPG of the respective department, is also eligible; provided that he/she completes some pre-requisite courses as determined by the Selection Committee, constituted under Art 5.3 of this ordinance.

4.3. Master of Philosophy

For admission to the courses leading to the award of the degree of M. Phil. in any department, a candidate must have obtained an M. Sc. or an equivalent degree in the relevant field/branch with at least Second Class/CGPA of 2.65 in the scale of 4.00 in both B.Sc. (Hon's/Pass) and M. Sc. with good previous academic records.

Or

A candidate having B.Sc. Engineering degree with good academic records from relevant field/branch, as decided by the ACPG of the respective department, is also eligible; provided that he/she completes some pre-requisite courses as determined by the Selection Committee, constituted under Art 5.3 of this ordinance.

4.4. Doctor of Philosophy

4.4.1. For admission to the courses leading to award of the degree of Doctor of Philosophy in any department, a candidate must have obtained an M. Sc. Eng./M. Eng./ M.Sc. with 4 years B.Sc. (Hon's)/M. Phil or its equivalent degree with good academic records in the relevant field/branch of Engineering/Science or its equivalent from any recognized University/Institution.

4.4.2. A student already working for an M. Sc. Eng./ M.Sc. with 4 years B.Sc. (Hon's) ./M. Phil degree in this University and showing excellent progress and promise in thesis work may be provisionally transferred to Ph.D. program after completion of his/her M. Sc. Eng./M. Phil. course work with a minimum CGPA of 3.50 out of 4.00 on the recommendation of the ACPG and approval of the CASR.

4.5. Master of Science in Engineering

The above requirements may be relaxed for candidates on deputation or sponsored by Academic Institutions/ Research Organizations/Government and Semi-Government Organizations. Such relaxation shall be recommended by the ACPG to the CASR for approval.

5. Admission Procedures

5.1. Applications for admission to the above programs shall be invited before commencement of each semester through regular means of advertisement and received by the Registrar.

5.2. On the recommendation of the appropriate EC, the Academic Council shall frame the rules for admission to the University for M.Sc. Eng./M.Sc./M. Phil. /Ph.D. program from time to time.

5.3. There shall be a Selection Committee in each department as constituted by the respective ACPG on the recommendation of the Head of the Department.

5.4. Before being finally selected for admission, a candidate may be required to appear at an interview by the Selection Committee.

5.5. Every selected candidate other than a Ph.D. candidate shall have to get himself/herself admitted to the University within the prescribed time limit on payment of prescribed fees.

5.6. A Ph.D. candidate selected by the Selection Committee shall be provisionally admitted to the University within the prescribed time limit on payment of prescribed fees and he/she may be required to pass the prerequisite credit and non-credit courses, if any, as prescribed by the DSC.

5.7. A provisionally admitted Ph.D. candidate shall be deemed to be eligible for final admission as a Ph.D. student with effect from the date of his/her provisional admission if and when he/she qualifies the comprehensive examination (Art 6.10.3(iii) of this ordinance).

6. Academic Regulations

6.1. There shall be two semesters in one academic year. One will start in January and the other in July.

6.2. The courses of study in a department shall be proposed by the respective ACPG and approved by the Academic Council on the recommendation of the Executive Committee of the respective Faculty. The ACPG may review the curriculum from time to time and propose for any modification if necessary.

6.3. The courses to be offered by a department in any semester shall be determined by the respective department.

6.4. Academic progress shall be assessed in terms of credit hours earned by the student. One credit hour theoretical course shall normally require 14 periods of lecture during one semester while one credit hour of laboratory/project/thesis work should normally require 42 periods of laboratory/project/thesis work in a semester. The number of credit hours for each course shall be specified in the syllabus of the respective department.

6.5. Status of a Student

There shall be two categories of student, namely,

i) Full-time: A full-time student shall not ordinarily be an employee of any organization, however, employees serving in different organizations may be registered as full-time student with prior permission from the concerned authority/employer. A full-time student may be employed as teaching/research assistant in this University.

ii) Part-time: Students serving in different organizations may be admitted as part-time student with a written consent from the employer.

6.6. Course Registration

6.6.1. Every admitted student shall have to get himself/herself registered into the courses on payment of prescribed fees.

6.6.2. Course registration by a student must be completed within two weeks from the start of a semester; otherwise the student shall not be allowed to continue the course in that semester.

6.6.3. A full-time student must register a minimum of 12 (twelve) credit hours and a maximum of 15 (fifteen) credit hours per semester.

6.6.4. A part-time student should normally register a minimum of 6 (six)-credit hours and a maximum of 9 (nine) credit hours per semester.

6.6.5. A student may be permitted to withdraw and/or change his/her registered course within three working weeks from the commencement of that semester on the recommendation of his/her supervisor (if any) and upon approval of the concerned teacher(s) and Head of the Department.

6.6.6. No student will be allowed to register a course for grade improvement. A student having a F grade in a compulsory course (if any) shall be allowed to repeat.

6.7. Credit Transfer

On the recommendation of the respective ACPG through EC and by the approval of the Academic Council, a student may be allowed to transfer a maximum of 50% of the required theory courses of this University completed by the student at other universities/institutions where he/she enrolled earlier for M. Sc./ M. Phil/ Ph. D program provided that the courses were not taken earlier than 3 (three) calendar years from the date of his/her first enrollment in the respective program in this University. In addition the student must obtain a minimum Grade Point of 3.00 out of 4.00 or its equivalent in each course to be transferred and the courses should be equivalent to the approved courses of this University.

6.8. Course Duration

6.8.1.1. M. Sc. Eng. Degree

The minimum duration to complete the requirements of M. Sc. Eng. degree shall normally be 3 (three) semesters and generally not be more than 5 (five) academic years from the date of his/her admission.

6.8.1.2. M. Sc. Degree

The minimum duration to complete the requirements of M. Sc. degree shall normally be 3 (three) semesters and generally not be more than 5 (five) academic years from the date of his/her admission.

6.8.2. M. Phil. Degree

The minimum duration to complete the requirements of M. Phil. degree shall normally be 4 (four) semesters and generally not be more than 5 (five) academic years from the date of his/her admission.

6.8.3. Ph. D. Degree

The minimum duration to complete the requirements of Ph.D. degree shall normally be 4 (four) semesters from the date of his/her provisional admission and generally not be more than 7 (seven) academic years from the date of his/her provisional admission.

6.9. Requirements for Continuation of the Post-Graduate Program

6.9.1. A student will not be allowed to continue the program if he/she obtains F grades in three or more courses in the first two registered semesters.

6.9.2. A student will not be allowed to continue the program if his/her CGPA falls below 2.5 (including C grades) at the end of the second or any subsequent semester.

6.9.3. A Ph. D. student will not be allowed to continue the program if he/she fails to qualify the Comprehensive Examination [Art 6.10.3(iii)] in 2(two) chances.

6.10. Requirements for the Degrees

6.10.1.1. M. Sc. Eng. Degree

The following are the requirements for M. Sc. Eng. degree:

i) A student must obtain a minimum CGPA of 2.65 in his/her course works.

ii) A student must have to complete a minimum of 36 credit hours of which 18 credit hours shall be assigned to a thesis or 9 credit hours for a project.

iii) In addition to the successful completion of course works, every student shall have to submit a thesis on his research work or a dissertation on his project work, as applicable, fulfilling the requirements as detailed in Art. No. 9.

6.10.1.2. M. Sc. Degree

The following are the requirements for M. Sc. degree:

i) A student must obtain a minimum CGPA of 2.65 in his/her course works.

ii) A student must have to complete a minimum of 36 credit hours of which 18 credit hours shall be assigned to a thesis or 9 credit hours for a project.

iii) In addition to the successful completion of course works, every student shall have to submit a thesis on his research work or a dissertation on his project work, as applicable, fulfilling the requirements as detailed in Art. No. 9.

6.10.2. M. Phil. Degree

The following are the requirements for M. Phil. degree:

i) A student must obtain a minimum CGPA of 2.65 in his/her course works.

ii) A student must have to complete a minimum of 48 credit hours of which 24 credit hours shall be assigned to a thesis.

iii) In addition to the successful completion of course work, every student shall have to submit a thesis on his research work fulfilling the requirements as detailed in Art. No.9.

6.10.3. Ph.D. degree

The following are the requirements for Ph. D. degree:

i) A student must obtain a minimum CGPA of 2.65 in his/her course works.

ii) A student must have to complete a minimum of 60 credit hours of which 45 credit hours shall be assigned to a thesis.

iii) He/she must have to pass the Comprehensive Examination. Comprehensive Examination shall comprise a written examination and/or an oral examination to test the knowledge of the student in his/her field of study and research. Comprehensive Examination shall ordinarily be held after the completion of the course work by the student. The DSC on the request of the supervisor shall fix a date and time for the Comprehensive Examination. The DSC shall conduct the Comprehensive Examination.

iv) In addition to the successful completion of course work and Comprehensive Examination, every student shall have to submit a thesis/dissertation on his/her research work fulfilling the requirements as detailed in Art. No. 9.

7. Grading System

7.1. Numerical marks may be made in answer scripts, tests etc. for assessing the performance of the students but all the final grading shall be made in letter grade/grade point as follows:

Numerical Marks	Letter Grade	Grade Point (G_i)	Performance
90% and above	A+	4.0	Excellent
≥80% but <90%	A	3.5	Very good
≥70% but <80%	B+	3.0	Good
≥60% but <70%	B	2.5	Average
≥50% but <60%	C	2.0	Pass
Below 50%	F	0.0	Fail
Incomplete	I	--	--
Satisfactory	S	--	--
Unsatisfactory	U	--	--

7.2. The Grade Point Average (GPA) shall be computed for each semester as follows:

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

Where,
n is the number of courses completed during the semester,
C_i is the number of credits allotted to a particular course, and
G_i is the grade point corresponding to the letter grade awarded for that course.

A Cumulative Grade Point Average (CGPA) shall also be computed at the end of second and subsequent semesters. The CGPA will be computed as follows:

$$CGPA = \frac{\sum_{j=1}^{m} S_j T_j}{\sum_{j=1}^{m} T_j}$$

Where,
m is the number of courses completed during the semester,
C_i is the number of credits allotted to a particular course, and
G_i is the grade point corresponding to the letter grade awarded for that course.

Both GPA and CGPA will be rounded off to the second place of decimal for reporting.

7.3. On the written request from a student, a maximum of two courses, having B or C grade in each, may be ignored for the calculation of CGPA. In such case the CGPA must not be less than 2.65 in the remaining courses.

7.4. Courses in which a student gets F grade shall not be counted towards credit hour requirements and for the calculation of GPA.

7.5. A student shall get I grade in a course with prior permission from the Head of the Department if he/she is unable to complete the course due to any unavoidable circumstances. He/she has to complete the course within the next two consecutive semesters; otherwise he/she will get F grade in that course. He/she may, however,

be allowed to register that course without further payment of course registration fees. In addition to that if the incomplete course(s) do/does not offer in the consecutive next 2 (two) terms then the students shall have to apply to the Chairman, CASR with the recommendation of respective Head of the Department for the withdrawal of the course(s).

7.6. Satisfactory (S) and unsatisfactory (U) shall be used for grading of thesis/project and non-credit prerequisite courses. If, however, thesis is discontinued an I grade shall be recorded.

8. Conduct of Examination for Theoretical Courses

8.1. In addition to class tests, assignments, term papers etc. there shall be a written examination on all theoretical courses at the end of each semester. The Head of the Department shall announce a date of the examination generally two weeks before its commencement. The final grade in a theoretical course shall be based on the performance of all class tests, assignments, term papers and written examination.

8.2. The respective course teacher will be solely responsible for the performance evaluation of a student as detailed in Art. No. 8.1. He/she will announce the final grade of the course within three weeks from the date of examination of that course and will also submit a copy to the Head of the Department.

8.3. The Controller of Examinations shall keep up-to-date record of all the grades obtained by a student in individual Academic Record Card. A student can get an official grade sheet from the office of the Controller of Examinations on payment of prescribed fees.

9. Project/ Thesis

9.1. Appointment of Supervisor/Co-Supervisor/Joint-Supervisor

9.1.1. Research works for a project/thesis shall be carried out under the supervision (Supervisor/Co-Supervisor/Joint-Supervisor) of a teacher, not below the rank of an Assistant Professor with sufficient research experience, publications and at least posses the degree which he/she is going to supervise, from the respective department or from any other department of this University proposed by the Head of the Department and recommended by the ACPG. A teacher of this University who is studying in postgraduate level shall not be allowed to supervise any Postgraduate student. A Co-Supervisor/Joint Supervisor is not encouraged in Masters Level unless there is an absolute necessity. In the Ph. D. Level, Co-Supervisor/Joint-Supervisor(s) are acceptable with proper justification by

(7.5 Approved by 51th meeting of academic council on 19/05/16)

the supervisor. A Joint-Supervisor or Co-Supervisor (if necessary) may be appointed from within/outside the University recommended by the ACPG.

9.1.2. In case of selecting a Supervisor/Joint supervisor/Co-supervisor from other than the respective department, an approval from the supervisor's Head of the Department has to be taken.

9.1.3. The Supervisor, Joint-supervisor/Co-supervisor (if any) shall be approved by the CASR on the recommendation of the ACPG.

9.1.4. A thesis/project supervisor has to be normally appointed after the completion of the first semester for M.Sc. Eng./M.Sc./M.Phil and within three months for Ph. D. students.

9.2. Research Proposal

9.2.1. M. Sc. Eng./ M.Sc./M.Phil

A student shall submit a project/thesis proposal to the ACPG through supervisor(s). The ACPG shall examine the proposal and recommend it for the approval of the CASR through the Head of the Department. In special circumstances, the ACPG may recommend any subsequent changes in the research topic and forward it through the Head of the Department to CASR for approval.

9.2.2. Ph. D.

After the successful completion of the Comprehensive Examination a student shall submit a research proposal to the DSC through the supervisor(s). The DSC shall examine the proposal and recommend it for the approval of the CASR through the Head of the Department. In special circumstances, the DSC may recommend any subsequent changes in the research topic and forward it to CASR for approval through the Head of the Department.

9.3. The project/research work should normally be carried out in the University. However, if necessary, the supervisor can allow his/her student to carry out the research work outside the University with the approval of the ACPG in the case of M. Sc.Eng./M.Sc./M.Phil. student or with the approval of the DSC in the case of Ph. D. student. The work schedule and financial involvement should be mentioned in the research proposal for carrying out research work.

9.4. At the end of a student's research work on the advice of the supervisor the student shall submit a thesis which must be an original contribution to engineering/sciences and worthy of publication. Every student shall have to submit required number of printed copies of his/her thesis/project dissertation in the approved format to the Head of the Department through his/her supervisor on or before a date to be fixed by the Head of the Department in consultation with the supervisor(s).

9.5. A student shall have to declare that he/she has carried out the project/research work and it not been submitted elsewhere for any purpose, except for publication, duly countersigned by the supervisor(s).

9.6. Project/ Thesis Examination

9.6.1. M. Sc. Eng. Project/Thesis, M. Sc. Project/ Thesis and M. Phil. Thesis

9.6.1.1. The CASR shall constitute an examination committee for each project/thesis examination and oral examination from the panel of examiners proposed by concerned Head of the Department in consultation with supervisor(s) and recommended by the concerned ACPG. The examination committee shall be as follows:

i)	Supervisor	Chairman
ii)	Joint supervisor/Co-supervisor (if any)	Member
iii)	Head of the Department	Member
iv)	One or two teachers from within the department/faculty not below the rank of Assistant Professor.	Member
v)	One external Examiner outside the University	Member (External)

9.6.1.2. The supervisor(s) and the external examiner shall examine the thesis/dissertation; whereas the examination committee shall assess the performance in the oral examination only.

9.6.1.3. If any examiner is unable to accept the appointment or wants to relinquish his/her appointment before the examination, the Vice-Chancellor shall appoint another examiner from the panel.

9.6.2 Ph. D. Thesis

9.6.2.1. Each student has to submit 10 (ten) copies of synopsis at the end of the research work and has to appear in an Oral Examination arranged by the Chairman of DSC. After satisfactory completion of the Oral Examination the student shall submit at least 5 (five) printed copies of the thesis in the final form to the Head of the Department through the supervisor in the approved format.

9.6.2.2. The DSC will propose a panel of external examiners for each thesis. Board of Examiners shall consist of the DSC and 2 (two) more external examiners, at least one from outside the country, from the relevant field to be appointed by the Vice-Chancellor in consultation with the thesis supervisor. The supervisor shall act as the Chairman of the Board of Examiners. A copy of the thesis is to be sent to each external examiner for evaluation and written opinion.

9.6.2.3. If any examiner is unable to accept the appointment or wants to relinquish his/her appointment before the examination, the Vice-Chancellor shall appoint another examiner from the panel in his/her place, without further reference to the DSC. The Vice-Chancellor may also appoint a third external examiner, if referred by the DSC in case of major contradiction to the external examiners' viewpoint.

9.6.2.4. On receipt of satisfactory report from the thesis examiners, an oral examination shall be arranged on a date or dates fixed by the Chairman of DSC in which the student shall defend his/her thesis. The student must satisfy the Board of Examiners as constituted under Art. 9.6.2.2 that he/she is capable of intelligently applying the results of his/her research to the solution of the problems and of undertaking independent research work. Besides he/she should show the evidence of satisfactory knowledge related to the theory and technique used in his/her research work.

9.6.2.5. In case a student fails to satisfy the Board of Examiners in thesis and/or Oral Examination, he/she shall be given one more chance to resubmit the thesis and/or re-appear in Oral Examination as recommended by the Board of Examiners.

9.6.2.6. A student may be awarded an M. Sc. Eng./M. Phil degree on the recommendation of the supervisor, if the student fails to qualify for the award of Ph. D degree.

10. Striking off and removal of names from the rolls

The name of the student shall be struck off and/ or removed from the rolls of the University on the following grounds:

i) Unsatisfactory progress of the student reported by the supervisor through the ACPG and approved by the CASR.
ii) Failing to proceed with the program according to the Art. 6.8. and 6.9 of this ordinance.
iii) Forced to discontinue his/her studies under disciplinary rules.
iv) Withdrawal of his/her name from the roll-sheet of the University.
v) Non–payment of dues of the University and the Halls of residence within a prescribed period.

11. Academic Fees

The amount of academic fees shall be decided by the University from time to time.

12. Refund of Fees

12.1. A student withdrawing officially from all courses and/or including thesis/project as per Art 10(iv) is entitled to get a refund of the course registration fees provided he/she withdraws in writing through the respective Head of the Department before the expiry of two working weeks from the commencement of the classes. Thesis/project registration fees in any case are not refundable.

12.2. In case of Art.10(ii) or after successful completion of the course, a student can get refund of University and Hall caution money after producing the clearance from all concerned.

13. Admission Co-ordination Committee for Post-graduate studies

The Post-graduate Admission Co-ordination Committee shall consist of the following members:

i) Vice-Chancellor, who shall also be the Chairman
ii) Pro-Vice-Chancellor (if any)
iii) All Deans
iv) Director (Research and Extension), who shall also be its Secretary
v) All Post-graduate degree offering Head of the Departments.

The Committee will decide upon the number of students to be admitted to any department each year on the basis of the present facilities of the said department.

14. Extension of time for completion of Degree

The application for extension of time span of a student should be processed through the CASR. A recommended proforma may be used for this purpose. The application must be submitted within 6 (six) months after the normal time span has elapsed.

Syllabus for Post Graduate Study
Department of Computer Science and Engineering (CSE)
(Recommended by the EC of EEE faculty at its 8th meeting on 25/01/09)

A. Compulsory Courses. (For M.Sc. Engineering)

Course No.	Course Title	Credit
CSE 6000	Thesis/Project	18/9

B. Elective Courses

Sl. No.	Course No.	Course Title	Credit
1.	CSE 6101	Advanced Graph Theory	3
2.	CSE 6103	Real Time Operating Systems	3
3.	CSE 6105	Parallel Computations and Algorithms	3
4.	CSE 6221	Advanced Database Systems	3
5.	CSE 6223	Advanced Human-Computer Interaction	3
6.	CSE 6225	Data Warehousing and Mining	3
7.	CSE 6227	Transactional Information Systems	3
8.	CSE 6229	Information Management and Retrieval	3
9.	CSE 6231	Web Engineering	3
10.	CSE 6233	Advanced Software Engineering	3
11.	CSE 6235	Computer Graphics and Animations	3
12.	CSE 6237	Enterprise Infrastructure and Management	3
13.	CSE 6239	Computer Vision	3
14.	CSE 6241	Multimedia Technologies and Applications	3
15.	CSE 6243	Advanced Digital Image Processing	3
16.	CSE 6245	Principles of Multimedia Networking	3
17.	CSE 6247	Large Scale Data Management	3
18.	CSE 6351	Principles of Cryptography	3
19.	CSE 6353	Advanced Network Security	3
20.	CSE 6355	Advanced Cryptography	3
21.	CSE 6461	Advanced Artificial Intelligent Systems	3
22.	CSE 6463	Machine Translation	3
23.	CSE 6465	Soft Computing	3
24.	CSE 6467	Advanced Natural Language Processing	3
25.	CSE 6469	Bioinformatics	3
26.	CSE 6471	Bio-inspired Computing Techniques	3
27.	CSE 6473	Advanced Machine Learning	3

28.	CSE 6475	Neural Networks and Deep Learning	3
29.	CSE 6571	Advanced Computer Architecture	3
30.	CSE 6573	Interconnection Networks	3
31.	CSE 6575	Photonic Switching Networks	3
32.	CSE 6577	Advanced Embedded-Systems	3
33.	CSE 6579	Advanced Ubiquitous Computing	3
34.	CSE 6581	Soft Error Tolerance	3
35.	CSE 6583	Advanced Digital Signal Processing	3
36.	CSE 6585	Cloud Computing	3
37.	CSE 6587	Advanced Wireless Networking	3
38.	CSE 6901	Special Study in Computer Science and Engineering	3

A student must complete a Thesis/Project study under the guidance of a supervisor.

CSE 6101: Advanced Graph Theory **Credit: 3**

Review of fundamental concepts, Bonds, The cycle space and the bond space, Blocks, Menger's theorem, Hamilton paths and cycles, Theorems of Dirac, Ore, Bondy; Berge's Theorem, Perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, Algorithms for matching and weighted matching, Independent sets and covering numbers, Turan's theorem, Ramsey theorems, Brooks theorem, Vizing's theorem; Planar graphs, Euler's formula, Kuratowski's theorem, Connectivity and strongly connected digraphs, Applications of graph theory: the Chinese postman problem, the travelling salesman problem, Graph coloring, Network flow problem, Graph algorithms in computer network security.

CSE 6103: Real-Time Operating System **Credit: 3**

Review of Operating Systems: Basic principles, System calls, Files, Processes, Design and implementation of processes, Communication between processes, Operating system structures.

Distributed Operating Systems: Topology, Network types, Communication, RPC, Client-server model, Distributed files systems, Design strategies.

Real-time Models and Languages: Event-based, Process-based, and Graph-based models, Petri net models, Real-time languages, RTOS tasks, Real-time scheduling, Interrupt processing, Synchronization control blocks, Memory requirements.

Real-time Kernel: Principles, Design issues, Polled loop systems, RTOS porting to a target, Comparison and study of various RTOSs like QNX, VxWorks, PSOS, and C executive, Case studies.

RTOS Application Domains: RTOSs for image processing, Embedded RTOSs for VolP, RTOSs for fault-tolerant applications, RTOSs for control systems.

CSE 6105: Parallel Computations and Algorithms **Credit: 3**

Introduction: Modern parallel computers, Seeking concurrency, Data Clustering, Programming parallel computers.

Parallel Architectures: Interconnection networks, Processor arrays, Multiprocessors, Multi-computers.

Parallel Algorithm Design: Design methodology, Boundary value problem, Finding maximum, n-body problem, performance analysis.

Document Classification: Algorithm design, Non-blocking communications, Documenting parallel programming, Enhancements.

Matrix manipulation: Sequential matrix multiplication, Row-wise block-stripped parallel algorithm, Cannon's algorithm, Matrix-vector multiplication.

Parallel Sorting and Searching Algorithms: Parallel quick sort, Hyper Quick sort, Parallel sorting by regular sampling. Backtrack search, Parallel backtrack search, Parallel branch and bound, Parallel alpha-beta search.

CSE 6221: Advanced Database Systems **Credit: 3**

Advanced Data and Index Structures: Hilbert curve, B and B+ trees, UB tree, Grid file, Bang file, Theta and Gamma partition, Object oriented indexing, Hash indexing.

Physical Data Organization: Disk organization, Heap files, Sorted files, Database tuning.

Parallel and Distributed Database Design: Distributed and multi-database design, Data allocation strategies, Global schema and fragmentation design, I/O parallelism, partitioning techniques, Architectures, Parallel and distributed query processing, Distributed recovery, Spatial data management.

Object Databases: Problems of the relational data model, Conceptual object data model, The ODMG standard, CORBA.

XML and Web Data: Semi-structured data, Overview of XML, XML schema, XML query languages.

CSE 6223: Advanced Human-Computer Interaction **Credit: 3** **(49th AC)**

Introduction to Human-Computer Interaction (HCI): Human Factors, Usability, Accessibility, Interfaces, Quality criteria, Measurements.

Introduction to "Observing the User Techniques": Interviews, Focus groups, Surveys, Direct observation, think aloud.

Theories and Principles: High-level Theories, Object-action interface model, Golden rules of interface design, etc.

Evaluation of Interface Design: Expert review, Usability testing, Acceptance tests, Experiments.

Interface Techniques and Technologies: Graphical User Interface (GUI), Direct manipulation, Menu selection, Form filling and dialog boxes, Command and natural languages, Multiple windows, Hypermedia and World Wide Web, Virtual environments.
User Interface: Interface widgets, Interactive devices, Printed and online facilities, etc.
User Interface Design: Design development process, Software tools, User and task analysis, Multimodal interfaces, Response time and display rate, Presentation style, Semiotics in interface design, etc.
Advanced Topic: Ubiquitous computing interaction, Highly interactive tools for data visualization.

CSE 6225: Data Warehousing and Mining **Credit: 3**

Data Warehousing and OLAP Technology: Introduction, Multidimensional data model, Data warehouse architecture and implementation.
Data Processing: Data cleaning, Data integration and transformation, Data reduction, Data discretization and hierarchy generation, Data compression techniques.
Data Warehousing and Decision support: Multidimensional database design, Aggregation queries, Views and decision support, Vie materialization and maintenance, Indexing on OLAP.
Data Mining Primitives: Data mining tasks, Characterization and comparison, Mining rules, Tree structured rules.
Clustering and Complex Type Data Mining: Types of clustering, Methods of clustering and its details, Mining spatial database, Mining multimedia database, Time series data, Text data and Web data.

CSE 6227: Transactional Information Systems **Credit: 3**

Background and Computation Models: Computational models, Notions of correctness and the page model.
Concurrency Control: Concurrency control algorithms, Multi-version concurrency control, Concurrency control on objects, Concurrency control algorithms on Objects, concurrency control on relational databases, Concurrency control on search structures.
Recovery: Transaction recovery, Crash recovery, Object model crash recovery.
Distributed Transactions: Distributed concurrency control, Distributed transaction recovery.

CSE 6229: Information Management and Retrieval **Credit: 3**

Introduction to Knowledge and Knowledge Management Concepts: Knowledge in organizations, Knowledge processes.

Knowledge Modeling: Ontologies, Structures, Concepts and relationships, Organization modeling, Communication and dynamics modeling, Knowledge transfer, Total knowledge management.
Introduction to Information Retrieval: Information versus data retrieval, The user task, Logical view of documents, Information retrieval in digital libraries and the web.
Information Retrieval Models: Taxonomy of IR models;
Classical IR: Boolean, Vector, Probabilistic;
Alternative Models: Bayesian networks, Neural networks, Structured text retrieval models;
Models for Browsing. Retrieval Evaluation: Retrieval performance evaluation, Reference collections.
Query Languages and Operations: Keyword based querying, Structural queries, Query expansion, Automatic local and global analysis.
Document Processing: Lexical analysis, Stemming and stop words, Text compression.

CSE 6231: Web Engineering **Credit: 3**

Distributed Systems Infrastructure and Architectural Models: Basic terminology, Networks, Internet, Intranet and extranet, Client/Server computing paradigm, Open systems and communication protocols, Communication systems and protocols.
Distributing Computing: Models and architectures, Open systems. OSI model.
Distributed Objects and Middleware: Middleware: Views, Definitions, Functions, Middleware for distribution, Distributed objects model, Interfaces and Interface Definition Language (IDL), Component Object Model (COM) and Distributed COM (DCOM), System Object Model (SOM) and Distributed SOM (DSOM).
Web and Programming: Web Elements: Browser and Web Document, Static, active and dynamic pages, Programming paradigms and web programming. Object-oriented vs. Object-based programming, Tasks suitable for programming on the Web, Application Programming Interface (API), Sockets, Client and Server implementation
CGI: Definition, Characteristics.
CGI Programming Mechanism: GET and POST methods.

CSE 6233: Advanced Software Engineering **Credit: 3**

Object-Oriented Modeling and Design: Advanced object modeling, Dynamic modeling, Functional modeling.
System design: Overview of system design, Allocating subsystems to processors and tasks, Management of data stores, Choose software control implementation, Handling boundary conditions, etc.

Object Design: Overview of object design, Designing algorithms, Design optimization, Object representation, Documenting design decisions, etc.
Software Projects Type: Software Projects Classification: According to application field, According to architectures, According to objectives, According to development conditions.
Configurable Products Classification: MIS, ERP, CRM, SCM, PRM, DSS, EIS, OA, EAI, CTI, SCADA.
Software Production Process Techniques: Techniques to Collect and Represent the End User Needs: Scenarios, BPM, Workflow, Extended examples of XML family languages use to define requirements.
Techniques for the Definition of the Contents of the Solution: Domain Analysis, Gap Analysis, Contents representation methods, Test plans.
Techniques for the Solution Architecture Definition: Design patterns, Visual inheritance, delegation, Real time system architectures.
Techniques for the Solution Realisation: AD Environments and product configuration toolkits, test driven development, Refactoring. Techniques for solution deployment and distribution, User training techniques, Techniques for solution management, maintenance and inventory, Outline of IEEE standards.
Software Process Management Techniques: Project Set Up: technological resources selection, human resources selection, the project plan, the choice of process management tools, WBS, Techniques for change management, Techniques for controlling project progress.

CSE 6235: Computer Graphics and Animations **Credit: 3**

Advanced Graphics Technique: Three dimensional drawings and fractals.
Rendering: Lighting Models: Radiometry, Direct illumination, BRDFs, Global Illumination: Monte Carlo path tracing, Radiosity, Visibility: Shadow algorithms, Discontinuity meshing, Visibility skeleton, Image-Based Rendering: Plenoptic function, Light fields & lumigraphs, Imposters. Texture and environment mapping techniques, procedural texture mapping and modelling.
Modelling: Polygonal Meshes: Representation, Simplification, Manipulation, Spline & Subdivision Surfaces: Topology, Continuity, Volumetric Representations: Implicits, Voxels, BSPs, Animation.
Kinematics: Articulated figures, Motion capture, Inverse kinematics, Passive Dynamics: Particle systems, Spring-mass systems, Active Dynamics: Controllers, Learning, Planning, Soft object animation and procedural animation.

CSE 6237: Enterprise Infrastructure and Management **Credit: 3**

Enterprise Infrastructure: Enterprise servers, Partitioned systems, High availability, Storage arrays, Storage Area Network (SAN), Network Attached Storage (NAS), Perfect availability, Disaster tolerance, Fault tolerance, Data backup and recovery.
Service Management: Service Level Agreements (SLA), Service desk, Configuration management, Change management, Release management, Contingency management, Availability management, Capacity management, Disaster management.
Project Management: Task types and task relationships, Resource allocation, Risk analysis and management, Formal project management methods, Project Finance, Project planning and implementation, Project completion and sign off, Project review, Project crashing.

CSE 6239: Computer Vision **Credit: 3**

Introduction: Goals of computer vision, Methodologies, Main approaches and directions, Applications, Relations with other fields.
Techniques for Image Acquisition: Monocular and multiple view vision, Active and passive vision, Intensity and range images
Image Processing: Sources of image degradation, Mathematical description and classification of noises, Noise filtering techniques
Feature Extraction and Grouping: Edge detection, Corner detection, Histogram and thresholding techniques, Curve fitting, Hough transform, Active contour, Grouping and segmentation techniques.
Stereo: 3D Shape from Two or More Images: correspondence problem, Sparse and dense stereo, Common assumptions used in matching, Dynamic programming, using visual cues.
Motion: 3D shape and motion from two or more images.
Optical Flow: Computing shape and motion from optical flow.

CSE 6241: Multimedia Technologies and Applications **Credit: 3**

Multimedia data in digital format and their properties, Color image models, Color palettes, Relation of the human visual and auditory perception to the rational of the multimedia representation format and compression algorithms, Lossless and lossy compression techniques on multimedia data, Principles and techniques of animation, Creating animated scenes, Analysis of image video and audio in the frequency Domain to identify important components to be encoded, Broadcast video standards, Video capture, Recording format, Major steps in video and audio compression standards, Audio file formats MIDI, Sound editing, Music and rhythm analysis interactive video production, Programming multimedia system, Authoring systems.

CSE 6243:Advanced Digital Image Processing **Credit: 3**

Review of digital image fundamentals, Image enhancement and restoration, Color fundamentals, Pseudo-color and full-color image processing, Color transformations, Smoothing and sharpening, Segmentation and matching, Noise reduction, Image compression, Various coding for image compression, Video compression techniques, Pattern recognition techniques, Image segmentation, Detection, Thresholding, clustering, Decision function, Training techniques, Applications of AI-techniques, Character recognition, Automated visual inspection, Stereo imaging, JPEG, MPEG, etc.

CSE 6245: Principles of Multimedia Networking **Credit: 3**

Introduction to multimedia networking and its requirements on different network layers, Protocols in different layers supporting multimedia streaming: RTSP (Realtime Streaming Protocol) and Progressive download, Image and Audio/Video compression technique, (Session Initiation Protocol) SIP and H.323 and SIP-H.323 interworking, RTP (Real-time Transport Protocol) and RTCP (RTP Control Protocol), Multicasting and Quality of service, Integrated and differentiated services, Resource allocation and traffic control (RSVP),Video broadcast techniques, Multimedia streaming over (peer-to-peer) P2P networks, Multimedia Content Delivery Networks, Multimedia streaming over wireless networks.

CSE 6247: Large Scale Data Management **Credit: 3** **(60th AC)**

Map Reduce: Architecture, Query Optimizations, Algorithm design, Storage Layouts and Optimizations, **Data Distribution**: Isolated Processes, Flat Scalability, Distributed File System, Parallel and Distributed databases. **Multidimensional Access Methods:** Architecture, Operations, Algorithms and Compressions. **Time Series Data**: Indexing techniques for massive time series data; **Spatial data:** spatial data types; indexing and querying spatial data; **Big Data:** Foundations, Characteristics, Dimensions, Scalability, Attributes and types, generation and Storage.

CSE 6351: Principles of Cryptography **Credit: 3**

Concept of Cryptography: Plaintext, Cipher text, Encryption process, Decryption process, encryption algorithm, decryption algorithm, key generation process, Cryptosystem, Cryptoanalysis, Block cipher, Stream cipher, Concept of symmetric and asymmetric cryptosystem.

Shannon's Theory: Introduction to Shannon's theory, Elementary probability theory, Perfect secrecy, Entropy, Properties of entropy, Spurious keys and unicity distance, Product cryptosystems.

Symmetric Cryptosystems: Linear cryptanalysis, Differential cryptanalysis, The data encryption standard, The advanced encryption standard, Modes of operation.

Cryptographic Hash Functions: Hash functions and data integrity, security of hash functions, Iterated hash functions, SHA-1, MD-5, RIPE-MD-160.

Asymmetric Cryptosystems: Introduction to public-key cryptography, Merkle-Heilman cryptosystem, The RSA cryptosystem, Related number theoretic algorithms, Other attacks on RSA, The Rabin cryptosystem, Semantic security of RSA.

Cryptosystems Based on the Discrete Logarithm Problem: The E1Gamal cryptosystem, Algorithms for the discrete logarithm problem, Lower bounds on the complexity of generic algorithms, Finite fields, Discrete logarithm algorithms in practice, Security of E1Gamal systems.

Digital Signature Schemes: Introduction, Security requirements for signature schemes, The E1Gamal signature scheme, Variants of the E1Gamal signature scheme, Provably secure signature schemes, Undeniable signatures, Fail-stop signatures.

Elliptical Curve Cryptography: Elliptical curves (EC), Operation on EC: Point addition, Doubling of a point, Addition of points over Fp, Doubling of points over Fp, Concept of elliptical curve cryptography, Elliptical curve DSA (Digital Signature Algorithm), Elliptical curve Diffie-Hellman protocol.

DNA Cryptography: Concept of DNA cryptography, DNA cryptography using one-time pads, DNA cryptography using XOR, DNA cryptography using substitution etc. Concept of quantum cryptography.

Message Authentication Code: Concept of MAC, HMAC and some other MAC schemes.

Key Exchange Scheme: Concept of key exchange, Diffie-Hellman(D-H) key exchange and some other scheme.

CSE 6353: Advanced Network Security **Credit: 3**

Issues of network security.

Threats to Network Security: Tampering, Wiretapping, Impersonation, Hacking, Cracking, **Phishing:** Phishing as a cyber-crime, Technical trends in phishing attacks, Understanding and defending phishing attacks, Social engineering and its impact on phishing.

ID Theft: Definition of ID theft, Possible ways of ID theft, Preventing ID theft, Two-factor authentication, Authorization mode based access controls.

Firewalls: Firewall architecture, Packet filters, Stateful inspection firewalls, Application-proxy gateway firewalls, Dedicated proxy servers, Hybrid firewalls, Network Address Translation (DNAT and SNAT), Port Address Translation (PAT), De-militarized Zone (DMZ), Virtual Private Networks (VPN), Intrusion Detection System (IDS), Intrusion Prevention System (IPS), Firewall administration, Firewall positioning policy.

Secure Network Devices: Secure modems, Dial-back systems, Crypto-capable Routers.
Risk Management: Effective strategies, Business process protection through assessment, Planning and recovery.
Internet Vulnerabilities: Operating systems, Cross platform applications, Network devices, Security policy and personnel (Inside attacks and outside attacks), Zero day attacks prevention and recovery, Web and E-commerce security.

CSE 6355: Advanced Cryptography **Credit: 3**

Digital Signature and Public Key Encryption: RSA, ElGamal and Paillier cryptosystems and their attacks, Probabilistic homomorphic and commutative properties of encryption, Re-encryption, Hybrid and Threshold cryptosystems, Secret sharing, Hash functions, Applications of these mechanisms.
Blind Signature: RSA and ElGamal based schemes, Traceable and untraceable properties, Applications in digital cash and voting protocols.
Anonymous Networks: Decryption and re-encryption type mixnets and their building blocks, Unlinkability of sender and recipient in mixnets, Chaum's mixnet, Verifiable mixnets, Voting protocols and mixnets.
Electronic Cash: Mechanisms of on-line and off-line transactions.
Electronic Voting: Homomorphic encryption, Blind signature and mixnet based voting schemes, Various requirements and formats of voting.
Zero Knowledge Proof: Properties and applications of zero knowledge, Interactive and non-interactive proof mechanisms.
Authentication: Anonymous mechanisms for non-trusted entities.
Visual Cryptography: Noar/Shamir's mechanism and applications.

CSE 6461: Advanced Artificial Intelligent Systems **Credit: 3**

Intelligent Agents: Introduction to multi-agent systems.
Agent Logics: Propositional logic: Syntax, Semantics, Satisfiability, Validity, Entailment, Equivalences and Truth tables.
Predicate Logic: Syntax (predicates, variables, and quantifiers), Semantics (interpretations, models), Deductive reasoning agents and practical agents.
Automated Reasoning: Deduction rules, Clausal form, Resolution rule soundness and completeness, Logic programming.
Intelligent Agents, Expert Systems and Object Oriented Systems: Comparison and applications of agents.
Agents and Search: Depth and breadth first, Hill-climbing, Best-first search, A*-search, Problem solving as search, Agent planning.

Agents and Games: Minimax procedure, Alpha-beta pruning, Planning in multi-agent systems, Reactive and hybrid agents, Multi-agent interactions, Languages for implementation of intelligent agents, Decision tree, Dimensionality reduction, Clustering problem.

CSE 6463: Machine Translation **Credit: 3**

Theoretical Problems: Definition, Context dependency, Interpretation and translation.
Engineering Problems of Machine Translation: Maintainability, tunability, modularity and efficiency.
Linguistics-based MT: Compositionality and isomorphism, Declarative frameworks, Constraint-based formalisms.
Knowledge-based MT: Translation and understanding, Design of interlinguas, The conceptual lexicon.
Statistics-based MT: E-M algorithms, Alignment of bilingual corpora, Translation templates.
Example-based MT: Similarity measures, Levels of comparison.
Treatment of Context Dependency: Knowledge-based transfer, Sublanguage-based MT, Translation units.

CSE 6465: Soft Computing **Credit: 3**

Fuzzy Logic: Introduction, Fuzzy sets, Fuzzy Rules, Fuzzy Arithmetic, Membership functions, Fuzzy inference engine, Membership functions, Draft Fuzzy Systems, Applications, Fuzzy logic and Genetic algorithms.
Natural Computations: Introduction, Adaptive models and Machine learning. Supervised Learning: Feed forward neural networks, Radial basis functions, Fuzzy neural networks.
Unsupervised Learning: Clustering techniques, Self-organizing maps.
Evolutionary Computations: Genetic programming, Learning classifier systems.
Reinforcement Learning: Introduction, Framework, Model, Applications, Q-learning, Dynamic programming, Monte Carlo methods.

CSE 6467: Advanced Natural Language Processing **Credit: 3**

Regular Expressions: Chomsky hierarchy, Regular languages and their limitations.
Finite-state Automata: Practical regular expressions for finding and counting language phenomena, A little morphology, In class demonstrations of exploring a large corpus with regex tools.
String Edit Distance and Alignment: String edit operations, Edit distance and examples of use in spelling correction and machine translation.

Context Free Grammars: Constituency, CFG definition, use and limitations, Chomsky normal form, Top-down parsing, Bottom-up parsing and the problems with each. The desirability of combining evidence from both directions.
Non-probabilistic Parsing: Efficient CFG parsing with CYK, another dynamic programming algorithm, Designing a little grammar and parsing with it on some test data.
Language modeling and Naive Bayes: Probabilistic language modeling and its applications, Markov models, N-grams, Estimating the probability of a word and smoothing, Generative models of language, their application to building an automatically-trained email spam filter and automatically determining the language.
Part of Speech Tagging and Hidden Markov Models: The concept of parts-of-speech, Examples, usage, The penn treebank and brown corpus. Probabilistic (weighted) finite state automata. Hidden Markov models (HMMs), definition and use. Lexical Semantics, pragmatics.

CSE 6469: Bioinformatics **Credit: 3**

The biological foundations of bioinformatics, Biological databases, Sequence comparisons and Sequence-based database searches, The decoding of eukaryotic genomes, Protein structures and structure-based rational drug design.
Systems Biology: The functional analysis of genomes, Comparative genome analyses, Bioinformatics algorithms.

CSE 6471: Bio-Inspired Computing Techniques **Credit: 3**

History and philosophy of bio-inspired computing.
Evolutionary Computation: Natural evolution, Principles of evolutionary algorithms, Genetic algorithms, Evolution strategies, Evolutionary programming, Genetic programming.
Molecular Computing: Molecule and Molecular computing basics, Conformation-based computing, Molecular recognition, Chemical-based computing, DNA computing, Bioelectronics and Biocomputers.
Neural Computing: Biological Neuron and its computational model, Feed forward neural networks, Complex-valued neural networks, Spiking neural networks.
Development Systems: Rewriting systems, Synthesis of developmental systems, Artificial evolutionary developmental systems, Evolutionary rewriting systems, Evolutionary developmental programs.
Immunological Computation: Immunology basics, Theoretical models of immune processes, Immunity-based computational models, T cell–inspired algorithms, B cell–inspired algorithms.

Behavioral Systems: Behavior in cognitive science, Behavior in artificial intelligence, Behavior-based robotics, Biological inspiration for robots, Robots as biological models, Robot learning.
Collective Intelligence: Phenomena and Models of biological self-organization, Ant colony optimization (ACO), Particle swarm optimization (PSO), Artificial bee colony(ABC) algorithm.

CSE 6473: Advanced Machine Learning **Credit: 3**

Probabilistic Graphical Models: Conditional independence, Bayesian networks, Deep belief networks, Inference methods, Markov random field (MRF), Factor graphs, Hidden Marko model (HMM).
Learning in the Probabilistic Models: Maximum likelihood (ML) estimation, maximum a posteriori probability (MAP) estimation, Conjugate priors, Naïve Bayes, Expectation maximization (EM), Variational Bayes, Bayesian model selection.
Supervised Learning: Classification and regression problems, Bias-variance dilemma, Generative/discriminative learning, Kernels, Support vector machine.
Unsupervised Learning: Clustering, Dimensionality reduction, Principal component analysis (PCA), Kernel PCA, Independent component analysis (ICA), Kernel ICA.
Mixture Models: Gaussian mixture model (GMM), Latent Dirichlet allocation.

CSE 6475: Neural Networks and Deep Learning **Credit: 3** **(60^{th} AC)**

Neural Networks: Development of artificial neuron and neural networks (NNs); Abilities of a neuron, single layer NN and multilayer NN; Activation functions; Weight initialization; Back-Propagation algorithm; Effect of batch update, dropout and ensemble construction; Complexity analysis of NNs; NNs in complex and other multidimensional domains; NNs as auto-encoder, prediction, classifier and pattern recognizer.
Deep Learning Aspects and Methods: Limitations of traditional NNs; Aspects and history of Deep Learning; Stacked Auto-Encoders (SAEs) and Stacked Denoising Auto-Encoders (SDAEs); Variational Auto-Encoders; Restricted Boltzmann Machines (RBMs) and Deep Belief Networks (DBNs); Convolutional Neural Networks (CNNs), Capsule Neural Network; Recurrent NNs, Long Short-Term Memory (LSTM), Back-Propagation Through Time; Generative Adversarial Networks (GANs).
Deep Learning in Scientific and Commercial Applications: Digit Recognition, Object Recognition, Image Classification, Image Retrieval, Image Captioning, Machine Translation, Question Answering, Natural Language Processing, Word Embedding, Speech Recognition, Video Surveillance.

Software Tools and Hardware Systems for Deep Learning: Demonstration of software tools for deep learning such as Matlab, Theano, Tensor Flow, pytorch, etc. Exploiting appropriate hardware systems to speed up the compute-intensive process of generating complex deep learning models, e.g. via graphics processing units.

CSE 6571: Advanced Computer Architecture **Credit: 3**

Measuring Performance and Cost: Performance measurement, Benchmarks, Costs of building computers.
Instruction Sets: Classifying instruction sets, Interactions between languages and instruction sets, measuring instruction set usage, Instruction set examples.
Improving CPU Performance: Pipelining, Basic pipelining, Data and control hazards, Dynamic instruction scheduling, Branch prediction, Instruction-level parallelism, VLIW processor.
Vector Processors: Vector architecture and design, Vector performance.
Memory Hierarchies: Evaluating memory hierarchy performance, Cache design and optimization, Virtual memory design, Memory protection, Memory coherency.
Storage Systems: Types and uses of storage devices, Interfacing I/O to the rest of the system, Reliability and availability, I/O system design.
Multiprocessors: Classifying parallel architectures, Centralized vs. distributed shared memory, Interconnection topologies, Synchronization, Memory consistency.

CSE 6573: Interconnection Networks **Credit: 3**

Fundamentals: Overview of interconnection network, Taxonomy of network topologies, Basics of switching, routing, and flow control, Routing mechanics.
Hierarchical Interconnection Networks: Why hierarchy?, Topologies, Network performance.
Routing Techniques: Deadlock-free routing, Deadlock-avoidance/recovery, Adaptive routing, Fault-tolerance.
Routing Architecture: Router datapath, Arbitration and Allocation policies, Collective communication support, Quality of service, Performance analysis.
NoC Architecture: Area, energy and reliability constraints, Area and energy constraint NoC design alternatives, NoC fault models and fault-tolerant design.

CSE 6575: Photonic Switching Networks **Credit: 3**

Fundamentals: Overview of indirect/dynamic network, Taxonomy of indirect Network topologies, Basic analysis.
Blocking Interconnection Networks: Introduction, Various blocking networks, Multi-path networks, Equivalence of multistage interconnection networks (MINs).

Rearrangeably Non-blocking Networks: Wide-sense non-blocking networks, Strictly non-blocking networks, Routing control, Horizontal expansion, Vertical replication.
Optical Network Infrastructure: Optical networks, Wavelength conversion, Static and Dynamic wavelength division multiplexing (WDM) networks, WC in WDM networks.
A Review of WDM: WDM, Photonic switching, Switching functions and photonic implementations.

CSE 6577: Advanced Embedded-Systems **Credit: 3** **(49th AC)**

Introduction: Embedded-systems overview, Characteristics of embedded computing applications, Embedded-system design challenges-Optimizing design metrics, Constraint-driven design, IP-based design, Hardware, Software co-design, Processor technology, IC technology, Design technology, Embedded-systems on Chip (SOC) technology.
Development Environment: Execution environment, Memory organization, System space, Code space, Data space, Unpopulated memory space, I/O space, System start-up, Interrupt response cycle, Function calls and Stack frames, Runtime environment, Object
Embedded computing platform: CPU bus, Memory devices, I/O devices, Component interfacing, Designing with microprocessors, Development and debugging, Design examples, Design patterns, Data-flow graphs, Assembly and linking, Basic compilation techniques, analysis and optimization.
Distributed Embedded-System Design: Inter-process communication, Signals, Signals in UML, Shared-memory communication, Accelerated design, Design for video accelerators, Networks for embedded systems, Network-based design, Internet-enabled systems.
Design techniques: Design methodologies and tools, Design flows, Designing hardware and software components, Requirement analysis and specification, System analysis and architecture design, System integration, Structural and behavioral description, Case studies.
Embedded Software Development Process and Tools:
Host and target Machines, getting embedded software into the target systems.
Real-time Operating Systems: OS services, Timer functions, Event functions.
Testing, Simulation and Debugging techniques and Tools: Testing on Host Machine, Simulations, Laboratory Tools.
Design Examples and Case studies.

CSE 6579: Advanced Ubiquitous Computing **Credit: 3** **(49th AC)**

The Ubiquitous Computing Vision: Introduction to ubiquitous computing.

Ubiquitous Computing Visionaries: Introducing the mouse and Early ubiquitous computing, Parc, MIT, Ethics, Privacy, Responsibility.

Architecture: Autonomic computing, Distributed computing, Cloud computing, Peer to peer, Mobility, Mobile computation and Agents, Smart places, Wearable computing, Service-orientation, Sensors and Actuators, **Augmented reality.**

HCI Principles for Ubiquitous Computing: Ubiquitous environments, Programming ubiquitous systems, Wearable computing.

Ubiquitous Theory: Location, Spatial databases, Topological reasoning, Mobile computation, Data structures and Metadata, Security and Privacy, Ambient calculus, Relational models, Specifications, UML, OMG, Ontologies.

Context Awareness: GPS, Location and Tracking, Ontologies, Reasoning.

Privacy: Problems of authentication, Confidentiality, Total information awareness, Credentials, Access control.

Applications: The internet of things, Smart homes, Social computing, Religious computing, Health and Medical computing, Science, Surveillance, Monitoring, Navigation.

CSE 6581: Soft Error Tolerance **Credit: 3**

Definition of soft errors.

Types of soft errors: Benign faults, Detectable unrecoverable errors, Silent data corruption, Soft error rates, Critical charge.

Sources of Soft Errors: External sources- alpha particle from package delay, Cosmic rays induced neutron interaction, Low energy neutron interaction with BPSG, Internal sources- IR or L di/dt supply noise, Power transients, Capacitive or inductive crosstalk, Risks of soft errors, Soft error's impact on system reliability, Affected computing structures.

Soft Errors Mitigation Approaches: Comparison between model based mitigation approach and mitigation in implemented system, Process technology solutions, Software based approaches, Hardware based approaches.

Analyzing Soft Errors Risks Minimization at the System Design Phase: Complexity analysis, Severity analysis, Criticality analysis and Ways to minimize criticality.

CSE 6583: Advanced Digital Signal Processing **Credit: 3**

Main features and applications of digital signal processing, Parametric methods for power spectrum estimation, FIR adaptive filters, Steepest descent adaptive filter, LMS algorithm, Convergence of LMS algorithms, Applications.

Decimation in multirate signal processing, Interpolation, Filter design and implementation for sampling rate conversion, Digital models for speech signal, Mechanism of speech production, Time domain processing of speech signal, Linear predictive coding, Wavelet transform, Perfect reconstruction filter banks and wavelets, Recursive multi-resolution decomposition, Haar wavelet, Daubechies wavelet. Z-transform, Inverse Z-transform and properties, Discrete Fourier transform, Inverse discrete Fourier transform and their properties.

CSE 6585: Cloud Computing **Credit: 3**

Fundamental cloud computing terminology and concepts, Similarities and differences between cloud computing, Grid computing and cluster computing**,** Basics of virtualization, Specific characteristics that define a Cloud, Understanding elasticity, Resiliency, On-demand and Measured usage, Benefits, Challenges and Risks of contemporary cloud computing, Platforms and Cloud services, Cloud resource Administrator and Cloud service owner roles, Cloud service and Cloud service consumer roles, Software as a service (SaaS), Platform as a service (PaaS) and Infrastructure as a service (IaaS), Cloud delivery models, Combining cloud delivery models, Public cloud, Private cloud, Hybrid cloud and Community cloud deployment models, Business cost metrics and Formulas for comparing and Calculating cloud and On-premise solution costs, Service level agreements (SLAs) for cloud-based IT resources, Formulas for calculating and Rating SLA quality of service characteristics, Cloud security and Trust.

CSE 6587: Advanced Wireless Networking **Credit: 3** **(49th AC)**

Introduction: Wired vs. Wireless Network Architectures, Basics of Wi-Fi, WiMAX, cellular and satellite wireless, Infrastructure based Wireless Networks.

Ad hoc Wireless Networks: Mobile Ad hoc Networks (MANETs), Vehicular Ad hoc Networks (VANETs), Wireless Sensor Networks (WSNs); Characteristics and Applications of Ad hoc Wireless Networks.

Medium Access Control (MAC) Protocols: MAC protocols for Wireless Networks; Challenges in designing wireless MAC protocols, Common MAC protocols for Wireless Networks, Major sources of energy wastage in WSNs, MAC protocols for WSNs and VANETs.

Node Localization in WSNs: Node Localization, Issues in localization algorithms, Ranging techniques, Localization in Mobile WSNs.

Routing Protocols: Routing protocols for Wireless Networks, Challenges in designing wireless Routing protocols, Routing Protocols for WSNs and VANETs.

CSE 6901: Special Study in Computer Science and Engineering Credit: 3

The course will be based on advanced and special topic in the field of computer science and Engineering . The course context should be designed by the teacher offering the course with a view to introducing a special course not included in this list as a regular course to help the students to be acquainted with fast developing special area or may be required for conducting post graduate research. The course may be designed with the permission of the head of the department and context accepted by the ACPG. The course must be approved as regular course as soon as possible by Academic Council. A maximum of two courses may be allowed in a semester.

খুলনা প্রকৌশল ও প্রযুক্তি বিশ্ববিদ্যালয়

খুলনা-৯২০৩

খুলনা প্রকৌশল ও প্রযুক্তি বিশ্ববিদ্যালয় ছাত্র শৃংখলা বিধি

(১৩/০৪/২০০৪ইং তারিখ অনুষ্ঠিত সিন্ডিকেটের ৩য় সভায় অনুমোদিত)

সাধারন শৃংখলা ও আচরণ বিধিঃ

৫। (ক) কোন ছাত্র কর্তৃক বিশ্ববিদ্যালয়ের আদেশ, বিধি, প্রবিধান, অর্ডিন্যান্স (নিয়ম) বা সংবিধি অমান্য করা এবং/বা প্রকাশ্যে নিন্দাবাদ করা; বিশ্ববিদ্যালয়ের কোন কর্মকর্তা বা কর্মচারীর প্রতি অসৌজন্যমূলক আচরণ বা অন্য কোন অপরাধকে বিশ্ববিদ্যালয়ের ভাইস-চ্যান্সেলর, প্রো-ভাইস চ্যান্সেলর, পরিচালক (ছাত্র কল্যাণ) বা বিশ্ববিদ্যালয়ের শিক্ষকবৃন্দ অসদাচরণ বা আইনশৃংখলা পরিপন্থী কাজ বলিয়া বিবেচনা করিতে পারিবেন এবং ঐ ছাত্রের বিরুদ্ধে শাস্তিমূলক ব্যবস্থা গ্রহণ করা যাইবে। এইরূপ ছাত্রের বিরুদ্ধে অপরাধের গুরুত্ব অনুসারে ৫(খ) ধারায় বর্ণিত কর্তৃপক্ষ কর্তৃক সতর্কীকরণ, জরিমানা ধার্য করা, সাময়িক বরখাস্ত, বিশ্ববিদ্যালয় হইতে চিরতরে বহিস্কার প্রভৃতি শাস্তি প্রদান করা যাইবে।

(খ) ছাত্র শৃংখলা জনিত শাস্তি প্রদানকারী কর্তৃপক্ষ সমূহ, তাঁহাদের প্রদানযোগ্য শাস্তির ক্ষমতা ও প্রতিক্ষেত্রে পুন:বিবেচনার কর্তৃপক্ষ নিম্নে বর্ণিত হইলঃ

শাস্তি প্রদানকারী কর্তৃপক্ষ	ক্ষমতা	পুন:বিবেচনার কর্তৃপক্ষ
(১) ছাত্র শৃংখলা কমিটি	সতর্কীকরণ, জরিমানা ধার্য, যে কোন মেয়াদের জন্য সাময়িক বরখাস্ত, বিশ্ববিদ্যালয় হইতে চিরতরে বহিস্কার।	একাডেমিক কাউন্সিল।
(২) ভাইস-চ্যান্সেলর	সতর্কীকরণ, জরিমানা ধার্য, অনধিক ৬ মাসের জন্য সাময়িক বহিস্কার।	ছাত্র শৃংখলা কমিটি।
(৩) বিভাগীয় প্রধান	সতর্কীকরণ, ১০০০ টাকা পর্যন্ত জরিমানা।	ভাইস-চ্যান্সেলর।
(৪) পরিচালক (ছাত্র-কল্যাণ)	সতর্কীকরণ, ১০০০ টাকা পর্যন্ত জরিমানা, হল হইতে সাময়িক বা স্থায়ীভাবে বহিস্কার।	ভাইস-চ্যান্সেলর।
(৫) প্রভোষ্ট	সতর্কীকরণ, ১০০০ টাকা পর্যন্ত জরিমানা, হল থেকে ১ বৎসর পর্যন্ত সাময়িক বহিস্কার।	পরিচালক (ছাত্র কল্যাণ) এর মাধ্যমে ভাইস-চ্যান্সেলর।
(৬) সহকারী প্রভোষ্ট	সতর্কীকরণ, ২০০ টাকা পর্যন্ত জরিমানা ও প্রভোষ্টকে অবহিত করণ।	প্রভোষ্ট
(৭) বিশ্ববিদ্যালয়ের কোন শিক্ষক	সতর্কীকরণ, ২০০ টাকা পর্যন্ত জরিমানা।	সংশ্লিষ্ট বিভাগীয় প্রধান।

৬। ভাইস-চ্যান্সেলরের বিবেচনায় আইন শৃংখলা পরিপন্থী কোন ঘটনার জন্য কোন ছাত্র বা ছাত্রগোষ্ঠীর বিরুদ্ধে ৫(খ) ধারায় উল্লেখিত কর্তৃপক্ষ (ছাত্র শৃংখলা কমিটি বাদে) কর্তৃক গৃহীত ব্যবস্থা সন্তোষজনক মনে না হইলে বা আদৌ কোন ব্যবস্থা গৃহীত না হইলে তিনি ঐ ছাত্র/ছাত্রদের বিরুদ্ধে যথোপযুক্ত শাস্তিমূলক ব্যবস্থা গ্রহণ করিতে পারিবেন। আর যদি তিনি মনে করেন তাহার/তাহাদের অপরাধের শাস্তি ৬ মাস সাময়িক বহিস্কারের অপেক্ষা অধিক হওয়া উচিৎ, তাহা হইলে তিনি বিষয়টি বিবেচনার জন্য ছাত্র শৃংখলা কমিটির নিকট উপস্থাপন করিবেন।

৭। যে কোন শাস্তির বিষয়ে পরিচালক (ছাত্র কল্যাণ) কে নোট প্রদান করিতে হইবে। তিনি গৃহীত ব্যবস্থার লিখিত বিবরণ নথিভুক্ত করিবেন। কোন ছাত্র বা ছাত্রগোষ্ঠী তাহার/তাহাদের বিরুদ্ধে ৫(খ) ধারায় বর্নিত কর্তৃপক্ষ কর্তৃক গৃহীত ব্যবস্থায় সন্তুষ্ট না হইলে উক্ত ধারায় নির্দেশিত কর্তৃপক্ষের নিকট শাস্তি পূনর্বিবেচনার জন্য আপীল করিতে পারিবে।

৮। পরিচালক (ছাত্র কল্যাণ) দন্ডপ্রাপ্ত ছাত্র/ছাত্রদের বিরুদ্ধে শাস্তিমূলক ব্যবস্থা বলবৎ/কার্যকর করার জন্য দায়ী থাকিবেন। তিনি আইন-শৃংখলা পরিপন্থী ও অসদাচরণের জন্য দোষী ছাত্রদের অপরাধের বিষয় প্রশংসাপত্রে/চারিত্রিক সনদপত্রে উল্লেখ পূর্বক

উক্ত পত্র সংশ্লিষ্ট ছাত্রকে প্রদান করিবেন। তবে সংশ্লিষ্ট ছাত্রের আবেদনক্রমে ভাইস-চ্যান্সেলরের মার্জনার লিখিত অনুমোদনের পরিপ্রেক্ষিতে দোষী ছাত্রের প্রশংসাপত্রে/চারিত্রিক সনদপত্রে এইরূপ অপরাধের বিষয় উল্লেখ করা হইতে বিরত থাকিবেন।

৯। কোন ছাত্র বিশ্ববিদ্যালয়ের রেজিষ্ট্রার বা কোন শিক্ষকের নিকট হইতে চারিত্রিক সনদপত্র গ্রহণ করিতে চাহিলে তাহাকে অবশ্যই পরিচালক (ছাত্র কল্যাণ) কর্তৃক ইস্যুকৃত প্রশংসাপত্র/চারিত্রিক সনদপত্রের কপি রেজিষ্ট্রার বা ঐ শিক্ষককের নিকট জমা দিতে হইবে এবং পরিচালক (ছাত্র কল্যাণ) প্রদত্ত প্রশংসাপত্র/চারিত্রিক সনদপত্রে যদি উক্ত ছাত্রের বিরুদ্ধে আইন শৃংখলা পরিপন্থী/অসদাচরণ সম্পর্কীত কিছু লিখিত থাকে তবে তাহা ঐ প্রশংসাপত্রে/চারিত্রিক সনদপত্রে হুবহু লিখিবার পর আবেদনকৃত পত্র ইস্যু করিতে পারিবেন।

১০। আবাসিক কোন ছাত্রের আচরণ সন্তোষজনক না হইলে অথবা কোন ছাত্র আইন শৃংখলা পরিপন্থী কাজের সাথে জড়িত থাকিলে সংশ্লিষ্ট প্রভোষ্ট, পরিচালক (ছাত্র কল্যাণ) কে অবহিতকরণ সাপেক্ষে ঐ ছাত্রকে কোন নির্দিষ্ট (১ বৎসরের অধিক) সময়ের জন্য হল পরিত্যাগ পূর্বক বিশ্ববিদ্যালয়ের বাহিরে অবস্থান করাইতে পারিবেন।

১১। অন্য হলের কোন ছাত্র/ছাত্রদের কর্তৃক সংঘটিত কোন অসদাচরণ বা আইন শৃংখলা পরিপন্থী ঘটনার জন্য যে হলে তাহা সংঘটিত হইয়াছে ঐ হলের প্রভোষ্ট তাহার/তাহাদের বিরুদ্ধে ঐ ছাত্রের আবাসিক হলের প্রভোষ্টকে অবহিত করিলে তিনি যথাযথ শাস্তির ব্যবস্থা করিবেন। গৃহীত শাস্তির ব্যাপারে প্রথম আবাসিক হলের প্রভোষ্ট সন্তুষ্ট না হইলে তিনি পূনর্বিচারের জন্য বিষয়টি পরিচালক (ছাত্র কল্যাণ) এর দৃষ্টিগোচরে আনিবেন। পরিচালক (ছাত্র কল্যাণ) উভয় প্রভোষ্টের সহিত আলোচনা করিয়া বিধি অনুযায়ী যথোপযুক্ত ব্যবস্থা গ্রহণ করিবেন।

১২। কোন ছাত্র/ছাত্রগোষ্ঠী পরিচালক (ছাত্র কল্যাণ) এর লিখিত অনুমোদন ছাড়া প্রথাসিদ্ধ ইউনিয়ন/ কমিটি/সমিতি (ছাত্র সংসদ, হল ইউনিয়ন, বিভাগীয় সমিতি) ছাড়া অন্যকোন প্রকার সমিতি/কমিটি গঠন করিতে পারিবে না বা উহার জন্য সভা সমিতিও আহবান করিতে পারিবে না। উভয় কাজই শাস্তিযোগ্য অপরাধ বলিয়া বিবেচিত হইবে। পরিচালক (ছাত্র কল্যাণ) এর পূর্বানুমোদন ছাড়া কোন ছাত্র/ছাত্রগোষ্ঠী ক্যাম্পাসে কোন রাজনৈতিক দলের সভা সমিতি বা ভোজসভার আয়োজন করিতে পারিবে না। ক্যাম্পাসে বাদ্যযন্ত্র বা সাংস্কৃতিক অনুষ্ঠান আয়োজনের জন্যও পূর্বানুমোদন প্রয়োজন হইবে। এই রূপ কোনপ্রকার নিয়মের লংঘণ শাস্তিযোগ্য অপরাধ বলিয়া বিবেচিত হইবে।

১৩। কোন ছাত্র/ছাত্রগোষ্ঠী ক্যাম্পাসে ধর্মঘট আহবান করিতে পারিবে না বা কোন ছাত্রকে স্বাভাবিক চলাচলে বাধা প্রদান করিতে পারিবে না বা তাহাকে ক্লাশ করা হইতে বিরত রাখিতে পারিবে না এবং এই উদ্দেশ্যে কোন সভা/সমিতি র‍্যালী করিতে পারিবে না। এই ধরণের কাজের সহিত জড়িত ছাত্র/ছাত্রগোষ্ঠী দোষী সাব্যস্ত হইলে বিশ্ববিদ্যালয় হইতে বহিস্কার পর্যন্ত করা যাইতে পারে। যাহারা এতদুদ্দেশ্যে ক্লাশ করা হইতে বিরত থাকিবে ঐ সব ছাত্রের স্কলারশীপ/স্টাইপেন্ড বাজেয়াপ্ত সহ অন্যান্য শাস্তিমূলক ব্যবস্থা গ্রহণ করা যাইবে।

১৪। কোন ছাত্র/ছাত্রগোষ্ঠী বিশ্ববিদ্যালয় এলাকায় অন্য কোন ছাত্র/ছাত্রগোষ্ঠীর সহিত দূর্ব্যবহার, উচ্ছঙ্খল আচরণ, শারীরিক বা মানষিক নির্যাতন করিতে পারিবে না। এইরূপ ঘটনা শাস্তিমূলক আচরণের মধ্যে পড়িবে। বিশ্ববিদ্যালয়ের বাহিরে কোন ছাত্র/ছাত্রগোষ্ঠী অন্য কোন ছাত্র/ছাত্রগোষ্ঠীর সহিত দূর্ব্যবহার বা অসদাচরণ করিলে তাহাও শাস্তিযোগ্য অপরাধ বলিয়া বিবেচিত হইবে। পরিচালক (ছাত্র কল্যাণ) এই ব্যাপারে যথোপযুক্ত ব্যবস্থা গ্রহণ করিবেন এবং অপরাধের গুরুত্ব অনুযায়ী বিষয়টি ভাইস-চ্যান্সেলর-এর দৃষ্টিগোচরে আনিবেন।

১৫। যে কোন অনাকাংখিত ঘটনা ভাইস-চ্যান্সেলর এর দৃষ্টিগোচর হইলে তিনি পরবর্তী ব্যবস্থা গ্রহণের নির্দেশ দান করিবেন বা সাময়িক ব্যবস্থা গ্রহণের জন্য উপযুক্ত কর্তৃপক্ষকে নির্দেশ দান করিতে পারিবেন। ভাইস-চ্যান্সেলর ক্যাম্পাসে শান্তি শৃংখলা বজায় রাখার স্বার্থে মাঝে মধ্যে বিজ্ঞপ্তি জারি করিতে পারিবেন। তিনি আপত্তিকর পোষ্টার, পত্রিকা বা প্রকাশনা নিষিদ্ধ ঘোষণা করিতে ও বাজেয়াপ্ত করিতে পারিবেন।

১৬। কোন ছাত্র/ছাত্রগোষ্ঠী ইচ্ছাকৃতভাবে বিশ্ববিদ্যালয়ের কোন সম্পদের ধ্বংস বা ক্ষতি সাধন করিলে তাহার/তাহাদের নিকট হইতে ক্ষতিপূরণ আদায় সহ অন্যান্য শাস্তিমূলক ব্যবস্থা গ্রহণ করা যাইবে।১৭। কোন ছাত্র/ছাত্রগোষ্ঠী বিশ্ববিদ্যালয় এলাকায় যে কাহারও সাথে অসৌজন্যমুলক/উচ্ছঙ্খল আচরণ করিলে তাহা শাস্তিযোগ্য অপরাধ বলিয়া বিবেচিত হইবে এবং অপরাধের গুরুত্ব বিবেচনায় তাহাকে/তাহাদেরকে বিশ্ববিদ্যালয় হইতে চিরতরে বহিস্কার পর্যন্ত শাস্তি প্রদান করা যাইবে।

১৮। বিশ্ববিদ্যালয়ের কোন ছাত্র মাদকাসক্তি, অসামাজিক কার্যকলাপ বা নৈতিক অবক্ষয়জনিত অপরাধে দোষী সাব্যস্ত হইলে তাহার বিরুদ্ধে প্রচলিত রাষ্ট্রীয় ব্যবস্থা ছাড়াও বিশ্ববিদ্যালয় কর্তৃপক্ষ শাস্তিমূলক ব্যবস্থা গ্রহণ করিতে পারিবেন।

১৯। বিশ্ববিদ্যালয়ের কোন শাস্তি প্রদানকারী কর্তৃপক্ষের নিকট যদি কোন ছাত্র/ছাত্রগোষ্ঠীর সংঘটিত অপরাধ সুনির্দিষ্টভাবে প্রতীয়মান হয় এবং বিশ্ববিদ্যালয়ের সুষ্ঠ পরিবেশের স্বার্থে তাৎক্ষণিক শাস্তি বিধান জরুরী হয় তাহা হইলে উল্লেখিত শাস্তি প্রদানকারী কর্তৃপক্ষ তাৎক্ষণিক শাস্তির ব্যবস্থা গ্রহণ করিবেন। তবে শর্ত থাকে যে, তাৎক্ষণিক শাস্তির মাত্রা অবশ্যই কর্তৃপক্ষের প্রদানযোগ্য শাস্তির সর্বোচ্চ সীমার মধ্যে থাকিবে।

পরীক্ষায় শৃংখলা ও আচরণ বিধি ঃ

২০। প্রধান প্রত্যবেক্ষক পরীক্ষার হলে শান্তি শৃংখলা বজায় রাখিবার জন্য দায়ী থাকিবেন।

২১। পরীক্ষার হলে কোন ছাত্র কর্তৃক সংঘটিত আইন শৃংখলা পরিপন্থী কোন কার্যকলাপ পরিলক্ষিত হইলে কর্তব্যরত প্রত্যবেক্ষক প্রধান প্রত্যবেক্ষককে অবহিত করিবেন। প্রধান প্রত্যবেক্ষক অপরাধের গুরুত্ব বিবেচনা করিয়া ঐ ছাত্রকে সর্বোচ্চ উক্ত পত্রের পরীক্ষা হইতে বহিস্কার করিতে পারিবেন। এইরূপ ঘটণা কর্তব্যরত প্রত্যবেক্ষক প্রধান প্রত্যবেক্ষকের মাধ্যমে ভাইস-চ্যান্সেলরকে রিপোর্ট করিবেন।

২২। পরীক্ষার্থীগণ নিম্নবর্ণিত নির্দেশ সমূহ কঠোর ভাবে মানিয়া চলিতে বাধ্য থাকিবে ঃ

(ক) পরীক্ষার্থীগণ উত্তর পত্রের কভার পৃষ্ঠা সহ কোথাও নিজের নাম লিখিতে পারিবে না। কোন পরীক্ষার্থী এইরূপ লিখিলে তাহার উত্তর পত্র মূল্যায়ন করা হইবে না।

(খ) প্রত্যেক পরীক্ষার্থী স্পষ্টাক্ষরে তাহার রোল নম্বর উত্তর পত্রের কভার পৃষ্ঠায় নির্দিষ্ট জায়গায় লিখিবে। ইহার কোন ব্যত্যয় ঘটিলে উত্তর পত্র মূল্যায়ন করা হইবে না।

(গ) কোন পরীক্ষার্থী অতিরিক্ত প্রশ্নোত্তরের খাতা ব্যবহার করিলে উক্ত অতিরিক্ত খাতার সঙ্গে তাহার রোল নম্বর লিখিবে এবং তাহা মূল খাতার সহিত শক্তভাবে আটকাইয়া দিবে।

(ঘ) কোন পরীক্ষার্থী প্রবেশপত্র ও পরিচয়পত্র ছাড়া কোনরূপ কাগজপত্র সহ পরীক্ষার হলে প্রবেশ করিতে পারিবে না। কাহারও নিকট এইরূপ কাগজপত্র পাওয়া গেলে তাহাকে তাৎক্ষনিকভাবে পরীক্ষার হল হইতে বহিস্কার করা যাইবে। পরীক্ষার্থীগণ শুধুমাত্র কর্তৃপক্ষ কর্তৃক সরবরাহকৃত কাগজপত্রে লিখিতে/খসড়া হিসাব করিতে পারিবে। পরীক্ষার খাতা ও অতিরিক্ত খাতা পরীক্ষা শেষে অবশ্যই প্রত্যবেক্ষকের নিকট জমা দিতে হইবে এবং এই সব খাতা ছেঁড়া বা অন্যের সঙ্গে অদল-বদল করা যাইবে না।

(ঙ) কোন পরীক্ষার্থী সাধারনভাবে পরীক্ষা আরম্ভ হইবার অর্দ্ধ ঘন্টা পরে পরীক্ষার হলে প্রবেশ করিতে পারিবে না এবং পরীক্ষার এক ঘন্টা কাল পূর্ণ না হইলে পরীক্ষার হল ত্যাগ করিতে পারিবে না।

(চ) পরীক্ষার খাতায় বিষয় বহির্ভূত কিছু লিখা দূষণীয়/অপরাধ বলিয়া বিবেচিত হইবে।

(ছ) কোন পরীক্ষার্থী প্রশ্নপত্রের উপরেও কিছু লিখিতে পারিবে না।

(জ) কোন পরীক্ষার্থীর নির্ধারিত টেবিল/চেয়ারে পরীক্ষার বিষয়বস্তু সংক্রান্ত কোন কিছু লিখা থাকিলে তাহা পরীক্ষা আরম্ভ হইবার পূর্বেই কর্তব্যরত প্রত্যবেক্ষকের দৃষ্টিগোচরে আনিতে হইবে। অন্যথায় ইহা পরীক্ষার্থী কর্তৃক সংঘটিত অপরাধ বলিয়া বিবেচিত হইবে।

(ঝ) এই বিধিতে অনুল্লেখিত কোন বিষয়ে পরীক্ষার্থীগণ কর্তব্যরত প্রত্যবেক্ষকের সিদ্ধান্ত মানিয়া চলিতে বাধ্য থাকিবে।

২৩। পরীক্ষার হলে অসদুপায়, অসদাচরণ বা পরীক্ষাসংক্রান্ত কোন কাজে শৃংখলা পরিপন্থী কোন কিছু করিলে সংশ্লিষ্ট ছাত্রের বিরুদ্ধে নিম্নবর্ণিত উপায়ে শাস্তিমূলক ব্যবস্থা গ্রহণ করা যাইবে ঃ

ক্রঃ নং	সংঘটিত অপরাধ	প্রদেয় শাস্তি
(ক)	অন্য পরীক্ষার্থী/পরীক্ষার্থীদের সহিত কথা বলা/যোগাযোগের চেষ্টা করা।	১ম বারঃ সতর্কীকরন/সিট পরিবর্তন ২য় বারঃ ঐ পত্রের ৫% মার্ক কাটিয়া লওয়া। ৩য় বারঃ প্রধান প্রত্যবেক্ষকের অনুমোদনক্রমে ঐ পত্রের জন্য হল হইতে বহিস্কার।
(খ)	পরীক্ষার হলে সংশ্লিষ্ট পরীক্ষা সংক্রান্ত কাগজপত্র নিজের কাছে রাখা বা কোন উৎস হইতে নকল করা বা অন্য কোন পরীক্ষার্থীর খাতা দেখিয়া লিখা।	পরীক্ষার হল হইতে বহিস্কার সহ ঐ পত্রের পরীক্ষা বাতিল এবং ৬ মাস হইতে ২ বৎসরের জন্য বিশ্ববিদ্যালয় হইতে বহিস্কার।
(গ)	পরীক্ষার্থীর শরীর, ক্যালকুলেটর সহ পরীক্ষায় ব্যবহৃত জ্যামিতিক যন্ত্রপাতিতে লেখা সহ হলে প্রবেশ।	পরীক্ষার হল হইতে বহিস্কার সহ ঐ পত্রের পরীক্ষা বাতিল এবং ৬ মাস হইতে ২ বৎসরের জন্য বিশ্ববিদ্যালয় হইতে বহিস্কার।
(ঘ)	পরীক্ষার্থীর টেবিল/চেয়ারে পরীক্ষার বিষয়ে কোন কিছু লিখিত পাওয়া গেলে।	পরীক্ষার হল হইতে বহিস্কার সহ সর্বনিম্ন ঐ পত্রের পরীক্ষা বাতিল এবং সর্বোচ্চ রেজিষ্ট্রেশনকৃত সকল বিষয়ের পরীক্ষা বাতিল।
(ঙ)	প্রত্যবেক্ষক বা পরীক্ষকের প্রতি উগ্র বাক্য ব্যবহার অথবা প্রত্যবেক্ষক/পরীক্ষককে ভয়-ভীতি প্রদর্শন।	সর্বনিম্ন রেজিষ্ট্রেশনকৃত সকল পরীক্ষা বাতিল এবং সর্বোচ্চ বিশ্ববিদ্যালয় হইতে চিরতরে বহিস্কার।
(চ)	পরীক্ষা শুরু হওয়ার পূর্বে ভিন্ন পন্থায় প্রশ্নপত্র সংগ্রহ করা/ সংগ্রহের চেষ্টা করা।	বিশ্ববিদ্যালয় হইতে ২ বৎসরের জন্য বহিস্কার/বিশ্ববিদ্যালয় হইতে ১ বৎসরের জন্য বহিস্কার।
(ছ)	পরীক্ষার্থীর নিকট পরীক্ষা সম্পর্কীত নয় এরূপ কোন কিছু লিখিত পাওয়া গেলে।	ঐ পত্রের পরীক্ষা বাতিল সহ পরীক্ষার হল হইতে বহিস্কার করা যাইতে পারে।
(জ)	পরীক্ষককে প্রভাবিত করা।	ঐ পত্রের পরীক্ষা বাতিল।
(ঝ)	অন্য ছাত্রের পরিবর্তে পরীক্ষা দেওয়া বা দেওয়ার চেষ্টা করা।	উভয় পরীক্ষার্থীর ঐ সেমিষ্টারের রেজিষ্ট্রেশনকৃত সকল বিষয়ের পরীক্ষা বাতিল সহ বিশ্ববিদ্যালয় হইতে সর্বনিম্ন ১ বৎসর এবং সর্বোচ্চ চিরতরে বহিস্কার।
(ঞ)	বাহির হইতে কোন প্রশ্নপত্রের উত্তর লিখিয়া পরীক্ষার খাতার সহিত জুড়িয়া দেওয়া বা দেওয়ার চেষ্টা করা।	রেজিষ্ট্রেশনকৃত সকল সেমিষ্টার পরীক্ষা বাতিল এবং/বা ১ হইতে ২ বৎসরের জন্য বিশ্ববিদ্যালয় হইতে বহিস্কার।

সেমিষ্টার ফাইনাল, ক্লাশ টেষ্ট, কুইজ প্রভৃতি সকল পরীক্ষার জন্য উপরে উল্লেখিত বিধিসমূহ প্রযোজ্য হইবে।

২৪। পরীক্ষা সংশ্লিষ্ট শাস্তি প্রয়োগকারী কর্তৃপক্ষ ও তাহাদের ক্ষমতাবলীঃ

কর্তৃপক্ষ		ক্ষমতা	পুনঃ বিবেচনার/আপীল কর্তৃপক্ষ
(ক)	ছাত্র শৃংখলা কমিটি	সর্বনিম্ন সতর্কীকরণ এবং সর্বোচ্চ বিশ্ববিদ্যালয় হইতে চিরতরে বহিস্কার।	একাডেমিক কাউন্সিল।
(খ)	ভাইস-চ্যান্সেলর	সতর্কীকরণ, ৬ মাস পর্যন্ত বিশ্ববিদ্যালয় হইতে বহিস্কার/চলতি সেমিষ্টারের রেজিষ্ট্রেশন কৃত সকল বিষয়ের পরীক্ষা বাতিল।	ছাত্র শৃংখলা কমিটি।
(গ)	অনুষদের ডীন/বিভাগীয় প্রধান/প্রধান প্রত্যবেক্ষক	সতর্কীকরণ, পরীক্ষার হল হইতে বহিস্কার। বিষয়টি ভাইস-চ্যান্সেলরের নিকট রিপোর্ট করিতে হইবে।	
(ঘ)	প্রত্যবেক্ষক	সতর্কীকরণ, ৫% নম্বর কর্তন করিয়া লওয়া। ৫% নম্বর কর্তন এর বিষয়টি ভাইস-চ্যান্সেলর এর নিকট প্রধান প্রত্যবেক্ষক এর মাধ্যমে রিপোর্ট করিতে হইবে।	প্রধান প্রত্যবেক্ষক।

Department of Computer Science and Engineering, KUET, Khulna

Summary of Course Distribution

(Effective from the Academic Session: 2014-2015)

Year/Term	Term-Wise Course Distribution & Related Information							Total Contact Hours & Credits	Subject –wise total credits
1ST Year 1ST Term	CSE1100 Introduction to Computer Systems 0-3 hrs/wk 0-1.5 Credit	CSE 1107 Discrete Mathematics 3-0 hrs/wk 3-0 Credit	EEE 1107-EEE 1108 Basic Electrical Engineering 3-3 hrs/wk 3-1.5 Credit	MATH 1107 Differential and Integral Calculus 3-0 hrs/wk 3-0 Credit	PHY 1107- PHY 1108 Physics 3-3 hrs/wk 3-1.5 Credit	HUM 1107 English and Human Communication 3-0 hrs/wk 3-0 Credit	HUM1108 English Skills Laboratory 0-3/2 hrs/wk 0-0.75 Credit	Hrs/wk=15+10.5= 25.50 Credit=15+5.25 = 20.25	CSE 3+1.50 Other Engineering 3+1.50 Mathematics 3+0.00 Physics 3+1.50 Humanities 3+0.75
1ST Year 2ND Term	CSE 1201-CSE 1202 Structured Programming 3-3 hrs/wk 3-1.5 Credit	CSE 1203- CSE 1204 Digital Logic Design 3-3 hrs/wk 3-1.5 Credit	EEE 1217-EEE 1218 Analog Electronics 3-3/2 hrs/wk 3-0.75 Credit PRE: EEE 1107	ME 1270 Computer Aided Design Laboratory 0-3/2 hrs/wk 0-0.75 Credit	MATH 1207 Coordinate Geometry and Differential Equations 3-0 hrs/wk 3-0 Credit	CHEM 1207-CHEM 1208 Chemistry 3-3/2 hrs/wk 3-0.75 Credit		Hrs/wk= 15+10.5= 25.50 Credit=15+5.25 = 20.25	CSE 6+3.00 Other Engineering. 3+1.50 Mathematics 3+0.00 Chemistry 3+0.75
2ND Year 1ST Term	CSE 2101-CSE 2102 Object Oriented Programming 3-3 hrs/wk 3-1.5 Credit PRE: CSE 1201	CSE 2105-CSE 2106 Data Structures and Algorithms 3-3 hrs/wk 3-1.5 Credit	CSE 2113 Computer Architecture 3-0 hrs/wk 3-0 Credit	EEE 2113-EEE 2114 Digital Electronics 3-3 hrs/wk 3-1.5 Credit *PRE: EEE 1217*	MATH 2107 Fourier Analysis and Linear Algebra 3-0 hrs/wk 3-0 Credit PRE: MATH 1207			Hrs/wk=15+9 = 24.00 Credit =15+4.5 = 19.50	CSE 9+3.00 Other Engineering. 3+1.50 Mathematics 3+0.00
2ND Year 2ND Term	CSE 2200 Advanced Programming 0-3 hrs/wk 0-1.5 Credit	CSE 2201-CSE 2202 Algorithm Analysis and Design 3-3 hrs/wk 3-1.5 Credit *PRE: CSE 2105*	CSE 2203-CSE 2204 Microprocessors and Microcontrollers 3-3 hrs/wk 3-1.5 Credit	CSE 2207-CSE 2208 Numerical Methods 3-3/2 hrs/wk 3-0.75 Credit *PRE: MATH 1207*	MATH 2207 Complex Variable, Vector Analysis and Statistics 3-0 hrs/wk 3-0 Credit	HUM 2207 Economics and Accounting 3-0 hrs/wk 3-0 Credit		Hrs/wk=15 +10.5= 25.50 Credit=15+5.25 = 20.25	CSE 9+5.25 Mathematics 3+0.00 Humanities 3+0.00
3RD Year 1ST Term	CSE 3100 Web Programming 0-3 hrs/wk 0-1.5 Credit	CSE 3101 Theory of Computation 3-0 hrs/wk *3-0 Credit*	CSE 3103-CSE 3104 Peripherals and Interfacing 3-3/2 hrs/wk 3-0.75 Credit PRE: CSE 2203	CSE 3109-CSE 3110 Database Systems 3-3 hrs/wk 3-1.5 Credit	CSE 3119-CSE 3120 Software Engineering and Information Systems 3-3 hrs/wk 3-1.5 Credit	ECE 3115-ECE 3116 Data Communication 3-3/2 hrs/wk 3-0.75 Credit PRE: EEE 2113		Hrs/wk=15+12.0 = 27.00 Credit=15+6.00 = 21.00	CSE 12+5.25 Other Engineering. 3+0.75
3RD Year 2ND Term	CSE 3200 System Development Project 0-3 hrs/wk 0-1.5 Credit	CSE 3201-CSE 3202 Operating Systems 3-3 hrs/wk 3-1.5 Credit	CSE 3207 Applied Statistics and Queuing Theory 3-0 hrs/wk 3-0 Credit	CSE 3211-CSE 3212 Compiler Design 3-3/2 hrs/wk 3-0.75 Credit PRE: CSE 3101	CSE 3217-CSE 3218 Mobile Computing 3-3/2 hrs/wk 3-0.75 Credit	HUM xxxx Course from Optional-I 3-0 hrs/wk 3-0 Credit		Hrs/wk=15+9 = 24.00 Credit = 15+4.5 = 19.50	CSE 12+4.50 Other Engineering. 3+0.00
4TH Year 1ST Term	CSE 4000 Project / Thesis 0-3 hrs/wk 0-1.5 Credit	CSE 4105-CSE 4106 Computer Networks 3-3 hrs/wk 3-1.5 Credit PRE: CSE 3201	CSE 4109-CSE 4110 Artificial Intelligence 3-3/2 hrs/wk 3-0.75 Credit PRE: CSE 2201	CSE 4120 Technical Writing and Seminar 0-3/2 hrs/wk 0-0.75 Credit	CSE xxxx Course from Optional-II 3-3/2 hrs/wk 3-0.75 Credit	CSE xxxx Course from Optional-II 3-3/2 hrs/wk 3-0.75 Credit	IEM 4127 Industrial Management 3-0 hrs/wk 3-0 Credit	Hrs/wk=15+12= 27.00 Credit =15+6.00 = 21.00	CSE 12+6.00 Other Engineering. 3+0.00
4TH Year 2ND Term	CSE 4000 Project / Thesis 0-6 hrs/wk 0-3 Credit	CSE 4207-CSE 4208 Computer Graphics 3-3/2 hrs/wk 3-0.75 Credit PRE: MATH 2207	CSE 4223-CSE 4224 Digital System Design 3-3/2 hrs/wk 3-0.75 Credit	CSE xxxx Course from Optional-III 3-0 hrs/wk 3-0 Credit	CSE xxxx Course from Optional-III 3-0 hrs/wk 3-0 Credit	CSE xxxx Course from Optional-III 3-0 hrs/wk 3-0 Credit		Hrs/wk=15+9 = 24.00 Credit =15+4.50 = 19.50	CSE 15+4.50

Remarks :

1. Theory Courses per Term = 5.00
2. Average Contact Hours per week/Term = 25.31
3. Average Credit per Term = 20.16
4. Total Credit = 161.25

Percentage of Courses (Credit)

CSE	68.84%
Other Engg.	12.56%
Mathematics	7.44%
Basic Science	5.12%
Humanities	6.04%
Total	100%

Engineering Subject. : 81.40%
Non-Engineering Subject : 18.60%

Total Contact Hours/week for 8 Terms

Theory : 120.00 13.0
Laboratory : 82.50 13.0

Credit

Theory : 120.00
Laboratory : 41.25

Total

Hrs : 202.50 (Per Week for 8 Terms)
Credit : 161.25

CSE	= 78+33	(Credit)
Other Engg.	= 15+5.25	"
Mathematics	= 12.00	"
Physics	= 3+1.50	"
Chemistry	= 3+0.75	"
Humanities	= 9+0.75	"
Total	= 161.25	"

Optional-I HUM 3207: Sociology and Government, HUM 3217: Business and Industrial law, HUM 3227: Professional Ethics and Moral Thoughts, HUM 3237: Occupational Psychology

Optional-II CSE 4103: VLSI Design, CSE 4104: VLSI Design Laboratory, CSE 4107: Digital Signal Processing, CSE 4108: Digital Signal Processing Laboratory, CSE 4111: Machine Learning, CSE 4112: Machine Learning Laboratory, CSE 4115: Computer and Network Security, CSE 4116: Computer and Network Security Laboratory, CSE 4117: Modeling and Simulation, CSE 4118: Modeling and Simulation Laboratory, CSE 4131: Pattern Recognition, CSE 4132: Pattern Recognition Laboratory, CSE 4127: Image Processing and Computer Vision, CSE 4128: Image Processing and Computer Vision Laboratory, CSE 4129: Ubiquitous Computing, CSE 4130: Ubiquitous Computing Laboratory.

Optional-III CSE 4211: Algorithm Engineering, CSE 4213: Fault Tolerant System, CSE 4215: E-Commerce, CSE 4217: Principles of Programming Languages, CSE 4219: Distributed Database Systems, CSE 4221: Natural Language Processing, CSE 4233: Robotics, CSE 4225: Embedded Systems, CSE 4227: Human Computer Interaction, CSE 4231: Control Systems Engineering, CSE 4235: Multimedia Technology, CSE 4237: Computational Geometry, CSE 4239: Data Mining, CSE 4241: Biomedical Engineering, CSE 4243: Parallel and Distributed Processing, CSE 4247: Graph Theory.