Chapter 1

GENERAL INFORMATION

1.1 Historical Background

Bangladesh University of Engineering and Technology, abbreviated as BUET, is the oldest institution for the study of Engineering and Architecture in Bangladesh. The history of this institution dates back to the days of Dhaka Survey School, which was established at Nalgola in 1876 to train surveyors for the then Government of Bengal of British India. As Engineering and Technology continued to play a more and more dominant role in the advancement of the country, this institution continued to act as the focal point for the development and the dissemination of engineering and technological know-how in this region. To meet this challenge, the Survey School grew in size and content, and became the Ahsanullah School of Engineering offering three-year diploma courses in Mechanical-, Civil- and Electrical Engineering. In 1948, the School was upgraded to Ahsanullah Engineering College under the University of Dhaka, offering four-year bachelor's courses in Civil-, Electrical- and Mechanical Engineering with a view to meet the increasing demand for engineers in the country and to expand the facilities for quicker advancement of engineering education. In order to create facilities for post-graduate studies and research, Ahsanullah Engineering College was upgraded to the status of a University under the name of East Pakistan University of Engineering and Technology (EPUET) in the year 1962. After the independence of Bangladesh in 1971, it was renamed as the Bangladesh University of Engineering and Technology. Starting with two faculties, the university has now enlarged into five faculties.

Undergraduate courses in the faculties of Engineering, Civil Engineering, Electrical and Electronic Engineering, and Mechanical

Engineering extend over four years and lead to B. Sc. Engineering in Civil, Electrical & Electronic, Mechanical, Chemical, Materials and Metallurgical, Computer Science and Engineering, and Naval Architecture & Marine Engineering. In the faculty of Architecture and Planning the degree of Bachelor of Architecture extends over five years, while the Bachelor of Urban and Regional Planning extends over four years.

Conducting post-graduate studies and research are now among the primary activities of the university. Most of the departments under the different faculties offer M. Sc. Engg. and M. Engg. degrees and some departments have Ph.D. programmes. Postgraduate degrees in Architecture (M. Arch) and in Urban and Regional Planning (MURP) are offered by the Faculty of Architecture and Planning.

In addition to its own research programmes, the university undertakes research projects sponsored by organizations, such as United Nations' Organizations, Commonwealth Foundation, University Grants Commission, Ministry of Science & Technology, etc. The expertise at the University, its teachers and the laboratory facilities can be utilized by other organizations of the country following standard procedures.

1.2 The BUET Campus

The BUET campus is situated at the centre of Dhaka city, the capital of Bangladesh, with easy access to the Hazrat Shahjalal International Airport, Kamalapur Railway Station, Bus Terminals and Sadarghat River Port. The campus is compact with five main multistoried buildings housing eighteen departments. It also has several institutes like Institute of Water and Flood Management (IWFM), Institute of Appropriate Technology (IAT), Institute of Information and Communication Technology (IICT), BUET-Japan Institute of Disaster Prevention and Urban Safety (BUET-JIDPUS), Accident Research Center, and Energy Center. Several large workshops, such as carpentry-, foundry-, sheet metal- and machine shops, etc. support and facilitate research and undergraduate project work. Students' housing and teachers' residence are at walking distances from the campus. There are eight halls of residence for students including one for female students within the campus.

1.3 Teaching Staff of the University

The total number of filled up teaching posts is 631 out of which 438 teachers are in active service and the rest of the teachers are on leave for higher studies and teaching and research in various universities/institutes around the world (as on February 11, 2017). The following is a list of teachers in different posts.

Sl. No.	Designation	Total
1.	Professor	196
2.	Associate Professor	48
3.	Assistant Professor	251
4.	Lecturer	138
Total Teachers		633

Besides these teaching posts, there are Professorships and Chairs namely:

a) **Dr. Rashid Chair**

In memory of late Dr. M. A. Rashid, formerly Professor of Civil Engineering and the first Vice-Chancellor of BUET, a chair has been created. The chair is sponsored by the graduates of the year 1961 of BUET (61 Club).

b) **M A Naser Chair**

In memory of late Dr. M A Naser, formerly Professor of Chemical Engineering and the second Vice-Chancellor of BUET, this chair has been created by the BUET Chemical Engineering Alumni Association

(ChEAA) at the Department of Chemical Engineering, BUET. The vision of the chair is to enhance excellence in teaching and promote greater interaction between the university and outside organizations. The vision would be realized by appointing professionals having experience in industry and academia. The appointment would be open to alumni and other distinguished academic, research and industry persons working in fields related to chemical engineering. The appointees to the chair will take effective steps to enhance relationship between the university and the industry.

c) **Professor Emeritus and Supernumerary Professors**

In order to get the benefits from the services of the eminent people of either scholastic and academic brilliance or outstanding professionals in Engineering Architecture and Planning, the university has established- provisions for appointment of such persons as emeritus and supernumerary professors.

1.4 Faculties and Teaching Departments

In the year 1978 there were only two faculties in this university, the Faculty of Engineering and the Faculty of Architecture and Planning, with the gradual expansion of the university some of the major engineering departments formed their own faculties. The Department of Electrical and Electronic Engineering was upgraded to the Faculty of Electrical and Electronic Engineering with two departments under it.

The University has now eighteen teaching departments under five faculties. All departments offer degree programmes, with the exception of some non-engineering departments. However, some of them offer postgraduate (PG) degrees. The engineering departments offer B. Sc. Engineering, M. Sc. Engineering, M. Engineering, and Ph. D. degrees. The Faculty of Architecture and planning offers Bachelor of Architecture, Master of Architecture and Master of Urban and Regional Planning degrees. The departments of Chemistry, Physics and Mathematics offer M. Phil and Ph.D. degrees. Institutes like IWFM and IICT offer postgraduate diploma, Masters and M. Phil degrees in their areas. The status of degrees offered by faculties and institutes are given below:

Sl. No	Faculty	Degree/Program
1.	**Faculty of Electrical and Electronic Engineering**	
	Department of Electrical and Electronic Engineering	Both UG and PG
	Department of Computer Science and Engineering	Both UG and PG
	Department of Biomedical Engineering	UG Only
2.	**Faculty of Civil Engineering**	
	Department of Civil Engineering	Both UG and PG
	Department of Water Resources Engineering	Both UG and PG
3.	**Faculty of Mechanical Engineering**	
	Department of Mechanical Engineering	Both UG and PG
	Department of Naval Architecture and Marine Engineering	Both UG and PG
	Department of Industrial and Production Engineering	Both UG and PG
4.	**Faculty of Engineering**	
	Department of Chemical Engineering	Both UG and PG
	Department of Materials and Metallurgical Engineering	Both UG and PG
	Department of Petroleum and Mineral Resources Engineering	PG only
	Department of Chemistry	PG only
	Department of Mathematics	PG only
	Department of Physics	PG only
	Department of Glass and Ceramics Engineering	PG only

Sl. No	Faculty	Degree/Program
5.	**Faculty of Architecture and Planning**	
	Department of Architecture	Both UG and PG
	Department of Urban and Regional Planning	Both UG and PG
	Department of Humanities	No degree offered
	Institutes	
6.	Institute of Information and Communication Technology	PGDIP and PG
7.	Institute of Water and Flood Management	PG only
8.	Institute of Appropriate Technology	No degree offered
9.	Accident Research Institute	No degree offered
10.	BUET-Japan Institute of Disaster Prevention and Urban Safety	No degree offered

1.5 University Administration

Chancellor:
Md. Abdul Hamid
Honorable President
The Peoples Republic of Bangladesh

Vice-Chancellor:
Prof. Dr. Saiful Islam

List of Administrative Officers:

Registrar
Controller of Examinations
Comptroller
Director of Students' Welfare
Director of Advisory, Extension & Research Service

Director of Bureau of Research, Testing & Consultation
Director of Planning and Development

Deans of Faculties:
Dean of Civil Engineering
Dean of Architecture & Planning
Dean of Electrical & Electronic Engineering
Dean of Mechanical Engineering
Dean of Engineering

Directors of Institutes & Centers:
Director, Institute of Water and Flood Management
Director, Institute of Appropriate Technology
Director, Accident Research Institute
Director, Institute of Information and Communication Technology
Director, BUET-Japan Institute of Disaster Prevention and Urban Safety
Director, Centre for Energy Studies
Director, Directorate of Continuing Education
Director, Centre for Environmental and Resource Management
Director, Centre for Regional Development

Provost of Residential Halls:
Provost, Ahsan Ullah Hall
Provost, Chattri Hall
Provost, Kazi Nazrul Islam Hall
Provost, Shahid Smrity Hall
Provost, Sher-e-Bangla Hall
Provost, Dr. M. A. Rashid Hall
Provost, Suhrawardy Hall
Provost, Titumir Hall

Chapter 2

THE DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

2.1 Introduction

Electrical and Electronic Engineering (EEE) education today has entered a transitional phase. On one hand, EEE curricula around the globe are experiencing increasing specialization. The use of specialized CAD and simulation software as teaching tools is on the rise. On the other hand, diversity of EEE education is also increasingly underscoring its multi-disciplinary nature. Over the last decade or so, the traditional role played by an Electrical and Electronic Engineer has changed quite significantly. Today's employers require Electrical and Electronic Engineers with excellent communication skills along with awareness about environmental and safety issues. Increasing the ethical and moral standards of the engineers is also getting higher priority in the industry. To keep pace with this globally changing need, the EEE department in BUET continually updates and reviews its curriculum and teaching practices. The graduates of this department serve as leaders in the Electrical and Electronic industry in Bangladesh. They also excel in the international arena as professional engineers, researchers and academicians and bring accolades for the University as well as for the country.

The EEE department has recently introduced a new curriculum, included in this booklet, in which emphasis has been given on specialization. The undergraduate programme has been arranged around three groups, namely, power, communication and electronics. A student is expected to specialize in one of these groups without compromising the fundamental knowledge in Electrical and Electronic Engineering. The department is also committed to provide the students access to modern laboratories and simulation and CAD software. A number of new laboratories, including the Digital Signal Processing Lab and the Simulation Lab, have been developed or updated within the department during the last few years. Widely used softwares, such as, SPICE and MATLAB, have been integrated into the undergraduate programme. The department, with the help of its expatriate alumni now working in Intel, has acquired CADENCE, a state-of-the-art CAD tool for design and analysis of VLSI circuits and systems.

EEE students in BUET are encouraged to participate in research and development activities of the department. Problems of national, regional and international importance receive serious attention in the department. In the recent past, students of this department have earned prizes in prestigious international project competitions arranged by IEEE, the premier worldwide organization of Electrical and Electronic Engineers. Research work in the department is conducted in various areas of EEE, such as, Digital Signal Processing, Optical Fiber and Satellite Communication, Semiconductor Devices, VLSI, Microwave, Power Electronics, Power Systems, Electrical Machines and Drives, Renewable Energy, Control System, Biomedical Engineering etc. In addition to this, there is opportunity in the department for postgraduate studies and research leading to a higher degree: M.Sc. Engg., M. Engg. and Ph. D.

Another significant part of the departmental activities is the Testing, Advisory and Consulting services provided to the industry and various national and international organizations. These types of activities provide the teachers with the opportunity to gain valuable practical experience. Such interaction between the university and the industry extends the role of the university in the national development.

EEE is one of the largest departments in the university with around 1000 undergraduate and 120 postgraduate students. The department has more than 50 members of the teaching staff, more than half of whom have Ph.D. degrees. The department is housed in the east wing of the ECE building (New Academic Building) in West Palashi.

2.2 List of Faculty Members of the Department

2.2.1 Faculties Currently in Active Service

Professors

1.	S. Shahnawaz Ahmed	B.Sc. Engg., M.Sc. Engg., Ph.D. (UK)
2.	Satya Prasad Majumder	B.Sc. Engg., M.Sc. Engg., Ph.D. (India)
3.	Md. Saifur Rahman	B.Sc. Engg., M.Sc. Engg., Ph.D. (UK)
4.	Pran Kanai Saha	B.Sc. Engg., M.Sc. Engg., Ph.D. (Ireland)
5.	Quazi Deen Mohd Khosru	B.Sc. Engg. (India), M.Sc. Engg., Ph.D. (Japan)
6.	Md. Shafiqul Islam	B.Sc. Engg., M.Sc. Engg., Ph.D. (Ireland)
7.	Md. Kamrul Hasan	B.Sc. Engg., M.Sc. Engg., M. Engg. (Japan), Ph.D. (Japan)
8.	Md. Aynal Haque	B.Sc. Engg., M.Sc. Engg., Ph.D. (Japan)
9.	A.B.M. Harun-Ur-Rashid	B.Sc. Engg., M. Engg. (Japan), Ph.D. (Japan)
10.	Kazi Mujibur Rahman	B.Sc. Engg., M.Tech. (India), Ph.D. (BUET)
11.	Sharif Mohammad Mominuzzaman	B. Sc. Engg., M. Sc. Engg., Ph.D. (Japan)
12.	Mohammad Jahangir Alam	B.Sc. Engg., M.Sc. Engg., Ph.D. (Ireland)
13.	Md. Shah Alam	B.Sc. Engg., M.Sc. Engg. (Japan), Ph.D. (Japan)
14.	Md. Ziaur Rahman Khan	B.Sc. Engg., M.Sc. Engg., Ph.D. (UK)
15.	Mohammed Imamul Hassan Bhuiyan	B.Sc. Engg., M.Sc. Engg., Ph.D. (Canada)

16.	Shaikh Anowarul Fattah	B.Sc. Engg., M.Sc. Engg., Ph.D (Canada)
17.	Md. Nasim Ahmed Dewan	B.Sc. Engg., M.Sc. Engg., Ph.D. (Ireland)
18.	S. M. Mahbubur Rahman	B.Sc. Engg., M.Sc. Engg., Ph.D. (Canada)
19.	Muhammad Anisuzzaman Talukder	B.Sc. Engg., M.Sc. Engg., Ph.D (USA)
20.	Celia Shahnaz	B.Sc. Engg., M.Sc. Engg., Ph.D (Canada)
21.	Mohammad Ariful Haque	B.Sc. Engg., M.Sc. Engg., Ph.D (BUET)
22.	Abdul Hasib Chowdhury	B.Sc. Engg., M.Sc. Engg, Ph.D. (BUET)
23.	Farseem Mannan Mohammedy	B.Sc. Engg., M.Sc. Engg., Ph.D (Canada)
24.	Mohammad Faisal	B.Sc. Engg., M.Sc. Engg., Ph.D (Japan)
25.	Samia Subrina	B.Sc. Engg., M.Sc. Engg., Ph.D (USA)
26.	Md. Forkan Uddin	B.Sc. Engg., M.Sc. Engg., Ph.D. (Canada)
27.	Md. Farhad Hossian	B.Sc. Engg., M.Sc. Engg., Ph.D. (Australia)
28.	Lutfa Akter	B.Sc. Engg., M.Sc. Engg., Ph.D (USA)
29.	Md. Kawsar Alam	B.Sc. Engg., M.Sc. Engg, Ph.D. (Canada)

Associate Professors

30.	Shaikh Asif Mahmood	B.Sc. Engg., M.Sc. Engg., Ph.D. (Canada)
31.	Yeasir Arafat	B.Sc. Engg., M.Sc. Engg.
32.	Shamim Reza	B.Sc. Engg., M.Sc. Engg., Ph.D. (Australia)
33.	Apratim Roy	B.Sc. Engg., M.Sc. Engg. , Ph.D. (BUET)

34.	Mahbub Alam	B.Sc. Engg., M.Sc. Engg., Ph.D. (France, USA)
35.	Nahid-Al-Masood	B.Sc. Engg., M.Sc. Engg., Ph.D. (Australia)

Assistant Professors

36.	Sajid Muhaimin Choudhury	B.Sc. Engg., M.Sc. Engg., Ph.D. (USA)
37.	Ahmed Zubair	B.Sc. Engg., M.Sc. Engg., Ph.D. (USA)
38.	Md. Asiful Islam	B.Sc. Engg., M.Sc. Engg., Ph.D. (USA)
39.	Md. Zunaid Baten	B.Sc. Engg., M.Sc. Engg. Ph.D. (USA)
40.	Md. Hadiur Rahman Khan	B.Sc. Engg., M.Sc. Engg.
41.	Arnab Bhattacharjee	B.Sc. Engg., M.Sc. Engg.

Lecturers

42.	Mohammad Abdullah Al Shohel	B.Sc. Engg.
43.	Mohammad Tariqul Islam	B.Sc. Engg., MSc. Engg.
44.	Asir Intisar Khan	B.Sc. Engg. , MSc. Engg.
45.	Dip Joti Paul	B.Sc. Engg.
46.	Shoilie Chakma	B.Sc. Engg.
47.	Towsif Taher	B.Sc. Engg.
48.	Marjana Mahdia	B.Sc. Engg.
49.	Rajat Chakrabarti	B.Sc. Engg.
50.	I. K. M. Reaz Rahman	B.Sc. Engg.
51.	Arik Subhana	B.Sc. Engg.
52.	Md. Irfan Khan	B.Sc. Engg.
53.	Sadman Sakib Ahbab	B.Sc. Engg.
54.	Tanvir Mahmud	B.Sc. Engg.
55.	Munia Ferdousi	B.Sc. Engg.
56.	Anika Tabassum	B.Sc. Engg.

2.2.2 Faculties on Leave

Professors
(on sabbatical leave)

1.	Md. Zahurul Islam	B.Sc. Engg., M.Sc. Engg., Ph.D. (Canada)

Associate Professors
(on study leave)

2.	Hamidur Rahman	B.Sc. Engg., M. Engg. (USA)

Assistant Professors
(on study leave)

3.	Hafiz Imtiaz	B.Sc. Engg., M.Sc. Engg.
4.	Md. Imran Momtaz	B.Sc. Engg., M.Sc. Engg.
5.	Muhammad Abdullah Arafat	B.Sc. Engg., M.Sc. Engg.
6.	Mohammad Asif Zaman	B.Sc. Engg., M.Sc. Engg.
7.	Nadim Chowdhury	B.Sc. Engg., M.Sc. Engg.
8.	Md. Hasibul Alam	B.Sc. Engg., M.Sc. Engg.
9.	Soumitra Roy Joy	B.Sc. Engg., M.Sc. Engg.
10.	Shuvro Chowdhury	B.Sc. Engg., M.Sc. Engg.
11.	Maruf Ahmed	B.Sc. Engg., M.Sc. Engg.
12.	Imtiaz Ahmed	B.Sc. Engg., M.Sc. Engg.
13.	Saeed-Uz-Zaman Khan	B.Sc. Engg., M.Sc. Engg.
14.	Gobinda Saha	B.Sc. Engg., M.Sc. Engg.
15.	Ehsanur Rahman	B.Sc. Engg., M.Sc. Engg.
16.	Zabir Ahmed	B.Sc. Engg., M.Sc. Engg.
17.	Md. Sadman Sakib Rahman	B.Sc. Engg., M.Sc. Engg.
18.	Md. Ayaz Masud	B.Sc. Engg., M.Sc. Engg.
19.	Md. Shafiqul Islam	B.Sc. Engg., M.Sc. Engg.
20.	Sumaiya Wahid	B.Sc. Engg., M.Sc. Engg.
21.	Mahnaz Islam	B.Sc. Engg., M.Sc. Engg.

Lecturers
(on study leave)

22.	Urmita Sikder	B.Sc. Engg., M.Sc. Engg.
23.	Faria Hayee	B.Sc. Engg., M.Sc. Engg.
24.	Orchi Hassan	B.Sc. Engg., M.Sc. Engg.
25.	Md. Shahadat Hasan Sohel	B.Sc. Engg., M.Sc. Engg.
26.	Kanak Datta	B.Sc. Engg., M.Sc. Engg.
27.	Abir Shadman	B.Sc. Engg., M.Sc. Engg.
28.	Sakib Hassan	B.Sc. Engg., M.Sc. Engg.
29.	Md. Mukhlasur Rahman Tanvir	B.Sc. Engg., M.Sc. Engg.
30.	Jewel Mohajan	B.Sc. Engg., M.Sc. Engg.
31.	Ajanta Saha	B.Sc. Engg., M.Sc. Engg.

2.3 Research Areas of the Teachers Offering Post-Graduate Courses

Prof. S. Shahnawaz Ahmed	On-line Power System Control and Operation, Renewable energy, Artificial intelligence applications in Power System, Wireless power transmission, Smart grid.
Prof. Satya Prasad Majumder	Optoelectronics, Lasers, Optical Fibres, Optical Network and Communications.
Prof. Md. Saifur Rahman	Digital Communication and Signal Processing, Computer Networks.
Prof. Pran Kanai Saha	Ultra-wide band communication, Wireless interconnect, Antenna, Electromagnetic and Control.
Prof. Taifur Ahmed Chowdhury	Captive Power Generation, Power System Operation.
Prof. Quazi Deen Mohd Khosru	Solid State Devices.
Prof. Md. Shafiqul Islam	Compound semiconductor devices, Second Harmonic Generation (SHG) devices.

Prof. Md. Kamrul Hasan	Digital Signal Processing, System Identification, Speech Signal Processing, Image Processing, Data Compression, and Biomedical Signal Processing.
Prof. Md. Aynal Haque	Biomedical Instrumentation and Signal Processing.
Prof. A.B.M. Harun-Ur-Rashid	Solid State Devices, VLSI Design, Power Electronics.
Prof. Kazi Mujibur Rahman	Power Electronics, Microprocessor and microcontroller, Power System Protection, Microelectronics.
Prof. Sharif Mohammad Mominuzzaman	Optoelectronic Devices, Processing of Nanostructured Materials for Semiconductor Devices, Nanostructures
Prof. Mohammad Jahangir Alam	Thin Film Technology, Solid State Devices and Circuits, VLSI.
Prof. Md. Shah Alam	Optical Waveguide Devices, Optical Fibers, Photonic Crystal Fibres, Microwaves, Numerical techniques for electromagnetics.
Prof. Md. Ziaur Rahman Khan	Solid state devices, Energy efficiency, Renewable energy, Power electronic devices.
Prof. Mohammad Imamul Hasan Bhuiyan	Image and video processing, Biomedical signal and image processing, Radar image processing, Communication, Neural network-based signal and image processing, Biometrics.
Prof. Shaikh Anowarul Fattah	Digital Signal Processing, Biometric recognition, Bio-informatics, Control, Multimedia communication.
Prof. Md. Nasim Ahmed Dewan	Plasma Technology, Thin Film, Solid State Technology, VLSI technology.
Prof. S. M. Mahbubur Rahman	Statistical Signal Processing, Image and Video Processing, Pattern

	Recognition, Intelligent Transportation System, Affective Computing.
Prof. Muhammad Anisuzzaman Talukder	Nano photonics, Quantum electronics, Metamaterials.
Prof. Celia Shahnaz	Speech, audio and music processing, Biomedical signal processing, Biometric security, Multimedia communication.
Prof. Mohammad Ariful Haque	Adaptive filter, Digital Signal Processing.
Prof. Abdul Hasib Chowdhury	Power Systems, Electrical Machines, Microprocessors and Power electronics.
Prof. Farseem Mannan Mohammedy	Optoelectronic and photonic devices, III-V growth and fabrication, Nanotechnology, Renewable energy.
Prof. Mohammad Faisal	Optical Fiber Communication, Digital Communication.
Prof. Samia Subrina	Thermal management of graphene and nanoscale devices, Modeling of heat conduction, Device & material characterization.
Dr. Lutfa Akter	Cognitive Radio Network, Wireless Sensor Networks, co-operative communication.
Dr. Md. Farhad Hossian	Wireless Communications, Green Communications, 4G/5G/Beyond networks, Heterogeneous Networks, Self-organizing Networks.
Dr. Md. Forkan Uddin	Wireless Communications and Networking, Mobile Cellular Communications, Wireless Local Area Networks, Wireless Mesh Networks, Wireless Vehicular Ad Hoc Networks, Optical non-linearity, Optical Communications, Digital Signal Processing, Smart Grid.

Dr. Md. Kawsar Alam	Nanodevice Modeling and Simulation, Charged Particle Interaction with Nano-materials, Solid State Electronics, Electron Emission Properties of Nanotubes, Photovoltaic Devices, Secondary Electron Emission, Electron Microscopy, Monte Carlo Simulation of Electron Trajectories in Solids and Nanostructures.
Dr. Md. Zahurul Islam	Fundamental science of nanoscale plasmonics; Numerical investigations of nanoplasmonic sensing (including biomedical applications) and photovoltaic (solar energy harvesting) structures; Wearable sensing systems; Fire detection and alarm system for building fire safety in Bangladesh
Dr. Shaikh Asif Mahmood	Theory, modeling, analysis and characterization of electronic material and devices, Carrier transport in nanoscale devices, X-ray detectors.
Dr. Mahbub Alam	Nanoscale optical devices based on phase coherent electron transport Electron photon interaction NEGF formalism for nanoscale optoelectronic device simulation Electron transport and optical interaction in Graphene and other 2-D materials
Dr. Md. Shamim Reza	Power Quality Analysis, Non-Intrusive Load Monitoring, Estimation. Techniques for Grid Synchronization, Energy Storage Systems, Diagnostics of Power Converters, Power Electronics, Smart Metering, Smart Grid, Digital Signal Processing.
Dr. Apratim Roy	Micro and Nanoelectronics, Radio-

	frequency Integrated Circuits for Wireless Applications, CAD of Analog Nanoarchitectures, Biomedical Circuits.
Dr. Nahid-Al-Masood	Power system analysis and modelling, grid integration of large-scale renewable resources, power system security and power system stability.
Dr. Ahmed Zubair	Fabrication and Characterization of Optoelectronic and Photonic Devices, Ultrafast Optical Phenomena, Terahertz Technology, Nanomaterials and Nanotechnology, Wearable Technology, and Renewable Energy.
Dr. Md. Asiful Islam	Microwave Imaging, Antennas, Photonic Crystal Fibers, Metamaterials
Dr. Md. Zunaid Baten	Design, experimental realization and characterization of novel electronic, optoelectronic and spintronic devices; thin film epitaxy, clean room processing and fabrication; quantum mechanical and semi-classical simulation and analysis of nano-scale electronic and photonic devices and systems.
Dr. Sajid Muhaimin Choudhury	Nanophotonics, Metasurface, Metamaterials, Plasmonics, Numerical Electromagnetics, Open Source EM Simulation.

2.4 Laboratory Facilities of the Department

The department endeavors to provide its faculty members and students adequate laboratory, library and other facilities. The departmental undergraduate courses are laboratory intensive and this requirement is catered by following laboratories at present:

1. Electrical Circuits Lab I

2. Electrical Circuits Lab II
3. Electrical Circuits Lab III
4. Electrical Machines Lab
5. Electronics Lab
6. Measurement and Instrumentation Lab
7. Power Electronics Lab
8. Microwave Engineering Lab
9. Telecommunication Lab
10. High Voltage Engineering Lab
11. Switchgear and Protection Lab
12. Power System Lab
13. Control Systems Lab
14. Computer Lab for Faculty and Postgraduate Students
15. Advanced Machine Lab
16. VLSI Lab
17. SCADA Lab
18. Digital Signal Processing Lab
19. Robert Noyce Simulation Lab
20. Electronic Circuits Simulation Lab
21. Digital Electronics and Microprocessor Lab
22. BUET-Huawei Wireless Communication Lab
23. Photonics Lab
24. EEE-IDCOL Solar Simulation, Testing and Research Lab
25. Undergraduate and Post Graduate Project Labs (07 in Number)
26. EuProw Lab
27. Materials and Fabrication Lab (under development)
28. Biomedical Instrumentation Lab (under development)

Students in Level-I (freshman) and Level-II (sophomore) have to undertake laboratory classes in physics, chemistry, mechanical, civil engineering and in different workshops. If necessary undergraduate and postgraduate students can access the laboratory facilities of other departments, institutes and centers during their project, thesis and research works.

Chapter 3

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAMME UNDER COURSE SYSTEM

3.1 Introduction

From the academic session 1990-91, this university is following a course system for undergraduate studies. Given below, is an extract from the report of the committee for framing recommendations for implementation and administration of course system of instruction at undergraduate level as approved in the meetings of the Academic Council held on September 24 and 30, 1992, and October 4 and 19, 1992. Only relevant sections of the report and the amendments that were subsequently made to it are included so that the students can have a clear understanding about Course System. The rules and regulations administering undergraduate curricula through Course System began applicable for students admitted to this university in First Year classes in Engineering and Architecture in 1990-91 and subsequent sessions.

3.1.1 The Course System

The undergraduate curricula at BUET is based on the course system. The salient features of the course system are:

i. Reduction of the number of theoretical courses and examination papers around five in each term,
ii. The absence of a pass or a fail on an annual basis,
iii. Continuous evaluation of student’s performance,
iv. Introduction of Letter Grades and Grade Points instead of numerical grades,

v. Introduction of some additional optional courses and thus enable students to select courses according to his/her interest as far as possible,
vi. Opportunity for students to choose fewer or more courses than the normal course load depending on his/her capabilities and needs,
vii. Flexibility to allow the student to progress at his/her own pace depending on his/her ability or convenience, subject to the regulations on credit and minimum grade point average (GPA) requirements, and
viii. Promotion of teacher-student contact.

In the curriculum for the undergraduate programmes, besides the professional courses pertaining to each discipline, there is a strong emphasis on acquiring a thorough knowledge in the basic sciences of Mathematics, Physics and Chemistry. Due importance is also given for the study of several subjects in Humanities and Social Sciences which, it is expected will help the student to interact more positively with the society in which he/she lives. Thus the course contents of the undergraduate programmes provide a harmonious blend of both basic sciences and their applications as well as their social relevance.

The first two terms of bachelor's degree programmes consist of courses in basic sciences, mathematics, humanities and social sciences, basic engineering and architecture subjects. The third and subsequent terms build directly on the knowledge of the basic subjects gained in the first two terms and go on to develop competence in specific disciplines.

3.2 Student Admission

Students will be admitted in undergraduate curricula in the Departments of Architecture, Urban and Regional Planning, Chemical Engineering, Civil Engineering, Computer Science and Engineering, Electrical and Electronic Engineering, Mechanical Engineering, Industrial and Production Engineering, Materials and Metallurgical Engineering, Water Resources Engineering and Naval Architecture and Marine Engineering as per existing rules of the university. The Registrar's Office serves as Admissions Office and deals with course registration in addition to student admission.

3.3 Number of Terms in a Year

There will be two Terms (Term I and Term II) in an academic year. In addition to these two regular Terms there may be a Short Term in the intervening period between end of Term II and commencement of Term I. During this term students, those who need, may take additional courses either to make up deficiencies in credit and GPA requirements or to fulfill the credit requirements for bachelor's degree spending less time than the normal duration; and other students may take vacation.

3.3.1 Duration of Terms

The duration of each of Term I and Term II will be 18 weeks which will be used as follows:

Classes	14 weeks
Recess before Term Final Examination	2 weeks
Term Final Examination	2 weeks
Total	18 weeks

The duration of a Short Term will be around 8 weeks of which about 7 weeks will be spent for class lectures and one week for Term Final Examination.

3.4 Course Pattern and Credit Structure

The entire undergraduate programme is covered through a set of theoretical and laboratory/sessional/studio courses.

3.4.1 Course Designation and Numbering System

Each course is designated by a two to four letter word identifying the department which offers it followed by a three digit number with the following criteria:

(a) The first digit will correspond to the year/level in which the course is normally taken by the students.
(b) The second digit will be reserved for departmental use for such things as to identify different areas within a department.
(c) The last digit will usually be odd for theoretical and even for laboratory or sessional courses.

The course designation system is illustrated by two examples.

EEE 101 Electrical Circuit I

Course title
Last odd digit designates a theoretical course
Second digit reserved for departmental use
An one in first position signifies First Level/First Year
Department identification code

EEE 102 Electrical Circuit I Sessional

Course title
Last even digit designates a laboratory/sessional course
Second digit reserved for departmental use
An one in first position signifies First Level/First Year
Department identification code

One lecture per week per term will be equivalent to one credit.

(b) Laboratory/Sessional/Design:

Credits for laboratory/sessional or design courses will be half of the class hours per week per term.

Credits are also assigned to project and thesis work taken by students. The amount of credits assigned to such work may vary from discipline to discipline.

The curriculum does not demand the same rate of academic progress from all students for obtaining the degree but only lays down the pace expected of a normal student. A student whose background or capacity for assimilation is lower will be permitted to complete the programme at a slower pace by studying a lesser number of courses during a given term (subject to a minimum course load). He may keep pace with his class by taking during the Short Term those courses which he had dropped during the Regular Terms, or by covering the entire degree programme over an extended period without developing any feeling of inferiority complex.

3.5 Types of Courses

The courses included in undergraduate curricula are divided into several groups as follows:

3.5.1 Core Courses

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

3.5.2 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 before some other course(s) can be taken. Any such course, on which one or more subsequent courses build up, may be offered in each of the two regular Terms.

3.5.3 Optional Courses

Apart from the core courses, students will have to complete a number of courses which are optional in nature in that students will have some choice to choose the required number of courses from a specified group/number of courses.

3.6 Course Offering and Instruction

The courses to be offered in a particular term will be announced and published in the Course Catalog along with a tentative Term Schedule before the end of the previous term. Whether a course is to be offered in any term will be decided by the respective Board of Undergraduate Studies (BUGS). Respective departments may arrange to offer one or more pre-requisite or core courses in any term depending on the number of students who dropped or failed the course in the previous term.

Each course is conducted by a teacher. The course teacher is responsible for maintaining the expected standard of the course and for the assessment of student's performance. Depending on the strength of registered students (i.e. the number of students) enrolled for the course, the teacher concerned might have course associates and teaching assistants (TA) to help him/her in teaching and assessment.

For a course strength necessitating two or more parallel classes or sections, one of the course teachers or any other member of the teaching staff of the department may be designated as course coordinator. He/She has the full responsibility for coordinating the work of the other members of the department involving in that course.

3.7 Departmental Monitoring Committee

Consistent with its resilient policy to keep pace with new developments in the field of science and technology, the university will update its course curriculum at frequent intervals (at least every three years). Such updating aims not only to include the expanding frontiers of knowledge in the various fields but also to accommodate the changing social, industrial and professional need of the country. This can be done through deletion and modification of some of the courses and also through the introduction of new ones.

BUGS of each department will constitute a Departmental Monitoring Committee with three teachers of the department. This committee will monitor and evaluate the performance of the Course System within the department. In addition to other teachers of the department, the committee may also propose from time to time to the BUGS any changes and modifications needed for upgrading the Undergraduate Curriculum and the Course System.

3.8 Teacher Student Contact

The proposed system encourages students to come in close contact with teachers. For promotion of teacher-student contact, each student is assigned to an Adviser and the student is free to discuss with his/her adviser all academic matters, especially those related to courses taken and classes being attended by him/her. Students are also encouraged to meet with other teachers any time for help on academic matters.

3.9 Student Adviser

One Adviser would normally be appointed for a batch of students by the BUGS of the concerned department(s) who will advise each student on the courses to be taken by a student. Adviser will discuss with the student his/her academic programme and then decide the number and nature of courses for which he/she can register. However, it is the student's responsibility to keep contact with his/her adviser who will review and eventually approve the student's specific plan of study and check on subsequent progress. The adviser should be in the rank of an Assistant Professor or above from the concerned department(s).

For a student of second and subsequent terms, the number and nature 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 for the courses during the next term within the framework of the guidelines with respect to minimum/maximum credit hour limits, etc. which are elaborated at appropriate places in this booklet. He/She is also authorized to permit the student to drop one or more courses based on his/her academic performance and the corresponding categorization (Art.3.16).

Special provisions exist for academically weak students with regard to make-up courses (Art. 3.19).

3.10 Registration Requirements

Any student who makes use of classroom or laboratory facilities or faculty time is required to register formally. Being admitted to the university, each student is assigned to a student adviser. The student can register for courses he/she intends to take during a given term only on the basis of the advice and consent of his/her adviser.

3.10.1 Registration Procedure

Students must register for each class in which they will participate. Each student will fill up his/her Course Registration Form in consultation with and under the guidance of his/her adviser. The original copy of the Course Registration Form will be submitted to the Registrar's Office, and then the requisite number of photocopies will be made by the Registrar's Office for distribution. The date, time and venue will be announced in advance by the Registrar's Office. Much counseling and advising are accomplished at registration time. It is absolutely necessary that all students present themselves at the registration desk at the specified time.

3.10.2 Limits on the Credit Hours to be taken

A student must be enrolled in at least 15 credit hours. He/She may be allowed to enroll in up to a maximum of 24 credit hours if recommended by his/her Adviser. A student must enroll for the prescribed laboratory courses in the respective Term within the allowed credit hour limits.

In special cases where a student cannot be allotted the minimum required 15 credit hours in a Term, the relevant BUGS may approve a lesser number of credit hours to suit individual requirements. Such cases shall only be applicable to students needing less than 15 credits for graduation.

3.10.3 Pre-condition for Registration

A student will be allowed to register in those courses subject to the capacity constrains and satisfaction of pre-requisite courses. If a student fails in a pre-requisite course in any Term, the concerned BUGS may allow him/her to register for a course which builds on the pre-requisite course provided his/her attendance and grades in continuous assessment in the said pre-requisite course is found to be satisfactory.

Registration will be done at the beginning of each term. The Registration programme with dates and venue will be announced in advance. Late registration is, however, permitted during the first week on payment of a late registration fee. Students having outstanding dues to university or a hall of residence shall not be permitted to register. All students have, therefore, to clear their dues and get a clearance or no dues certificate, on the production of which, they will be given necessary Course Registration Forms and complete the course registration procedure. Registration Forms will normally be available in the Register's Office. However, for the First Year students, prior department-wise enrollment/admission is mandatory. An orientation programme will be conducted for them at the beginning of the first term when they will be handed over the registration package on producing enrollment slip/proof of admission.

3.10.4 Pre-registration

Pre-registration for courses to be offered by the students in a particular term will be done on specified dates before the end of the previous term. All students in consultation with their course advisers are required to complete the pre-registration formalities, failing which a fine of Tk. xx.xx (amount may be decided by the authority) will have to be paid before registration in the next term. Further a student who does not pre-register may not get the courses desired by him/her subsequently.

3.10.5 Registration Deadline

Student must register for the courses to be taken before the commencement of each term and no late registration will be accepted after one week of classes. Late registration after this date will not be accepted unless the student submits a written appeal to the Registrar through the concerned Head and can document extenuating circumstances such as medical problems (physically incapacitated and not able to be presented) from the Chief Medical Officer of the University or some other academic commitments which precluded enrolling prior to the last date of registration.

3.10.6 Penalty for Late Registration

Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. xx.xx (amount may be decided by the authority). This extra fee will not be waived whatever be the reason for late registration.

3.10.7 Course Adjustment Procedure

A student will have some limited options to add or delete courses from his/her registration list, within the first two weeks from the beginning of the term. He/She may add courses only within the first two weeks of a regular Term and only the first week of a short Term. In case of dropping a course a student will be allowed to do so within four weeks after the commencement of a regular Term and two weeks after the commencement of a short Term. Adjustment of initially registered courses in any Term can be done by duly completing the Course Adjustment Form. These forms will normally be available in the Registrar's Office. For freshman students such forms can be included in the registration packet at the time of orientation.

Any student willing to add or drop courses will have to fill up a Course Adjustment Form in consultation with and under the guidance of his/her adviser. The original copy of the Course Adjustment Form will be submitted to the Registrar's Office, and then the requisite number of photo copies will be made by the Registrar's Office for distribution to the concerned Adviser, Head, Dean, Controller of Examination and the student.

All changes in courses must be approved by the Adviser and the Head of the department concerned. The Course Adjustment Form will have to be submitted to the Registrar's Office after duly filled in and signed by the concerned persons. To add/drop a course, respective teacher's consent will be required.

3.10.8 Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to serious illness or serious accident, he/she may apply to the Head of the degree awarding department for total withdrawal from the Term within a week after the end of the Term Final Examination. However, he/she may choose not to withdraw any laboratory/sessional/design course if the grade obtained in such a course is ‘D’ or better. The application must be supported by a medical certificate from the Chief Medical Officer of the University. The Academic Council will take the final decision about such application.

3.11 Grading Systems

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory courses this continuous assessment is made through a set of quizzes/in class evaluation, class participation, homework assignments, and a term final examination. The assessment in laboratory/sessional courses is made through observation of the student at work in class, viva-voce during laboratory hours, and quizzes. For architecture students, assessments in design sessionals would be done through evaluation of a number of projects assigned throughout the term. As discussed earlier, each course has a certain number of credits which describe its weightage. A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits that he/she has completed satisfactorily and the weighted average of the grade points that he/she has maintained. A minimum grade point average is required to be maintained for satisfactory progress. Also a minimum number of earned credits should be acquired in order to qualify for the degree as prescribed under article 3.22.

Letter grades and corresponding grade-points will be awarded in accordance with provisions shown below:

Numerical Grade	Letter Grade	Grade Point
80% or above	A+ (A plus)	4.00
75% to less than 80%	A (A regular)	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 regular)	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 regular)	2.25
40% to less than 45%	D	2.00

Numerical Grade	Letter Grade	Grade Point
less than 40%	F	0.00
Continuation (for project & thesis/design courses)	X	-

3.11.1 Distribution of Marks

Thirty percent (30%) of marks shall be allotted for continuous assessment i.e., quizzes and homework assignments, in class evaluation and class participation. The remainder of the marks will be allotted to Term Final examination which will be conducted centrally by the University. There will be internal and external examiners for each course in the Term Final examination of 3 hours duration. The distribution of marks for a given course will be as follows:

i.	Class participation	10%
ii.	Homework Assignment and Quizzes	20%
iii.	Final Examination (3 hours)	70%
	Total	100%

Basis for awarding marks for class participation and attendance will be as follows:

Attendance	**Marks**
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
less than 60%	0

The number of quizzes of a course shall be at least n+1, where n is the number of credits of the course. Evaluation of the performance in quizzes will be on the basis of the best n quizzes. The scheme of continuous assessment that a teacher proposes to follow for a course will be announced on the first day of classes.

3.12 Earned Credits

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.

A student who obtains 'F' grade in a Core Course in any term will have to repeat the course.

If a student obtains 'F' grade 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 course in which he/she previously obtained 'F' grade, he/she will not be eligible to get a grade better than "B" in such a course.

If a student obtains a grade lower than 'B' in a course, he/she will be allowed to repeat the course only once for the purpose of grade improvement by forgoing his/her earlier grade, but he/she will not be eligible to get a grade better than 'B' in such a course. A student will be permitted to repeat for grade improvement purposes a maximum of four courses in B.Sc Engg. and BURP programmes and a maximum of five courses in B Arch programme.

If a student obtains 'B' or a better grade in any course, he/she will not be allowed to repeat the course for the purpose of grade improvement.

3.13 Honours

Candidates for Bachelor's degree in engineering and architecture will be awarded the degree with honours if their overall GPA is 3.75 or better.

3.13.1 Dean's List

As a recognition of excellent performance, the names of students obtaining a cumulative GPA of 3.75 or above in two regular Terms in each academic year may be published in the Dean's List in each faculty. Students who have received F grade in any course during any of the two regular terms will not be considered for Dean's List in that year.

3.14 Calculation of GPA

Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student. For example, if a student passes/completes five courses in a semester having credits of C_1, C_2, C_3, C_4, and C_5 and his/her grade points in these courses are G_1, G_2, G_3, G_4, and G_5, respectively then

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

3.14.1 A Numerical Example

Suppose a student has completed five courses in a Term and obtained the following grades:

Course	Credits	Grade	Grade points
EEE 203	3	A^+	4.00
EEE 205	3	B	3.00
EEE 207	3	A	3.75
Math 205	2	B^+	3.25
Hum 203	1	A^-	3.50

Then his/her GPA for the term will be computed as follows:

GPA = [illegible]

3.15 Student Classification

For a number of reasons it is necessary to have a definite system by which to classify students as First Year/Freshman, Second Year/Sophomore, Third Year/Junior and Fourth Year/Senior. At BUET, regular students are classified according to the number of credit hours earned towards a degree. The following classification applies to the students.

Year/Level	**Earned Credit Hours**	
	Engineering/URP	**Architecture**
First Year (Freshman) Level I	0 to 36	0 to 34
Second Year (Sophomore) Level II	>36 to 72	>34 to 72
Third Year (Junior) Level III	>72 to 108	>72 to 110
Fourth Year (Senior) Level IV	>108	>110 to 147
Fifth Year Level V		>147

3.16 Registration for the Second and Subsequent Terms

A student is normally required to earn at least 15 credits in a Term. At the end of each term, the students will be classified into the following three categories:

Category 1: Consisting of students who have passed all the courses prescribed for the term and have no backlog of courses. A student belonging to Category 1 will be eligible to register for all courses prescribed for the next term.

Category 2: Consisting of students who have earned at least 15 credits in the term but do not belong to category 1. A student belonging to Category 2 is advised to take at least one course less in the next term subject to the condition that he/she has to register for such backlog courses as may be prescribed by the adviser.

Category 3: Consisting of students who have failed to earn 15 credits in the term. A student belonging to Category 3 is advised to take at least two courses less subject to registration for a minimum of 15 credits. However he/she will be required to register for such backlog courses as may be prescribed by the adviser.

3.17 Performance Evaluation

The performance of a student will be evaluated in terms of two indices, viz. term grade point average, and cumulative grade point average, which is the grade average for all the terms. The term grade point average is computed dividing the total grade points earned in a term by the number of term hours taken in that term. The overall or cumulative grade point average (CGPA) is computed by dividing the total grade points accumulated up to date by the total credit hours earned. Thus a student who has earned 275 grade points in attempting 100 credit hours of courses would have a cumulative grade point average of 2.75.

Students will be considered to be making normal progress toward a degree if their cumulative or overall GPA for all work attempted is

2.20 or more. Students who regularly maintain Term GPA of 2.20 or better are making good progress toward their degrees and are in good standing with the university. Students who fail to maintain this minimum rate of progress will not be in good standing. This can happen when one or more of the following conditions exist:

i. Term GPA falls below 2.20,
ii. Cumulative GPA falls below 2.20,
iii. Earned credits fall below 15 times the number of Terms attended/studied.

All such students can make up deficiencies in GPA and credit requirements by completing courses in next term(s) and backlog courses, if there be any, with better grades. When GPA and credit requirements are achieved, the student is returned to good standing.

3.18 Academic Progress, Probation and Suspension

Academic Progress: Undergraduate students will be considered to be making normal progress toward a degree if their cumulative or overall GPA for all work attempted is not less than 2.20.

Probation and Suspension: Undergraduate students who regularly maintain Term GPA of 2.20 or better are making good progress toward their degrees and are in good standing with the university. Students who fail to maintain this minimum rate of progress 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 Term GPA falls below 2.20, or
ii. The cumulative GPA falls below 2.20.

Students on probation are subject to such restrictions with respect to courses and extracurricular activities as may be imposed by the respective Dean of faculty.

The minimum period of probation is one Term, but the usual period is for one academic year. This allows the student an opportunity to improve the GPA through the completion of additional course work during the period that the student is on probation. The probation is extended for additional terms until the student achieves an overall GPA of 2.20 or better. When that condition is achieved, the student is returned to good standing.

Academic probation is not to be taken lightly- it is very serious matter. 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 this university. A student who has been suspended may make a petition to the Dean of faculty, but this petition will not be considered until the student has been suspended at least one full Term.

Petitions for reinstatement must set forth clearly the reasons for the previous unsatisfactory academic record and it must delineate the new conditions that have been created to prevent the recurrence of such work. Each such petition is considered individually on its own merits.

After consideration of the petition, and perhaps after consultation with the student, the Dean in some cases, reinstate the student if this is the first suspension. However, a second suspension will be regarded as final and absolute.

3.19 Measures for Helping Academically Weak Students

The following provisions will be made as far as possible to help academically weak students to enable them to complete their studies within the maximum period of seven years in engineering and eight years in architecture student, respectively:

i. All such students whose cumulative grade point average (CGPA) are less than 2.20 at the end of a term may be given a load of not exceeding four courses, in the next term.
ii. For other academic deficiencies, some basic and core courses may be offered during the Short Term in order to enable the student to partially make-up for the reduced load during Regular Terms.

Following criteria will be followed for determining academically weak students:

i. CGPA falling below 2.20.
ii. Term grade point average (TGPA) falling below 2.20 points below that of previous term.
iii. Earned credit falling below 15 times the number of terms attended.

3.20 Special Courses

a) These courses, which include self-study courses, will be from amongst the regular theory courses listed in the course catalog, a special course can be run only in exceptional cases.

b) Whether a course is to be floated as a special course will be decided by the Head of the concerned department in consultation with the teacher/course coordinator concerned. Decision to float a course as a special course shall be reported to the Academic Council.

c) The special course may be offered to any student in his/her last term if it helps him/her to graduate in that term. It will be offered only if the course is not running in that term as a regular course.

d) Normally no lecture will be delivered for the special course but laboratory/design classes may be held if they form a part of the course. The course coordinator/course teacher will also assign homeworks, administer quizzes and final examination for giving his or her assessments at the end of the term.

e) A student will be allowed to register for a maximum of two courses on self study basis.

f) A Special Course shall not be utilized for grade improvement purposes.

3.21 Rules for Courses offered in a Short Term

a) The courses to be run during the Short Term shall be decided on the recommendations of the Departments on the basis of essential deficiencies to be made up by a group of students. Once floated, other students could be allowed to register in those courses subject to the capacity constrains and satisfaction of pre-requisites.

b) Students will be allowed to register in a maximum of two courses during the Short Term.

c) A course may be given a weightage up to 6 credits in any Short Term following a graduating/final Term if he/she is short by a maximum of 6 earned credits only, on a self-study basis with no formal instruction. In a self-study course, there will be a Final Examination, besides the continuous assessment.

d) A fee of Tk. xx.xx (amount may be decided by the authority) for each credit hour to be registered is to be borne by the students who enroll during Short Term.

3.22 Minimum Earned Credit and GPA Requirements for Obtaining Graduation

Minimum credit hour requirements for the award of bachelor's degree in engineering and architecture will be decided by the respective BUGS. However, at least 157 credit hours for engineering and 190 credit hours for architecture must be earned to be eligible for graduation, and this must include the specified core courses.

The minimum GPA requirement for obtaining a bachelor’s degree in engineering, URP or architecture is 2.20.

Completion of fulltime Studentship: Students who have completed minimum credit requirement for graduation for a Bachelors degree shall not be considered and registered as fulltime students.

A student may take additional courses with the consent of his/her adviser in order to raise GPA, but he/she may take a maximum of 15 such additional credits in engineering and URP and 18 such additional credits in architecture beyond respective credit-hour requirements for bachelor’s degree during his/her entire period of study.

3.22.1 Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for Bachelor’s degree will have to apply to the Controller of Examinations through his/her Adviser for graduation. Provisional degree will be awarded on completion of credit and GPA requirements. Such provisional degrees will be confirmed by the Academic Council.

3.23 Industrial/Professional Training Requirements

Depending on each department's own 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.

3.24 Time Limits for Completion of Bachelor's Degree

A student must complete his studies within a maximum period of seven years for engineering and URP and eight years for architecture.

3.25 Inclusion of Repeaters from Annual System in Course System

Repeater students including Private students of Annual system will be included in the Course System of curricula as and when such situation will arise.

3.25.1 Equivalence of Courses and Grades

Equivalence of courses passed previously by any repeater student including Private students shall be determined by the respective BUGS for the purpose of:

a) Allowing course exemption, and

b) Conversion of numerical grades into letter grades in exempted courses.

3.25.2 Exemption of Courses

Repeater students including private students may be granted exemption in theoretical course(s) in which he/she secured 45% or more marks and in sessional/laboratory course(s) in which he/she secured 41% or more marks.

3.25.3 Time Limit for Completion of Bachelor's Degree

Time allowed for a student included in Course System from Annual System to complete studies leading to a bachelor's degree will be proportional to the remaining credits to be completed by him/her.

A student in engineering, for example, having earned 40 credit hours through equivalence and exemption (of previously completed courses) out of a total requirement of 160 credits for bachelor's degree will get (7 yrs $\times$ 120/160 = 5.25) = 5.5 years (rounded to next higher half-a-year) or 11 (eleven) Regular Terms to fulfill all requirements for bachelor's degree. For a student in architecture, time allowed will be calculated in a similar way.

3.25.4 Relaxation of Course Registration for Students Transferred to Course System from Annual System

The requirement of registration of a minimum 15 credit hours in a term shall be waived for only the terms of the level where he/she has been transferred in course system provided that he/she has been granted exemption in some of the courses offered in those terms.

3.26 Attendance, Conduct, Discipline etc.

3.26.1 Attendance

All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly, and one is required to attend at least 60% of all classes held in every course.

3.26.2 Conduct and Discipline

A student shall conform to a high standard of discipline, and shall conduct himself/herself, within and outside the precincts of the university in a manner befitting the students of a university of national importance. He/she shall show due courtesy and consideration to the employees of the university and Halls of Residence, good neighborliness to his/her fellow students and the teachers of the university and pay due attention and courtesy to visitors.

To safeguard its ideals of scholarship, character and personal behavior, the university reserves the right to require the withdrawal of any student at any time for any reason deemed sufficient.

3.27 Absence during Term

A student should not be absent from quizzes, tests, etc. during the Term. Such absence will naturally lead to reduction in points/marks which 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 three weeks due to illness, should approach the course teacher(s) or the course coordinator(s) for make-up quizzes or assignments immediately on returning to the classes. Such request should be supported by medical certificate from a university Medical officer. The medical certificate issued by a registered medical practitioners (with the Registration Number shown explicitly on the certificates) will also be acceptable only in those cases where the student has valid reasons for his absence from the university.

Chapter 4

COURSES FOR UNDERGRADUATE ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME

The curriculum for EEE students in this calendar has been approved by BUET Academic Council on 8 February 2016 and effective for the L-1/T-I students of January 2016 term.

Course schedule for the undergraduate students of the Department of Electrical and Electronic Engineering is given below.

The first digit of a course number represents the level, the second digit is for group. Odd number in the third digit signifies a theory course and even number represents a laboratory/sessional course. For all 3 credit theory and 1.5 credit laboratory/sessional courses, contact hour is 3 hours.

The second digit in the course number has the following meaning:

Digit 0 and 1 is for core course

2 for interdisciplinary
3 and 4 for communication
5 and 6 for electronics
7 and 8 for power
9 Reserved

4.1 Core Courses for EEE Undergraduate Programme

4.1.1 Core Courses (EEE)

Sl. No	Course Number	Course Name	Credit Hour
1	EEE 101	Electrical Circuits I	3
2	EEE 102	Electrical Circuits I Laboratory	1.5
3	EEE 105	Electrical Circuits II	3
4	EEE 106	Electrical Circuits II Laboratory	1.5

Sl. No	Course Number	Course Name	Credit Hour
5	EEE 201	Electronic Circuits I	3
6	EEE 202	Electronic Circuits I Laboratory	1.5
7	EEE 203	Energy Conversion I	3
8	EEE 205	Energy Conversion II	3
9	EEE 206	Energy Conversion Laboratory	1.5
10	EEE 207	Electronic Circuits II	3
11	EEE 208	Electronic Circuits II Laboratory	1.5
12	EEE 209	Engineering Electromagnetics	3
13	EEE 211	Continuous Signals and Linear Systems	3
14	EEE 212	Numerical Technique Laboratory	1.5
15	EEE 303	Digital Electronics	3
16	EEE 304	Digital Electronics Laboratory	1.5
17	EEE 305	Power System I	3
18	EEE 306	Power System I Laboratory	1.5
19	EEE 307	Electrical Properties of Materials	3
20	EEE 309	Communication Systems I	3
21	EEE 310	Communication Systems I Laboratory	1.5
22	EEE 311	Digital Signal Processing I	3
23	EEE 312	Digital Signal Processing I Laboratory	1.5
24	EEE 313	Solid State Devices	3
25	EEE 315	Power Electronics	3
26	EEE 316	Power Electronics Laboratory	1.5
27	EEE 317	Control System I	3
28	EEE 318	Control System I Laboratory	1.5
29	EEE 414	Electrical Services Design	1.5
30	EEE 415	Microprocessors and Embedded Systems	3
31	EEE 416	Microprocessors and Embedded Systems Laboratory	1.5
32	EEE 439	Communication Systems II	3
33	EEE 400	Project/Thesis	6
		Subtotal	**81**

4.1.2 Core Courses (Humanities)

Sl. No	Course Number	Course Name	Credit Hour
1	HUM 127	Sociology	3
Or	HUM 137	Professional Ethics	3
Or	HUM 277	Fundamental of Economics	3
2	HUM 135	English	3
3	HUM 272	Developing English Skills Laboratory	1.5
4	HUM 279	Financial and Managerial Accounting	3
		Subtotal	**10.5**

4.1.3 Core Courses (CSE)

Sl. No	Course Number	Course Name	Credit Hour
1	CSE 109	Computer Programming	3
2	CSE 110	Computer Programming Sessional	1.5
		Subtotal	**4.5**

4.1.4 Core Courses (Mathematics)

Sl. No	Course Number	Course Name	Credit Hour
1	MATH 157	Calculus I	3
2	MATH 159	Calculus II	3
3	MATH 257	Ordinary and Partial Differential Equations	3
4	MATH 259	Linear Algebra	3
5	MATH 357	Probability and Statistics	3
		Subtotal	**15**

4.1.5 Core Courses (Physics)

Sl. No	Course Number	Course Name	Credit Hour
1	PHY 121	Waves and Oscillations, Optics and Thermal Physics	3
2	PHY 102	Physics Sessional	1.5
3	PHY 165	Electricity and Magnetism, Modern Physics and Mechanics	3
		Subtotal	**7.5**

4.1.6 Core Courses (Chemistry)

Sl. No	Course Number	Course Name	Credit Hour
1	CHEM 101	Chemistry	3
2	CHEM 114	Inorganic, Quantitative Analysis Sessional	1.5
		Subtotal	**4.5**

4.1.7 Core Courses (ME)

Sl. No	Course Number	Course Name	Credit Hour
1	ME 267	Mechanical Engineering Fundamentals	3
2	ME 268	Mechanical Engineering Fundamentals Sessional	1.5
		Subtotal	**4.5**

4.1.8 Core Course (CE)

Sl. No	Course Number	Course Name	Credit Hour
1	CE 106	Engineering Drawing	1.5
		Subtotal	**1.5**

4.1.9 Core Course (IPE)

Sl. No	Course Number	Course Name	Credit Hour
1	IPE 493	Industrial Management	3
		Subtotal	**3**

4.1.10 Compulsory/Core Course Distribution:

Department	Theory	Lab	Project /Thesis	Credit Hours	Contact Hours per Week
CSE	1	1	-	4.5	6
CE	-	1	-	1.5	3
ME	1	1	-	4.5	6
IPE	1	-	-	3.0	3
Physics	2	1	-	7.5	9
Chemistry	1	1	-	4.5	6
Mathematics	5	-	-	15	15
Humanities	3	1	-	10.5	12
Subtotal	14	6	-	51	60
EEE	18	14	6+6 contact hours = 6 credit Hours	81	108
Total compulsory courses	32	20	6+6 contact Hours = 6 Credit hours	132	168 Contact Hours
Elective courses	7 Elective Theory Courses (21 contact Hours) and 3 Elective Laboratories (9 contact Hours, 4.5 Credit Hours)				
Total of Elective Courses				25.5	30
Total				157.5	198

4.2 Elective Courses

Rules for distributing major and minor groups and elective courses are as follows:

1. A Student will be assigned one of the three elective group (from Communication and signal processing, electronics and power groups) as major. The criterion for assigning the major group will be student's choice and his/her CGPA up to L-2 T-2. The group will be assigned at the end of L-2 T-2 of a student.
2. There will be maximum 1/3 of total students of a level (excluding old students) in each of the three groups (i.e. communication and signal processing, electronic and power group).
3. A student may take minimum of 5 elective from the major and maximum of 2 elective subjects from any (including major) group for completing the requirements of B. Sc. Engg (EEE) degree (implying that a student may take 7 elective courses from his/her major group).
4. A student will work on his/her B. Sc. Engg (EEE) thesis on a topic of his/her major group under a supervisor assigned to him/her by the department. A faculty may be assigned to supervise student/s of any group if he/she expresses such desire to carry out certain research of his/her interest outside his/her major research area/s. Policy of thesis topic and supervisor assignment to a student of a batch will be set by the BUGS at the beginning of thesis commencement term of the students of a batch.
5. Elective I through Elective VII as per requirement of a term will be decided from the total elective courses of a group by the BUGS of the department at the beginning of a term. No particular course will bear a certain elective course suffix (i.e. Elective I/II/... and so on). This selection will be made as per availability of faculty member in the relevant subject and the availability of the laboratory facility on the subject (in case of a course with a laboratory).
6. If a student fails in an elective theory course that has a sessional, the student may take that theory course again or

may take another theory course together with its corresponding sessional.

7. In case of any unforeseen situation or ambiguity, the Departmental BUGS will take an appropriate decision.

4.2.1 Power Group

Sl. No	Course Number	Course Name	Credit Hour
1	EEE 371	Power System II	3.0
2	EEE 372	Power System II Laboratory	1.5
3	EEE 471	Energy Conversion III	3.0
4	EEE 473	Renewable Energy	3.0
5	EEE 475	Power Plant Engineering	3.0
6	EEE 477	Power System Protection	3.0
7	EEE 478	Power System Protection Laboratory	1.5
8	EEE 479	Power System Reliability	3.0
9	EEE 481	Power System Operation and Control	3.0
10	EEE 483	High Voltage Engineering	3.0
11	EEE 484	High Voltage Engineering Laboratory	1.5
12	EEE 485	Power Transmission and Distribution	3.0
13	EEE 487	Nuclear Power Engineering	3.0
14	EEE 489	Smart Grid	3.0

4.2.2 Electronics Group

Sl. No	Course Number	Course Name	Credit Hour
1	EEE 351	Analog Integrated Circuits and Design	3.0
2	EEE 451	Processing and Fabrication Technology	3.0
3	EEE 453	VLSI Circuits and Design I	3.0
4	EEE 454	VLSI Circuits and Design I Laboratory	1.5
5	EEE 455	Compound Semiconductor Devices	3.0
6	EEE 457	VLSI Circuits and Design II	3.0
7	EEE 458	VLSI Circuits and Design II Laboratory	1.5
8	EEE 459	Optoelectronics	3.0
9	EEE 460	Optoelectronics Laboratory	1.5
10	EEE 461	Semiconductor and Nano Devices	3.0
11	EEE 463	Nano-electronics and Nanotechnology	3.0

4.2.3 Communication and Signal Processing Group

Sl. No	Course Number	Course Name	Credit Hour
1	EEE 331	Random Signals and Processes	3.0
2	EEE 431	Digital Signal Processing II	3.0
3	EEE 433	Microwave Engineering	3.0
4	EEE 434	Microwave Engineering Laboratory	1.5
5	EEE 435	Optical Communications	3.0
6	EEE 437	Wireless Communications	3.0
7	EEE 438	Wireless Communication Laboratory	1.5
8	EEE 441	Telecommunication Engineering	3.0
9	EEE 443	Radar and Satellite Communication	3.0
10	EEE 445	Multimedia Communications	3.0
11	EEE 447	Introduction to Digital Image Processing	3.0
12	EEE 449	Information and Coding Theory	3.0
13	EEE 491	Introduction to Medical Imaging	3.0
14	EEE 493	Digital Filter Design	3.0
15	EEE 495	Speech Communications	3.0
16	EEE 497	Telecommunication Networks (See note below)	3.0
17	EEE 498	Telecommunication Networks Laboratory	1.5
18	EEE 499	Wireless and Mobile Networks (See note below)	3.0

(Note: For total credit hour fulfillment of the degree of B. Sc. Engg (EEE), credits of either EEE497 or EEE499 will be counted but not both.)

4.2.4 Interdisciplinary Courses

Sl. No	Course Number	Course Name	Credit Hour
1	EEE 421	Control System II	3.0
2	EEE 422	Control System II Laboratory	1.5
3	EEE 425	Biomedical Signals, Instrumentation and Measurement	3.0
4	EEE 426	Biomedical Signals, Instrumentation and Measurement Laboratory	1.5
5	EEE 427	Measurement and Instrumentation	3.0
6	EEE 428	Measurement and Instrumentation Laboratory	1.5

Sl. No	Course Number	Course Name	Credit Hour
7	CSE 451	Computer Networks	3.0
8	CSE 452	Computer Networks Laboratory	1.5

4.3 Course Offering

Level-1 Term-I (Common to all)

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 101	Electrical Circuits I	3.0	3.0
2	EEE 102	Electrical Circuits I Laboratory	3.0	1.5
3	CSE 109	Computer Programming	3.0	3.0
4	CSE 110	Computer Programming Laboratory	3.0	1.5
5	CE 106	Engineering Drawing	3.0	1.5
6	PHY 121	Waves and Oscillations, Optics and Thermal Physics	3.0	3.0
7	MATH 157	Calculus I	3.0	3.0
8	MATH 159	Calculus II	3.0	3.0
		Total	**24.0**	**19.5**

Level-1 Term-II (Common to all)

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 105	Electrical Circuits II	3.0	3.0
2	EEE 106	Electrical Circuits II Laboratory	3.0	1.5
3	PHY 165	Electricity and Magnetism, Modern Physics and Mechanics	3.0	3.0
4	PHY 102	Physics Sessional	3.0	1.5
5	CHEM 101	Chemistry	3.0	3.0
6	CHEM 114	Inorganic and Quantitative Analysis Laboratory	3.0	1.5
7	MATH 257	Ordinary and Partial Differential	3.0	3.0

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
		Equations		
8	HUM 127/ HUM277/ HUM137	Sociology/ Fundamentals of Economics/ Professional Ethics	3.0	3.0
		Total	**24.0**	**19.5**

Level-2 Term-I (Common to all)

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 201	Electronic Circuits I	3.0	3.0
2	EEE 202	Electronic Circuits I Laboratory	3.0	1.5
3	EEE 203	Energy Conversion I	3.0	3.0
4	EEE 211	Continuous Signals and Linear Systems	3.0	3.0
5	EEE 212	Numerical Technique Laboratory	3.0	1.5
6	MATH 259	Linear Algebra	3.0	3.0
7	HUM 135	English	3.0	3.0
8	HUM 272	Developing English Skills Laboratory	3.0	1.5
		Total	**24**	**19.5**

Level-2 Term-II (Common to all)

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 205	Energy Conversion II	3.0	3.0
2	EEE 206	Energy Conversion laboratory	3.0	1.5
3	EEE 207	Electronic Circuits II	3.0	3.0
4	EEE 208	Electronic Circuits II Laboratory	3.0	1.5

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
5	EEE 209	Engineering Electromagnetics	3.0	3.0
6	ME 267	Mechanical Engineering Fundamentals	3.0	3.0
7	ME 268	Mechanical Engineering Fundamentals Sessional	3.0	1.5
8	MATH 357	Probability and Statistics	3.0	3.0
		Total	**24.0**	**19.5**

Level-3 Term-I (Common to all)

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 305	Power System I	3.0	3.0
2	EEE 306	Power System I Laboratory	3.0	1.5
3	EEE 307	Electrical Properties of Materials	3.0	3.0
4	EEE 309	Communication Systems I	3.0	3.0
5	EEE 310	Communication Systems I Laboratory	3.0	1.5
6	EEE 311	Digital Signal Processing I	3.0	3.0
7	EEE 312	Digital Signal Processing I Laboratory	3.0	1.5
8	HUM 279	Financial and Managerial Accounting	3.0	3.0
		Total	**24.0**	**19.5**

Level-3 Term-II (Common to all)

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 303	Digital Electronics	3.0	3.0

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
2	EEE 304	Digital Electronics Laboratory	3.0	1.5
3	EEE 313	Solid State Devices	3.0	3.0
4	EEE 315	Power Electronics	3.0	3.0
5	EEE 316	Power Electronics Laboratory	3.0	1.5
6	EEE 317	Control Systems I	3.0	3.0
7	EEE 318	Control Systems I Laboratory	3.0	1.5
8	IPE 493	Industrial Management	3.0	3.0
		Total	**24.0**	**19.5**

Level-4 Term-I

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 400	Project/Thesis	6.0	3.0
2	EEE 415	Microprocessors and Embedded Systems	3.0	3.0
3	EEE 416	Microprocessors and Embedded Systems Laboratory	3.0	1.5
4	EEE 439	Communication Systems II	3.0	3.0
5	EEE XXX	Elective I	3.0	3.0
6	EEE XXX	Elective II	3.0	3.0
7	EEE XXX	Elective II Laboratory	3.0	1.5
8	EEE XXX	Elective III	3.0	3.0
		Total	**30.0**	**21**

Level-4 Term-II

Sl. No	Course Number	Course Name	Contact Hours per Week	Credit Hour
1	EEE 400	Project/Thesis	6.0	3.0
2	EEE 414	Electrical Services Design	3.0	1.5
3	EEE XXX	Elective IV	3.0	3.0
4	EEE XXX	Elective IV Laboratory	3.0	1.5
5	EEE XXX	Elective V	3.0	3.0
6	EEE XXX	Elective VI	3.0	3.0
7	EEEXXX	Elective VI Laboratory	3.0	1.5
8	EEEXXX	Elective VII	3.0	3.0
		Total	**27.0**	**19.5**

4.4 Course Curriculum for the Department of Electrical and Electronic Engineering

Core Courses

EEE 101 Electrical Circuits I

3 Credit Hours, 3 Contact Hours per Week

Circuit variables: voltage, current, power and energy, Voltage and current independent and depended sources, Circuit elements resistance, inductance and capacitance. Modeling of practical circuits, Ohm's law and Kirchhoff's laws, Solution of simple circuits with both dependent and independent sources, Series-parallel resistance circuits and their equivalents, Voltage and current divider circuits, Delta-Wye equivalent circuits, Techniques of general DC circuit analysis (containing both independent and dependent sources): Node-voltage method, Mesh-current method, Source transformations. Thevenin and Norton equivalents, Maximum power transfer. Superposition technique. Properties of Inductances and capacitances. Series-parallel combinations of inductances and capacitances; Concepts of transient and steady state response with dc source.

Definitions of ac voltage, current, power, volt-ampere and various factors (including power, peak, form factors etc.) , Introduction to sinusoidal steady state analysis: Sinusoidal sources, phasor, impedance, admittance, reactance, susceptance; voltage, current, power of R, L, C. R-L, R-C, R-L-C circuits with sinusoidal source, Series - parallel and Delta-Wye simplifications of circuits with R, L, Cs. Techniques of general ac circuit analysis (containing both independent and dependent sources): Node-voltage method, Mesh-current method, Source transformations, Thevenin and Norton Equivalents, Phasor diagrams. Sinusoidal steady state power calculations, RMS values, Real and reactive power. Maximum power transfer, impedance matching. Steady state voltage, current.

EEE 102 Electrical Circuits I Laboratory

1.5 Credit Hours, 3 Contact hours per week

In this course students will perform simulation study and experiments to verify practically the theories and concepts learned in EEE 101.

EEE 105 Electrical Circuits II

3 Credit Hours, 3 Contact Hours per Week

Circuits with non-sinusoidal excitations, power and power factor of ac circuits with multiple sources of different frequencies; Transients in AC circuits, Passive Filter Networks: basic types. Characteristic impedance and attenuation, ladder network, low pass, high pass filters, propagation coefficient and time delay in filter sections, practical composite filters. Resonance in AC circuits: Series and parallel resonance and Q factors. Magnetically coupled circuits. Analysis of three phase circuits: Three phase supply, balanced and unbalanced circuits, power calculation and measurements, Power factor improvement.

Basic Magnetic Circuits: Magnetic quantities and variables: Field, Flux, Flux Density, Magnetomotive Force, Magnetic Field Strength, permeability and B-H Curve, reluctance, magnetic field strength. Laws in magnetic circuits: Ohm’s law and Ampere’s circuital law. Magnetic circuits: Composite series magnetic circuit, parallel and series-parallel circuits. Comparison between electrical and magnetic quantities, Hysteresis and hysteresis loss. Magnetic materials.

EEE 106 Electrical Circuits II Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

In this course students will perform simulation study and experiments to verify practically the theories and concepts learned in EEE 105.

EEE 201 Electronic Circuits I

3 Credit Hours, 3 Contact Hours per Week

Semiconductor diodes: semiconductor material and properties, pn junction, diode circuits: dc analysis and models, diode circuits: AC equivalent circuits, other diode types, single phase rectification and regulators, zener diode circuits, clipper and clamper circuits, multiple diode circuits, photo diodes and LED circuits, DC power supply; MOS Transistors: Structure of MOSFET, Current-Voltage Characteristics, MOS Device Models, DC circuit analysis, basic MOFET applications, Biasing, constant current biasing, multistage MOSFET circuits, Junction Field effect transistor (JFET), MOSFET amplifier: basic transistor amplifier configurations-Common-Source, Common-Gate Stage, Source Follower (common drain); single stage integrated circuit MOSFET amplifiers, multistage amplifiers, basic JFET amplifiers; Bipolar Junction transistor (BJT): BJT, DC analysis of BJT circuits, basic transistor applications, biasing, multistage circuits, BJT linear amplifiers-basic configurations, CE amplifiers, AC load lines, CC and CB amplifier, multistage amplifiers, power consideration; Frequency Response: Amplifier frequency response, system transfer function, frequency response: transistor amplifiers with circuit capacitors, frequency response-BJT, frequency response-FET, high frequency response of transistor circuits. Output stages and power amplifiers: power amplifiers, power transistors, classes of amplifiers, Class-A power amplifier, Class-AB push pull complimentary output stage.

EEE 202 Electronic Circuits I Laboratory

1.5 Credit Hours, 3 Contact Hour per week

In this course students will perform simulation study and experiments to verify practically the theories and concepts learned in EEE 201.

EEE 203 Energy Conversion I

3 Credit Hours, 3 Contact Hours per Week

Transformer: principle of operation, construction, no load and excitation current, behavior during loading, effect of leakage flux, ideal transformer, leakage reactance and equivalent circuit of a transformer, equivalent impedance, voltage regulation, per unit quantities, regulation, losses and efficiency, determination of parameters by tests, polarity of transformer windings, vector group, transformer parallel operation. Harmonics in excitation current, transformer inrush current, three phase transformer connections, three phase transformers, harmonic suppression in three phase transformer connection. Autotransformer, instrument transformers.

Three phase induction motor: rotating magnetic field, reversal of rotating magnetic field, synchronous speed, torque in induction motor, induction motor construction: squirrel cage, wound rotor; slip and its effect on rotor frequency and voltage, equivalent circuit of an induction motor, air gap power, mechanical power and developed torque, torque speed characteristic, losses, efficiency and power factor, classification, motor performance as a function of machine parameters, shaping torque speed characteristic and classes of induction motor, per unit values of motor parameters, determination of induction motor parameters by tests, methods of braking, speed control.

Induction generator: operation, characteristics, voltage build up, applications in wind turbine.

EEE 205 Energy Conversion II

3 Credit Hours, 3 Contact Hours per Week

Synchronous generator: construction, armature (stator) and rotating field (exciter), excitation system with brushes and brushless excitation system, cooling, generated voltage equation of distributed short pitched armature winding, armature winding connections and harmonic cancellation in distributed short pitched winding, equivalent circuit, synchronous impedance, generated voltage and terminal voltage, phasor diagram, voltage regulation with different power factor type loads, determination of synchronous impedance by tests, phasor diagram, salient pole generator d-q axes parameters, equivalent circuit, generator equations, determination of d-q axes parameters by tests, equation of developed power and torque of synchronous machines (salient and non salient pole motor and generator). Parallel operation of generators: requirement of parallel operation, conditions, synchronizing, effect of synchronizing current, hunting and oscillation, synchronoscope, phase sequence indicator, load distribution of alternators in parallel, droop setting, frequency control, voltage control, house diagrams.

Synchronous Motors: construction, operation, starting, effect of variation of load at normal excitation, effect of variation of excitations, V curves, inverted V curves and compounding curves, power factor adjustment, synchronous capacitor and power factor correction.

DC motors: principle of operation, constructional features, back emf and torque equations, armature reaction and its effect on motor performance, compensating winding, problems of commutation and their mitigations, types of dc motors and their torque speed characteristics, starting and speed control of dc motors, applications of different types of dc motor.

Single Phase Induction Motor: operation, quadrature field theory, double revolving field theory, split phasing, starting methods, equivalent circuit, torque-speed characteristic and performance calculation.

Introduction to photovoltaic systems.

EEE 206 Energy Conversion Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 203 and EEE 205. In the second part, students will design simple systems using the principles learned in EEE 203 and EEE 205.

EEE 207 Electronic Circuits II

3 Credit Hours, 3 Contact Hours per Week

Ideal operational amplifier and op-amp circuits;

Op-amp applications: inverting amplifier, non-inverting amplifier, summing amplifier, differential amplifier, logarithmic amplifier, operational transconductance amplifiers exponential amplifier, differentiator, integrator, voltage to current converter, voltage follower, and other applications.

Non-ideality of op-amp: Non-ideal op-amp characteristics and its effects.

Integrated circuit biasing and active loads: BJT current sources, FET current sources, small signal analysis of active loads, design applications: an NMOS current source; differential and multistage amplifiers: BJT differential amplifier, FET differential amplifier, differential amplifier with active load, BiCMOS circuits, gain stage and simple output stage, BJT operational amplifier circuit,

Frequency response of amplifiers: Poles, zeros and Bode plots, amplifier transfer function, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-stage and cascade amplifiers, frequency response of differential amplifiers;

Feedback and stability: Basic feedback concept, feedback topologies: voltage(series-shunt) amplifiers, current (shunt-series) amplifiers, transconductance (serie-series) amplifiers, transresistance (shunt-shunt) amplifiers, loop gain, stability of feedback circuit, frequency compensation;

Applications and Design of Integrated Circuits: Active filter, Oscillators, Schmitt trigger Circuits, Nonsinusoidal oscillators and timing circuits, integrated power amplifier, voltage regulator, Design application: An active Band-pass filter.

555 Timer IC and its Applications

Introduction to power amplifier classes: class A, class B, class AB, class C operation.

EEE 208 Electronic Circuits II Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

In this course students will perform simulation study and experiments to verify practically the theories and concepts learned in EEE 207.

EEE 209 Engineering Electromagnetics

3 Credit Hours, 3 Contact Hours per Week

Static electric field: Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density- boundary conditions; capacitance- electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries; boundary value problems- Poisson's and Laplace's equations in different co-ordinate systems. Steady electric current: Ohm's law, continuity equation, Joule's law, resistance calculation. Static Magnetic field: Postulates of magnetostatics, Biot-Savart's law, Ampere's law and applications, vector magnetic potential, magnetic dipole, magnetization, magnetic field intensity and relative permeability, boundary conditions for magnetic field, magnetic energy, magnetic forces, torque and inductance of different geometries. Time varying fields and Maxwell's equations: Faraday's law of electromagnetic induction, Maxwell's equations - differential and integral forms, boundary conditions, potential functions; time harmonic fields and Poynting theorem. Plane electromagnetic wave: plane wave in loss less media- Doppler effect, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media- low-loss dielectrics, good conductors; group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

EEE 211 Continuous Signals and Linear Systems

3 Credit Hours, 3 Contact Hours per Week

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

EEE 212 Numerical Techniques Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

Laboratory on numerical techniques using computer solution of differentiation and integration problems, transcendental equations, linear and non-linear differential equations and partial differential equations.

EEE 303 Digital Electronics

3 Credit Hours, 3 Contact Hours per Week

Introduction to number systems and codes. Analysis and synthesis of digital logic circuits: Basic logic functions, Boolean algebra, combinational logic design, minimization of combinational logic. MOSFET Digital circuits: NMOS inverter, CMOS inverter, CMOS logic circuits, Clocked CMOS logic circuits, transmission gates, sequential logic circuits,

Memories: classification and architecture, RAM memory cells, Read only memory, data converters, BJT digital circuits: ECL, TTL, STTL, BiCMOS, Design application A static ECL gate.

Modular combinational circuit design: pass transistor, pass gates, multiplexer, demultiplexer and their implementation in CMOS, decoder, encoder, comparators, binary arithmetic elements and ALU design.

Sequential circuits: different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits. Modular sequential logic circuit design: shift registers, counters and their applications. State Machine Design.

Asynchronous and synchronous sequential circuits.

EEE 304 Digital Electronics Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 303. In the second part, students will design simple systems using the principles learned in EEE 303.

EEE 305 Power System I

3 Credit Hours, 3 Contact Hours per Week

Network representation: Single line and reactance diagram of power system and per unit system. Line representation: equivalent circuit of short, medium and long lines, reactive compensation of lines, introduction to DC transmission.

Load flow: Gauss- Siedel and Newton Raphson methods. Power flow control.

Synchronous machines: transient and subtransient reactance and short circuit currents. Symmetrical fault calculation methods. Symmetrical components: power, unsymmetrical series impedances and sequence networks. Different types of unsymmetrical faults: solid faults and faults through impedance.

Protection: fault level calculation, selection of circuit breakers, introduction to relays and circuit breakers. Typical layout of a substation.

Power plants: types, general layout of a thermal power plant and major components of gas turbine, steam turbine and combined cycle power plants.

EEE 306 Power System I Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments and do simulations to verify practically the theories and concepts learned in EEE 305. In the second part, students will design simple systems using the principles learned in EEE 305.

EEE 307 Electrical Properties of Materials

3 Credit Hours, 3 Contact Hours per Week

Crystal structures: Types of crystals, lattice and basis, Bravais lattice and Miller indices. Classical theory of electrical and thermal conduction: Scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall effect and thermal conductivity. Introduction to quantum mechanics: Wave nature of electrons, Schrodinger's equation, one-dimensional quantum problems- infinite quantum well, potential step and potential barrier; Heisenbergs's uncertainty principle and quantum box, Electron in a 3D box. Hydrogen Atom.

Band theory of solids: Band theory from molecular orbital, Bloch theorem, Kronig-Penny model, Brillouin zone, effective mass, density-of-states. Carrier statistics: Maxwell-Boltzmann and Fermi-Dirac distributions, Fermi energy. Modern theory of metals: Determination of Fermi energy and average energy of electrons, classical and quantum mechanical calculation of specific heat.

Dielectric properties of materials: Dielectric constant, polarization-electronic, ionic, orientational and interfacial; internal field, Clausius-Mosotti equation, spontaneous polarization, frequency dependence of dielectric constant, dielectric loss, piezoelectricity, ferroelectricity, pyroelectricity.

Magnetic properties of materials: Magnetic moment, magnetization and relative permitivity, different types of magnetic materials, origin of ferromagnetism and magnetic domains.

Introduction to superconductivity: Zero resistance and Meissner effect, Type I and Type II superconductors and critical current density. BCS theory. Magnetic recording materials, Josephson theory.

Introduction to meta-materials.

EEE 309 Communication Systems I

3 Credit Hours, 3 Contact Hours per Week

Overview of communication systems: Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, transmission media types, bandwidth and transmission capacity.

Noise: Sources of noise, characteristics of various types of noise and signal to noise ratio.

Communication systems: Analog and digital. Continuous wave modulation: Transmission types- base-band transmission, carrier transmission; amplitude modulation- introduction, double side band, single side band, vestigial side band, quadrature; spectral analysis of each type, envelope and synchronous detection; angle modulation- instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM. Sampling- sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling, flat-topped sampling; pulse amplitude modulation- principle, bandwidth requirements; pulse code modulation (PCM)- quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM; delta modulation (DM)- principle, adaptive DM; line coding- formats and bandwidths.

Digital modulation and demodulation: Amplitude-shift keying- principle, ON-OFF keying, bandwidth requirements, detection, noise performance; phase-shift keying (PSK)- principle, bandwidth requirements, detection, differential PSK, quadrature PSK, noise performance; frequency-shift keying (FSK)- principle, continuous and discontinuous phase FSK, minimum-shift keying, bandwidth requirements, detection of FSK, Multilevel signalling

Multiplexing: Time-division multiplexing (TDM)- principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; frequency-division multiplexing (FDM)- principle, de-multiplexing. PDH, SONET/SDH.

Multiple-access techniques: Time-division multiple-access (TDMA), frequency-division multiple access (FDMA); code-division multiple-access (CDMA) - spread spectrum multiplexing, coding techniques and constraints of CDMA.

EEE 310 Communication Systems I Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 309. In the second part, students will design simple systems using the principles learned in EEE 309.

EEE 311 Digital Signal Processing I

3 Credit Hours, 3 Contact Hours per Week

Introduction to digital signal processing. Sampling, quantization and signal reconstruction. Analysis of discrete-time system in the time domain: impulse response model, difference equation model. Correlation: power signal, energy signal, applications. Z-transform and analysis of LTI systems. Frequency analysis of discrete-time signals: discrete Fourier series and discrete-time Fourier transform (DTFT). Frequency analysis of LTI systems. Discrete Fourier transform (DFT) and fast Fourier transform (FFT). Minimum phase, maximum phase and all pass systems. Calculation of spectrum of discrete-time signals. Digital filter design- linear phase filters, specifications, design using window, optimal methods; IIR filters-specifications, design using impulse invariant, bi-linear z-transformation, least-square methods.

EEE 312 Digital Signal Processing I Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 311. In the second part, students will design simple systems using the principles learned in EEE 311.

EEE 313 Solid State Devices

3 Credit Hours, 3 Contact Hours per Week

Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level.

Carrier transport processes and excess carriers: Drift and diffusion, generation and recombination of excess carriers, built-in-field, recombination-generation SRH formula, surface recombination, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.

PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and AC conditions, time variation of stored charge, reverse recovery transient and capacitance.

Bipolar Junction Transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents, coupled-diode model and charge control analysis, Ebers-Moll model and circuit synthesis. BJT non-ideal effects; Hetero-junction transistors.

Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts.

MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET. Non-ideal characteristics of MOSFET: channel-length modulation and short-channel effects in MOSFETs. MOS scaling.

Introduction to Multigate FET architecture: Double gate MOSFET, FinFET, Surrounding gate FET, high-K dielectric FETs.

EEE 315 Power Electronics

3 Credit Hours, 3 Contact Hours per Week

Fundamental of power electronics, characteristics of static power semiconductor devices (BJT, MOSFET, IGBT, Thyristors). AC/DC power converters: uncontrolled rectifiers (single phase and three phase), controlled rectifiers (single phase and three phase), dual converter. AC/AC power converters: phase controlled converters (single phase and three phase), AC switch, cycloconverter. DC/DC converters: choppers (step down and step up), switching regulators (buck, boost, buck-boost). DC/AC converters: types, single phase and three phase inverters. Various applications of converters.

EEE 316 Power Electronics Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 315. In the second part, students will design simple systems using the principles learned in EEE 315.

EEE 317 Control System I

3 Credit Hours, 3 Contact Hours per Week

Review of Laplace transform, Initial and Final value theorems, Transfer Functions: Open-loop stability, Poles, Zeros, Time response, Transients, Steady-state, Block diagrams and signal flow diagram, Feedback principles: Open versus Closed-loop control, High gain control, Inversion; State variables: Signal flow diagram to state variables, transfer function to state variable and state variable to transfer function, Stability of closed-loop systems: Routh's method, Root locus, PID control: Structure, Design using root locus, Pole assignment: Sylvester's theorem, PI and PID synthesis using pole assignment, Frequency Response: Nyquist plot, Bode diagram, Nyquist stability theorem, Stability margins, Closed-loop sensitivity functions, Model errors, Robust stability, Controller design using frequency response: Proportional control, Lead-lag control, PID control, Digital control systems: introduction, sampled data systems, stability analysis in Z-domain.

EEE 318 Control System I Laboratory

1.5 Credit Hours 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 317. In the second part, students will design simple systems using the principles learned in EEE 317.

EEE 414 Electrical Services Design

1.5 Credit Hours, 3 Contact Hours per Week

Familiarization with CAD tools for building services design. Introduction to building regulations, codes and standards: BNBC, NFPA etc. Terminology and definitions: fuses, circuit breakers, distribution boxes, cables, bus-bars and conduits. Familiarization with symbols and legends used for electrical services design. Classification of wiring. Design for illumination and lighting: lux, lumen, choice of luminaries for various applications- domestic building, office building and industry. Wattage rating of common electrical equipment.

Designing electrical distribution system for low and high rise domestic, office and academic buildings, for multipurpose buildings. Size selection of conductors and breakers, bus-bar trunking (BBT) system for various applications. Single line diagram (SLD) of a typical 11kV/0.415kV, 500kVA sub-station and a 200kVA pole-mounted transformer.

Earthing requirements, various earthing methods. Earthing and lightning protection system design.

Familiarization with indoor and underground telephone and fiber optic cables, UTP and CAT5/6 data cables. Designing routing layout and installation of intercom, PABX, telephone, public address (PA) systems, cable TV distribution, LAN and wireless data systems for a building.

Safety regulations, design of security systems including CCTV, burglar alarm.

Concept of fire prevention and its importance. Fire detection (smoke, heat etc.) and alarm system (with voice evacuation), firefighting system (sprinkler system, hose).

Installation of air-conditioning, heating, lifts and elevators.

EEE 415 Microprocessors and Embedded Systems

3 Credit Hours, 3 Contact Hours per Week

Basic components of a computer system. Simple-As-Possible (SAP) computer: SAP-1, selected concepts from SAP-2 and SAP-3 (jump, call, return, stack, push and pop). Evolution of microprocessors.

Introduction to Intel 8086 microprocessor: features, architecture, Minimum mode operation of 8086 microprocessor: system timing diagrams of read and write cycles, memory banks, design of decoders for RAM, ROM and PORT.

Introduction to Intel 8086 Assembly Language Programming: basic instructions, logic, shift and rotate instructions, addressing modes, stack management and procedures, advanced arithmetic instructions for multiplication and division, instructions for BCD and double precision numbers, introduction to 8086 programming with C language. Hardware Interfacing with Intel 8086 microprocessor: programmable peripheral interface, programmable interrupt controller, programmable timer, serial communication interface, keyboard and display interface (LED, 7 segment, dot matrix and LCD).

EEE 416 Microprocessors and Embedded Systems Laboratory

1.6 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 415. In the second part, students will design simple systems using the principles learned in EEE 415.

EEE 439 Communication Systems II

3 Credit Hours, 3 Contact Hours per Week

Baseband digital transmission, Limitations, Pulse shaping, Repeaters, Pulse equalization techniques, AWGN channel model, bit error rate of a baseband transmission system, channel capacity theorem.

Digital modulation techniques, detection and demodulation techniques, digital receivers, matched filter and correlator receiver, bit error rate calculation of a digital link, digital link design.

Error correction coding: block codes, cyclic codes, systematic and nonsystematic cyclic codes, decoding techniques.

Wireless digital communication system, wireless channel model, non-cellular and cellular communication, cellular concept, frequency reuse techniques.

Multiple access techniques: FDMA, TDMA, CDMA and SDMA. Introduction to 2G and 3G mobile communication systems.

Introduction to optical fiber communication and Satellite communication.

Local area network, OSI model, random access techniques, Aloha, slotted Aloha.

EEE 400 Thesis/Project
3 Credit Hours, 6 Contact Hours per Week Level-4, Term-I
3 Credit Hours, 6 Contact Hours per Week Level-4, Term-II

Study of practical problems in the fields of electrical and electronic engineering.

Elective Courses

Interdisciplinary

EEE 421 Control System II

3 Credit Hours, 3 Contact Hours per Week

Compensation using pole placement technique. State equations of digital systems with sample and hold, state equation of digital systems, digital simulation and approximation. Solution of discrete state equations: by z-transform, state equation and transfer function, state diagrams, state plane analysis. Stability of digital control systems. Digital simulation and digital redesign. Time domain analysis. Frequency domain analysis. Controllability and observability. Optimal linear digital regulator design. Digital state observer. Microprocessor control. Introduction to neural network and fuzzy control, adaptive control. H^{α} Control, nonlinear control. Elements of System Identification, Introduction to Multivariable control (decoupling, interaction, analysis & design), Introduction to optimal control and estimation, Case studies.

EEE 422 Control System II Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 421. In the second part, students will design simple systems using the principles learned in EEE 421.

EEE 425 Biomedical Signals, Instrumentation and Measurements

3 Credit Hours, 3 Contact Hours per Week

Origin and major types of biological signals: Human body: cells and physiological systems, bioelectric potential, bio-potential electrodes and amplifiers, blood pressure, flow, volume and sound, electrocardiogram, electromyogram, electroencephalogram, phonocardiogram, vector cardiogram. Interpretation of bio-signals. Noise in bio-signals.

Measurement of bio-signals: transducers, amplifiers and filters. Measurement and detection of blood pressure. Blood flow measurement: plethysmograph and electromagnetic flow meter. Measurement of respiratory volumes and flow, related devices. X-ray. Tomograph: positron emission tomography and computed tomography. Magnetic resonance imaging. Ultrasonogram. Patient monitoring system and medical telemetry. Therapeutic devices: cardiac pacemakers and defibrillators. Electrical safety in bio instrumentations and sensing.

EEE 426 Biomedical Signals, Instrumentation and Measurement Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 425. In the second part, students will design simple systems using the principles learned in EEE 425.

EEE 427 Measurement and Instrumentation

3 Credit Hours, 3 Contact Hours per Week

Introduction: Applications, functional elements of a measurement system and classification of instruments. Measurement of electrical quantities: Current and voltage, power and energy measurement. Current and potential transformer. Transducers: mechanical, electrical and optical. Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque. Basic elements of DC and AC signal conditioning: Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits. Data Transmission and Telemetry: Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices. Data acquisition system and microprocessor applications in instrumentation.

EEE 428 Measurement and Instrumentation Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 427. In the second part, students will design simple systems using the principles learned in EEE 427.

CSE 451 Computer Networks

3 Credit Hours, 3 Contact Hours per Week

Switching and multiplexing; ISO, TCP-IP and ATM reference models. Different Data Communication Services: Physical Layer-wired and wireless transmission media, Cellular Radio: Communication satellites; Data Link Layer: Elementary protocols, sliding window protocols. Error detection and correction, HDLC, DLL of internet, DLL of ATM; Multiple Access protocols, IEEE.802 Protocols for LANs and MANs, Switches, Hubs and Bridges; High speed LAN; Network layer: Routing, Congestion control, Internetworking, Network layer in internet: IP protocol, IP addresses, ARP; NI in ATM transport layer: transmission control protocol. UDP, ATM adaptation layer; Application layer: Network security; Email, Domain Name System; Simple Network Management Protocol; HTTP and World Wide Web.

CSE 452 Computer Networks Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in CSE 451. In the second part, students will design systems using the principles learned in CSE 451.

Communication and Signal Processing Group

EEE 331 Random Signals and Processes

3 Credit Hours, 3 Contact Hours per Week

Probability and Random variables: Sample space, set theory, probability measure, conditional probability, total probability, Bayes theorem, independence and uncorrelatedness. Expectation, Variance, moments and characteristic functions. Commonly used distribution and density functions. Central limit theorem. Transformation of a random variables: one, two and N random variables. Joint distribution, density, moments and characteristic functions. Hypothesis Testing.

Random Processes: Correlation and covariance functions. Process measurements. Gaussian, and Poisson random processes. Markov Process. Noise models. Stationarity and Ergodicity. Spectral Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs. Statistical Estimation Techniques (ML, MMSE, MAP).

EEE 431 Digital Signal Processing II

3 Credit Hours, 3 Contact Hours per Week

Spectral estimation of random processes: classical methods, minimum variance method, parametric methods: AR and ARMA spectral estimation, Levinson-Durbin algorithm, super resolution techniques: Pisarenko, and MUSIC.

Adaptive signal processing: Applications, e.g., equalization, interference suppression, acoustic echo cancellation. FIR and IIR adaptive filters. Recursive least squares algorithm, steepest descent and Newton algorithm, least mean-square (LMS) algorithm, convergence analysis. Variable step-size LMS algorithm.

Multirate DSP: Interpolation and decimation, single-stage and multistage implementation, design of anti-aliasing and anti-imaging filters. Polyphase representation of multirate systems. Multirate implementation of ideal LP filter, digital filter banks, narrowband filters. Perfect reconstruction filters banks. Short time Fourier transform, subband decomposition and wavelet transform, CWT, DWT, inter-scale relationship of DWT coefficients, multirate implementation. Applications of wavelet transform.

EEE 433 Microwave Engineering

3 Credit Hours, 3 Contact Hours per Week

Transmission Lines: The Lumped-Element Circuit Model for a Transmission Line, Field Analysis of Transmission Lines, The Terminated Lossless Transmission Lines, The Smith Chart, The Quarter-Wave Transformers, Generator and Load Mismatches, Impedance Matching and Tuning, Lossy Transmission Lines. Waveguides: General Formulation, Modes of Propagation and Losses in Parallel Plate, Rectangular and Circular Waveguides. Microstrip Lines: Structures and Characteristics. Microwave Resonators: Waveguide Cavity Resonators, Microstrip Resonators. Microwave Network Analysis: Scattering Matrices and Multiport Analysis Techniques. Radiation and Antennas: Types of Antenna and Their Applications, Radiating Field Regions, Radiation Pattern- Isotropic, Directional and Omni Directional Patterns, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency and Gain, Polarization, Vector Effective Length, Effective Aperture, Equivalent Circuit Model and Corresponding Parameters, Friis Transmission Equation, Mathematical Formalism for Far Field Analysis, Infinitesimal Dipole Antenna, Finite Length Dipole Antenna, Infinitesimal Loop Antenna, Antenna Array, N Element Linear Array, Endfire and Broadside Array- Array Factor and Directivity.

EEE 434 Microwave Engineering Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 433. In the second part, students will design simple systems using the principles learned in EEE 433.

EEE 435 Optical Communications

3 Credit Hours, 3 Contact Hours per Week

Introduction to optical communication. Guided and unguided optical communication system, Light propagation through guided medium, Optical Fibers: SMF and MMF, SI fibers and GI fibers. Fiber modes, mode theory for light propagation through fibers, single mode condition and multimode condition. Transmission impairments: fiber loss, chromatic dispersion in a fiber, polarization mode dispersion (PMD). Different types of fibers: DSF, DCF, Dispersion compensation schemes. Fiber cabling process, Fiber joints/connectors and couplers, Optical transmitter: LED and laser, Operating principles, Characteristics and driver circuits. Optical receivers: PN, PIN and APD detectors, Noise at the receiver, SNR and BER calculation, Receiver sensitivity calculation. IM/DD and Coherent communication systems. Nonlinear effects in optical fibers. Optical amplifiers, Optical modulators, Multichannel optical systems: Optical FDM, OTDM and WDM. Optical Access Network, Optical link design and Free space optical communication.

EEE 437 Wireless Communication

3 Credit Hours, 3 Contact Hours per Week

Introduction: Wireless communication systems, regulatory bodies. Radio wave propagation: Free-space and multi-path propagation, ray tracing models, empirical path loss models, large-scale and small-scale fading, power delay profile, Doppler and delay spread, coherence time and bandwidth. Statistical channel models: Time-varying channel models, narrowband and wideband fading models, baseband equivalent model, discrete-time model, space-time model, auto- and cross-correlation, PSD, envelope and power distributions, scattering function. Channel capacity: Flat-fading channels - CSI, capacity with known/partially known/unknown CSI. Frequency-selective fading channels - time-invariant channels, time-varying channels. Performance of digital modulations: Error and outage probability, inter-symbol interference, MPSK, MPAM, MQAM, CPFSK. Diversity techniques: Time diversity - repetition coding, beyond repetition coding. Antenna diversity - SC, MRC, EGC, space-time coding. Frequency diversity - fundamentals, single-carrier with ISI equalization, DSSS, OFDM. Space-time communications: Multi-antenna techniques, MIMO channel capacity and diversity gain, STBC, OSTBC, QOSTBC, SM, BLAST, smart antennas, frequency-selective MIMO channels. Broadband communications: DSSS, FHSS, spreading codes, RAKE receivers, MC-CDMA, OFDM, OFDMA, multiuser detection, LTE, WiMAX.

EEE 438 Wireless Communication Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

Laboratory experiments and design of wireless communication systems based on the syllabus of EEE 437 Wireless Communications.

EEE 441 Telecommunication Engineering

3 Credit Hours, 3 Contact Hours per Week

Introduction: Principle, evolution and telecommunication networks. National and International regulatory bodies, Telephone apparatus, telephone Exchanges, subscriber loop, supervisory tones, PSTN. Switching systems: Introduction to analog system: Strowger and Crossbar switching systems, Stored program control (SPC) systems, Digital switching systems: space division switching, time division switching, blocking probability and multistage switching, and digital memory switch. Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing. Integrated services digital network (ISDN): N-ISDN and B-ISDN, architecture of ISDN, B-ISDN implementation. Digital subscriber loop (DSL), Wireless local loop (WLL), FTTx, SONET/SDH, WDM Network, IP telephony and VoIP, ATM network and Next Generation Network (NGN).

EEE 443 Radar and Satellite Communications

3 Credit Hours, 3 Contact Hours per Week

Introduction to Satellite Communication, Satellite frequency bands, satellite orbits, satellite types, regulation of the spectrum and interference, propagation channel, air interfaces, link budget analysis, Digital Modulation, Error Correction Codes, Multiple Access, receiver synchronization, baseband processing, fixed and mobile applications, basics of satellite networking.

Radar equation, radar cross section, information contents in radar signals, noise and clutter, radar detectors, Doppler and MTI radar, pulse compression, CW and FM-CW radar, radar transmitter and receivers, introduction to polarimetric radar and synthetic aperture radar.

EEE 445 Multimedia Communications

3 Credit Hours, 3 Contact Hours per Week

Introduction and classification of multimedia signals, auditory and visual systems of humans, representations of text, audio and video signals, color representations of visual signals. Compression of multimedia signals for communication: sampling, orthogonal transforms and subband coding of signals. Techniques of compressions for communication: text compression using Huffman and Lempel Ziv coding, audio compression using LPC, GSM/CELP, MP3/AAC, image compression using JPEG, JPEG2000, video compression using H.363, MPEG-4. Mutlimedia communication networks and protocols: MPEG transport stream, H.221 framing, IP-based transport protocols such as UDP, TCP, RTP, DCCP, RTCP and VoIP. Quality of Services. Synchronization and signaling of multimedia communications using SS7, H.323, SIP, SDP, RTSP, Megaco. Digital television, HDTV. Multimedia content creation and management. Wireless communications of multimedia signals. Security issues of multimedia communications.

EEE 447 Introduction to Digital Image Processing,

3 Credit Hours, 3 Contact Hours per Week

History and background of digital image processing, image processing system and applications, visual perception, sensors for image acquisition, sampling and quantization, intensity transformation and enhancement of images in spatial domain, histogram equalization, Fuzzy techniques for image processing, 2D discrete Fourier transform, image restoration, Wiener and constraint least-square filters for images, homomorphic filters, image reconstruction from projections, multi-resolution image processing, sub-band coding and image compression.

EEE 449 Information and Coding Theory

3 Credit Hours, 3 Contact Hours per Week

Entropy and Mutual Information: Entropy, joint entropy and conditional entropy, Relative entropy and mutual information, chain rules for entropy, relative entropy and mutual information, Jensen's inequality and log-sum inequality

Differential Entropy: Differential entropy and discrete entropy, joint an conditional differential entropy, properties of differential entropy, relative entropy and mutual information

Entropy Rates of Stochastic Process: Markov Chain, Entropy rate and hidden Markov models

Source Coding: Kraft inequality, optimal codes, Huffman code and its optimality, Shannon-Fano-Elias coding, arithmetic coding

Channel Capacity: Binary symmetric channels and properties of channel capacity, channel coding theorems, joint source and channel coding theorem

Block coding and decoding, BCH, RS codes, Convolutional coding, Viterbi Decoder, Turbo codes, decoding techniques

STBC, SFBC, STFBC

Gaussian Channel: Introduction to Gaussian Channel, Band limited channel, Parallel Gaussian Channel, Gaussian Channel with feedback.

EEE 491 Introduction to Medical Imaging

3 Credit Hours, 3 Contact Hours per Week

Introduction to imaging, medical imaging modalities, Medical imaging before x-rays, Hippocratic thermography, dissection, laproscopy, X-radiography, Computed tomography (CT), evolution of CT scanner design, image reconstruction algorithms, filtered back-projection method, iterative method, low dose computed tomography, Ultrasound, Sonar and other early applications of acoustics, basic principles of ultrasound imaging, Evolution of ultrasound technology and clinical applications, Magnetic resonance imaging, Early use of nuclear magnetic resonance (NMR) spectroscopy, Principles of NMR and MRI, Evolution of magnetic resonance imaging (MRI) technology and clinical applications, development and applications of functional

MRI, Introduction to Nuclear imaging.

EEE 493 Digital Filter Design

3 Credit Hours, 3 Contact Hours per Week

Application of digital filters, analog filters, linear phase FIR filters, optimal filter design, Remez exchange algorithm, multiband filters, approximately linear phase IIR filter, all pass filter, design of IIR filter using optimization methods: Newton's method, Quasi-Newton algorithms, Minimax algorithms, improved Minimax algorithms, filter design in time-frequency domain, design of special filters: Hilbert transformer, narrowband filter, fractional delay filter, Wiener filter, filter design using Kalman filter/parallel Kalman filter, Wavelet filter.

EEE 495 Speech Communication

3 Credit Hours, 3 Contact Hours per Week

Speech production and phonetics: articulatory and acoustic features; Speech analysis: formant, pitch, time and frequency domain analysis techniques, spectrogram; Speech coding: linear predictive coding, vocoders, vector quantization; Speech enhancement: spectral subtraction based techniques; Speech synthesis: formant synthesizers; Speech and speaker recognition: feature extraction and conventional recognition methods.

EEE 497 Telecommunication Networks

3 Credit Hours, 3 Contact Hours per Week

Introduction to Telecom System and Networks, Essentials of a Telecom Network. Telecommunication Switching system: TDM switching, Space division switching, Time-Space Switching, Circuit

Switching and Packet Switching, Switching Fabrics. Integrated Services Digital Network (ISDN), Broadband ISDN (B - ISDN), Switching and Signaling Techniques in ISDN, Signaling System – 7 (SS - 7), ISDN Protocols and standards. Telecom Network Architectures, Network Topology: Ring, Bus, Tree, Star, Architecture of a node, Functions of a node; Routing & Switching, Principles of Routing; Hot Potato Routing, Deflection Routing, Virtual Path Routing, Shortest Path Routing etc. Access Technologies: Conflict free Multiple Access techniques: FDMA, OFDMA, TDMA, CDMA, Demand Assignment Multiple Access (DAMA), CSMA-CD, CSMA-CA. Network Protocol Stack, IP Protocol, Voice over IP (VoIP), Asynchronous Transfer Mode (ATM) technology, IP over ATM, Synchronous Optical Network (SONET) and Synchronous digital Hierarchy (SDH), IP over SONET, SONET over WDM networking Access Network Technologies: Hybrid Fiber Coax (HFC), Fiber to the X (FTTX), Ethernet Passive Optical Network (EPON), Gigabit PON (GPON). Next generation Networking (NGN), Next generation SONET/SDH, Networks and Standards, Multiple Protocol Label Switching (MPLS), MPLS over WDM.

(**Note: For total credit hour fulfillment of the degree of B. Sc. Engg (EEE), credits of either EEE 497 or EEE 499 will be counted but not both.)**

EEE 498 Telecommunication Networks Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

Laboratory experiments and designs based on the course EEE 497 Telecommunication Networks.

EEE 499 Wireless and Mobile Networks

3 Credit Hours, 3 Contact Hours per Week

Overview of wireless networks, different generations of wireless networks. Wireless Transmission techniques: baseband transmission, Carrier modulated band pass transmission, Ultra wideband (UWB) transmission, wireless modems, Spread Spectrum techniques; direct system (DS) and Frequency Hopping (FH) Spread Spectrum Systems. Wireless Network topologies, Cellular networks, Cellular fundamentals, carrier to co channel interference ratio (C/CCI), Capacity expansion techniques. Access Techniques: FDMA, TDMA, CDMA, narrowband and wideband Access technologies, OFDMA, Hybrid multiple Access techniques: FDMA-TDMA, OFDMA-TDMA, MC-CDMA; Spectral Efficiency and Capacity of wireless networks. Diversity in Mobile networks: MIMO Wireless Networks, Space, Time and Frequency coding techniques. Switching technologies: Circuit switching, packet switching, Protocol Stack, Random Access Technology and Wireless LANs, Aloha, Slotted Aloha, CSMA-CA and W-LAN Protocols, Routing in Wireless Networks, Optimal Routing and Scheduling, Single-hop and Multi-hop Networks. Quality of Service (QoS) in Wireless Networks, Traffic Management, Wireless Adhoc Networks, Wireless Sensor Networks. Cellular Network standards: GSM, IS-95, UMTS, CDMA-2000, W-CDMA, 3G and future generation.

(**Note: For total credit hour fulfillment of the degree of B. Sc. Engg (EEE), credits of either EEE 497 or EEE 499 will be counted but not both.)**

Electronics Group

EEE 351 Analog Integrated Circuits

3 Credit Hours, 3 Contact Hours per Week

Analog IC Design: Bipolar, MOS and BiCMOS IC technology and its impact, eggshell analogy, application areas and the future of analog IC design.

Review of transistors: Large and small signal models, compact models for Bipolar, FET, and BiCMOS. Amplifiers with passive and active loads, cascode stages.

Multiple current sources/sinks using Bipolar and FET technologies. Current mirrors: Basic, cascode and active current mirrors; influence of channel modulation, mismatched transistors and error in aspect ratios. Wilson current mirror.

Constant current or voltage references: Supply voltage and temperature independent biasing, band-gap references; constant-Gm biasing. Widlar band-gap voltage reference.

Differential pairs: Differential vs. single-ended operations of simple amplifiers, differential and common mode voltages, common mode rejection ratio (CMRR), input common mode range (ICMR), transfer characteristics, small signal analysis, and frequency response of differential pairs.

High-gain amplifiers: Design and analysis of operational amplifiers (Op Amps) using BJTs and FETs, hierarchy in analog integrated circuits for an Op-Amps, internal structure of IC Op-Amps, high-performance Op-Amps.

Switch capacitor circuits: Equivalent resistance of a switched capacitor, unity gain buffers, charge amplifiers and integrators. Sampling switches: Charge injection, clock feed-through, charge feed-through; quantized model and remedy of charge injection. Switched capacitor filters.

Origin of internally developed noises in ICs; shot, thermal, flicker, burst and avalanche noises in a device. Representation of noises in circuits, noises in single stage and differential amplifiers, noise bandwidth.

EEE 451 Processing and Fabrication Technology

3 Credit Hours, 3 Contact Hours per Week

Substrate materials: Crystal growth and wafer preparation, epitaxial growth technique, molecular beam epitaxy, chemical vapor phase epitaxy and chemical vapor deposition (CVD).

Doping techniques: Diffusion and ion implantation. Growth and deposition of dielectric layers: Thermal oxidation, CVD, plasma CVD, sputtering and silicon-nitride growth.

Introduction to Semiconductor Characterization Tools.

Etching: Wet chemical etching, silicon and GaAs etching, anisotropic etching, selective etching, dry physical etching, ion beam etching, sputtering etching and reactive ion etching. Cleaning: Surface cleaning, organic cleaning and RCA cleaning. Lithography: Photo-reactive materials, pattern generation, pattern transfer and metalization. Steps of lithography. Non-optical lithography.

Discrete device fabrication: Diode, transistor, resistor and capacitor. Integrated circuit fabrication: Isolation - pn junction isolation, mesa isolation and oxide isolation. BJT based microcircuits, p-channel and n-channel MOSFETs, complimentary MOSFETs and silicon on insulator devices. Testing, bonding and packaging.

EEE 453 VLSI Circuits and Design I

3 Credit Hours, 3 Contact Hours per Week

IC trends, technology and design approaches. MOS device : structure, operation, threshold voltage and characteristics.

Ratioed circuits : NMOS inverter with resistive and transistor load, Pseudo NMOS inverter.

Ratioless circuits :CMOS inverters : operation, transfer characteristics, design for equal rise and fall time, propagation delay, rise time, fall time and power consumption estimation. NMOS pass transistor and CMOS pass gate circuits. Buffer chain design to drive large capacitive load.

Integrated circuit fabrication technology : photolithography, CMOS process flow, design rules. Estimation of resistance and capacitance from layout. Layout matching. Stick diagram and area estimation from stick diagram. Reliability issues : Latch-up, electromigartion.

Basic logic gates in CMOS. Synthesis of arbitrary combinational logic in CMOS, pseudo-NMOS, dynamic CMOS, clocked CMOS and CMOS domino logic. Structured design : Parity generator, bus arbitration logic, multiplexers based design, programmable logic array (PLA) design. Clocked sequential circuit design: two phase clocking, dynamic shift register. CMOS latches and flip flops.

Subsystem design : 4-bit arithmetic processor : bus architectures, shifter, design of a general purpose ALU.

Memory elements design: System timing consideration, three transistor and one transistor dynamic memory cell. Pseudo-static RAM/register cell. 4 transistor dynamic and 6 transistor static CMOS memory cell. 4x4 bit register array and 16 bit static CMOS memory array.

Finite State Machine design: Design of Moore Type and Mealy type FSM using Verilog.

Testing VLSI circuits.

EEE 454 VLSI Circuits and Design I Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 453. In the second part, students will design simple systems using the principles learned in EEE 453.

EEE 455 Compound Semiconductor Devices

3 Credit Hours, 3 Contact Hours per Week

Reviews of Compound semiconductor: Zinc-blend crystal structures, growth techniques, alloys, band gap, basic opto-electronic properties, density of carriers in intrinsic and doped compound semiconductors.

Introduction to Physics of Hetero-Junctions: Band alignment, band offset, Anderson's rule, single and double sided hetero-junctions, quantum wells and quantization effects, lattice mismatch and strain and common hetero-structure material systems.

Hetero-Junction diode: Band banding, carrier transport and I-V characteristics. Hetero-junction field effect transistor: Structure and principle, band structure, carrier transport and I-V characteristics. Nonideal effects, frequency response, high electron mobility transistor.

Hetero-structure bipolar transistor (HBT): Structure and operating principle, quasi-static analysis, extended Gummel-Poon model, Ebers-Moll model, secondary effects and band diagram of a graded alloy base HBT.

Resonant Tunneling diodes: physics and operation. Resonant Tunneling Transistors: device physics, operation and characteristics.

EEE 457 VLSI Circuits and Design II

3 Credit Hours, 3 Contact Hours per Week

Scaling of MOS transistor and interconnect: RC delay modeling, repeaters and cascaded drives. Advanced CMOS nanometer process flow and enhancement of CMOS process, technology related CAD issues and manufacturing issues, design margin and PVT corners.

Circuit characterization: delay estimation and transistor sizing for minimum delay, crosstalk and noise analysis. High speed digital circuit design techniques, circuit families. Architecture for high speed design: Carry select, carry skip, carry look ahead and tree adders. Modified Booth algorithm, Wallace tree multiplication.

Sequential circuit design: sequencing methods, maximum and minimum delay constrains, clock skew. Design of latches and flip-flops, clock Generation and synchronization, High-speed clock generation and distribution.

ASIC Cell based design, standard cell place and route design, timing directed placement design, mixed signal design. Interchange formats: LEF, DEF, SDF, DSPF, SPEF, ALF PDEF,CIF and GDS2. Floor planning, power distribution and I/O design.

Algorithm and architecture for digital processors in verilog, system verilog and system-C : building block for signal processors, digital filters and signal processors, pipelined architecture.

Architecture for arithmetic processors: addition, subtraction, multiplication and division. Complete design of a simple RISC processor. Post-synthesis design validation: timing verification, fault simulation and testing, design for test.High speed and low power memory circuit design: advanced topics in DRAM and SRAM.

EEE 458 VLSI Circuits and Design II Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 457. In the second part, students will design simple systems using the principles learned in EEE 457.

EEE 459 Optoelectronics

3 Credit Hours, 3 Contact Hours per Week

Optical properties in semiconductor: Direct and indirect band-gap materials, basic transitions in semiconductors, radiative and non-radiative recombination, optical absorption, photo-generated excess carriers, minority carrier life time, luminescence and quantum efficiency in radiation.

Properties of light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation.

Light emitting diode (LED): Principles, materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers. Double-Hetero-structure (DH) LEDs, Characteristics, Surface and Edge emitting LEDs.

Stimulated emission and light amplification: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions.

Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, elementary laser diode characteristics, hetero-junction lasers, optical and electrical confinement. single frequency solid state lasers-distributed Bragg reflector (DBR), distributed feedback (DFB) laser.

Introduction to quantum well lasers. Introduction to quantum well lasers, Vertical Cavity Surface Emitting Lasers (VCSELs), optical laser amplifiers.

Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes, hetero-junction photodiodes, Schottky photo-diodes and phototransistors. Noise in photo-detectors. PIN and APD. Photo-detector design issues. Solar cells: Solar energy and spectrum, silicon and Schottkey solar cells. Modulation of light: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magneto-optic devices. Introduction to integrated optics.

EEE 460 Optoelectronics Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

Laboratory based on EEE 459

EEE 461 Semiconductor and Nano Device

3 Credit Hours, 3 Contact Hours per Week

Lattice vibration: Simple harmonic model, dispersion relation, acoustic and optical phonons. Free electron model: Electrical conductivity. Band structure: Isotropic and anisotropic crystals, band diagrams and effective masses of different semiconductors and alloys. Scattering theory: Perturbation theory, Fermi-Golden rule for static and oscillating potentials, scattering rates for impurity and phonons, inter-band and inter-sub-band optical absorption, mobility. Quantum mechanical model of carrier transport: Tunneling transport, current and conductance, resonant tunneling, resonant tunneling diodes, super-lattices and mini-bands. Introduction to inter sub-band transition devices.

EEE 463 Introduction to Nanotechnology and Nanoelectronics

3 Credit Hours, 3 Contact Hours per Week

Why Nanotechnology: importance, size scales, quantum size effects, revolutionary applications, potentials. Nanotools: scanning tunneling microscope, atomic force microscope, electron microscope, measurement techniques based on fluorescence, other techniques. Basics of Fabrication: fabrication and processing industry, wafer manufacturing, deposition techniques: evaporation, sputtering, chemical vapor deposition, epitaxy; Wet and dry etching techniques; photolithography, electron beam lithography, stamp technology. Bottom-up processes: chemical and organic synthesis techniques, self-assembly, other techniques. Nanoelectronics: overview of quantum mechanics, Schrodinger equation, particle in a box. Band theory of solids. Importance of nanoelectronics, Moore's law, ITRS roadmap. Tunneling devices: quantum tunneling, resonant tunneling diodes. Single electron transistor: Coulomb blockade. Quantum confinement: wires and dots, carbon nanotubes, graphenes. Brief introductions on Molecular electronics and nanobiology.

Power Group

EEE 371 Power System II

3 Credit Hours, 3 Contact Hours per Week

Definition and classification of stability, two axis model of synchronous machine, loading capability, rotor angle stability - swing equation, power-angle equation, synchronizing power coefficients, equal area criterion, multi-machine stability studies, step-by-step solution of the swing curve, factors affecting transient stability. Frequency and voltage stability.

Economic Operation within and among plants, transmission-loss equation, dispatch with losses.

Flexible AC transmission system (FACTS) - **i**ntroduction, **s**hunt compensation (SVC, STATCOM), series compensation (SSSC, TCSC, TCSR, TCPST), series-shunt compensation (UPFC).

Power quality- voltage sag and swell, surges, harmonics, flicker, grounding problems; IEEE/IEC standards, mitigation techniques.

EEE 372 Power System II Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments and do simulations to verify practically the theories and concepts learned in EEE 371. In the second part, students will design simple systems using the principles learned in EEE 371.

EEE 471 Energy Conversion III

3 Credit Hours, 3 Contact Hours per Week

Basic principles of energy conversion: electromagnetic, electrostatic, thermoelectric, electrochemical, and electromechanical.

Acyclic machines: generators, conduction pump and induction pump.

Nonconventional energy conversion: solar-photovoltaic, solar-thermal, wind, geothermal, wave and tidal energy, MHD (Magneto Hydrodynamic) systems.

Motors and drives: series universal motor, permanent magnet DC motor, brushless DC motor (BLDC), stepper motor, reluctance motor, switched reluctance motor, hysteresis motor, repulsion motor, permanent magnet synchronous motor, linear induction motor, electro static motor.□

EEE 473 Renewable Energy

3 Credit Hours, 3 Contact Hours per Week

Renewable energy sources: Solar, wind, mini-hydro, geothermal, biomass, wave and tides.

Solar Photovoltaic: Characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, sun tracking systems, Maximum Power Point Tracking (MPPT): chopper, inverter. Sizing the PV panel and battery pack in stand-alone PV applications. Modern solar energy applications (residential, electric vehicle, naval, and space). Solar power plants connected to grid.

Solar thermal: principles of concentration, solar tower, parabolic dish, receiver, storage, steam turbine and generator.

Wind turbines: Wind turbine types and their comparison, power limitation, Betz's law; Control mechanism: pitch, yaw, speed. Couplings between the turbine and the electric generator, Wind turbine generator - DC, synchronous, self excited induction generator and doubly fed induction generator. Grid interconnection: active and reactive power control.

Biomass and biogas electricity generation.

EEE 475 Power Plant Engineering

3 Credit Hours, 3 Contact Hours per Week

Load forecasting. Load curve: demand factor, diversity factor, load duration curve, energy load curve, load factor, capacity factor, utilization factor. Thermal power station: heat rate, incremental heat rate, efficiency, capacity scheduling, load division. Principles of power plants: steam, gas, diesel, combined cycle, hydro and nuclear. Captive power plant and cogeneration. Power plant auxiliaries and instrumentation. Power evacuation and switchyard. Selection of location: technical, economical and environmental factors. Generation scheduling.

EEE 477 Power System Protection

3 Credit Hours, 3 Contact Hours per Week

Electric arcs, arc extinction mechanism, transient recovery voltage. Circuit Breakers: operating mechanisms, construction and operation of Miniature Circuit Breaker (MCB), Molded Case Circuit Breaker (MCCB), Air Circuit Breaker (ACB), Air Blast Circuit Breaker (ABCB), Vacuum Circuit Breaker (VCB), Oil Circuit Breaker (OCB), Minimum Oil Circuit Breaker (MOCB) and Sulfur Hexafluoride (SF_6) circuit breaker. High Rupturing Capacity (HRC) Fuse, Drop Out Fuse (DOF), Load Break Switches, Contactors. Bus bar layout, isolators, earthing switch; lightning arresters, CT, PT: wound type and CCVT (Capacitor Coupled Voltage Transformer), MOCT (Magneto Optical Current Transducer).

Fundamental of protective relaying. Classical relays (electromagnetic attraction type, induction type); numerical relays. Inverse Definite Minimum Time (IDMT) relays, directional relays, differential and percentage differential relays, distance relays, pilot relays (wire pilot, carrier).

Protection of generators, motors, transformers, transmission lines, HVDC system and feeders.

EEE 478 Power System Protection Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 477. In the second part, students will design simple systems using the principles learned in EEE 477.

EEE 479 Power System Reliability

3 Credit Hours, 3 Contact Hours per Week

Review of probability concepts. Probability distribution: Binomial, Poisson, and Normal. Reliability concepts: Failure rate, outage, mean time to failure, series and parallel systems and redundancy. Markov process. Probabilistic generation and load models. Reliability indices: Loss of load probability and loss of energy probability. Frequency and duration. Reliability evaluation techniques of single area system. Interconnected system: tie line and evaluation of reliability indices.

EEE 481 Power System Operation and Control

3 Credit Hours, 3 Contact Hours per Week

Overview: vertically integrated vs. deregulated power system. Real-time operation: SCADA; EMS (energy management system); various data acquisition devices - RTU, IED, PMU, DFDR, WAMPAC (wide area monitoring, protection and control).

Application functions: state estimation; short term load forecasting; unit commitment (UC); economic dispatch (ED); optimal power flow (OPF). Frequency control: generation and turbine governors, droop, frequency sensitivity of loads, ACE (area control error), AGC (Automatic Generation Control) and coordination with UC and ED; frequency collapse and emergency load shed.

Power system security: static and dynamic; security constrained OPF.

Electricity market operation: GenCos, ISO, DisCos, bidding, spot market, social welfare, market clearing price (MCP), locational marginal price (LMP), bilateral contracts and forward market, hedging.

Demand side control: DMS (distribution management system), DSM (demand side management), smart grid concept.

EEE 483 High Voltage Engineering

3 Credit Hours, 3 Contact Hours per Week

High voltage DC generation: rectifier circuits, ripple minimization, voltage multipliers, Van-de-Graaf and electrostatic generators; applications.

High voltage AC generation: Tesla coils, cascaded transformers and resonance transformers.

Impulse voltage generation: Shapes, mathematical analysis, codes and standards, single and multi-stage impulse generators, tripping and control of impulse generators.

Breakdown in gas, liquid and solid dielectric materials, applications of gas and solid dielectrics in transformer. Corona.

High voltage measurements and testing: IEC and IEEE standards, sphere gap, electrostatic voltmeter, potential divider, Schering bridge, Megaohm meter, HV current and voltage transducers: contact and noncontact.

Over-voltage phenomenon and insulation coordination. Lightning and switching surges, basic insulation level (EV, EHV and UHV systems), surge diverters and arresters.

EEE 484 High Voltage Engineering Laboratory

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 483. In the second part, students will design simple systems using the principles learned in EEE 483.

EEE 485 Power Transmission and Distribution

3 Credit Hours, 3 Contact Hours per Week

Transmission line parameters: Inductance - inductance due to internal flux, flux linkages between points external to an isolated conductor, flux linkages of one conductor in a group, single-phase two-wire line, composite-conductor lines, three-phase lines with equilateral/ unsymmetrical spacing, double circuits, bundled conductors;

Capacitance - electric field of a long straight conductor, potential difference between points due to a charge, capacitance of a two-wire line, capacitance of three-phase line with equilateral/ unsymmetrical spacing, effect of Earth on transmission line capacitance, bundled conductor, parallel-circuit three-phase lines.

Sag of overhead lines, Types of insulators and electrical stress analysis.

Underground cables: Types and construction; oil filled, gas insulated and XLPE cables; electrical characteristics - electrical stress, capacitance, charging current, insulation resistance, dielectric power factor and dielectric loss, skin effect, proximity effect; identification of fault location.

HVDC transmission: Comparison of AC and DC transmission, HVDC transmission system components, monopolar and bipolar HVDC transmission, power converters: CSC (Current source converter) and VSC (Voltage source converter), operation and control of HVDC transmission link.

Substations: Substation equipment, bus bar arrangements, substation earthing, neutral grounding, substation automation, GIS substation.

Distribution systems: Primary and secondary distribution - radial, ring main, and interconnected system, distribution losses and feeder reconfiguration.

EEE 487 Nuclear Power Engineering

3 Credit Hours, 3 Contact Hours per Week

Basic concepts: nuclear energy, atoms and nuclei, radioactivity, nuclear processes, fission, fusion. Nuclear systems: particle accelerator, isotope separators, neutron chain reaction, reactor types, power generation. Layout of nuclear power plant (NPP). Nuclear power plant reactors : pressurized water reactor, boiling water reactor, CANDU reactor, gas cooled reactor, liquid metal cooled reactor, breeder reactor. Auxiliaries, instrumentation and control. Grid interconnection issues: effects of frequency and voltage changes on NPP operation. Advanced and next generation nuclear plants; very high temperature reactors. Biological effects, reactor safety and security; Three Mile island case; Chernobyl case; Fukushima case. Fuel cycle; radioactive waste disposal.

EEE 489 Smart Grid

3 Credit Hours, 3 Contact Hours per Week

Smart grid: two way communication; distributed energy resources (DERs) - DG (distributed generation) and ES (energy storage); high power density batteries, EV (electric vehicles) and PHEV (plug-in hybrid electric vehicles); smart sensors, meters and appliances at demand side.

Data communication channels; protocols; TCP/IP; IEEE 802 series wireless LANs: bluetooth, Zigbee, WiMax; wired LANs- Ethernet, PSTN, PLC (Power Line Carrier); cyber security.

Smart meters and AMI (advanced metering infrastructure): construction; standards for information exchange- Modbus, DNP3 and IEC61850; interfacing with HAN, NAN, WAN.

Power electronic interfaces between grid and DERs.

Demand side integration (DSI): DSM; real time pricing; ancillary markets; DR (demand response) for load shaping, frequency and voltage control, energy efficiency.

Microgrids, self healing and restoration.

4.5 Courses offered by other Departments to EEE students

4.5.1 Computer Science and Engineering

CSE 109 Computer Programming

3 Credit Hours, 3 Contact Hours per Week

Introduction to digital computers. Programming languages, algorithms and flow charts. Structured Programming using C: Variables and constants, operators, expressions, control statements, functions, arrays, pointers, structure unions, user defined data types, input-output and files. Object-oriented Programming using C++: introduction, classes and objects; polyorphism; function and operator overloading; inheritance.

CSE 110 Computer Programming Sessional

1.5 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in CSE 109. In the second part, students will learn program design.

CSE 451 Computer Networks

3 Credit Hours, 3 Contact Hours per Week

Switching and multiplexing; ISO, TCP-IP and ATM reference models. Different Data Communication Services: Physical Layer-wired and wireless transmission media, Cellular Radio: Communication satellites; Data Link Layer: Elementary protocols, sliding window protocols. Error detection and correction, HDLC, DLL of internet, DLL of ATM; Multiple Access protocols, IEEE.802 Protocols for LANs and MANs, Switches, Hubs and Bridges; High speed LAN; Network layer: Routing, Congestion control, Internetworking, Network layer in internet: IP protocol, IP addresses, ARP; NI in ATM transport layer: transmission control protocol. UDP, ATM adaptation layer; Application layer: Network security; Email, Domain Name System; Simple Network Management Protocol; HTTP and World Wide Web.

CSE 452 Computer Networks Sessional

3 Credit Hours, 3 Contact Hours per Week

This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in CSE 451. In the second part, students will design systems using the principles learned in CSE 451.

4.5.2 Civil Engineering

CE 106 Engineering Drawing

1.5 Credit Hours, 3 Contact Hours per Week

Introduction- lettering, numbering and heading; instrument and their use; sectional views and isometric views of solid geometrical figures. Plan, elevation and section of multistoried building; building services drawings; detailed drawing of lattice towers.

4.5.3 Mechanical Engineering

ME 267 Mechanical Engineering Fundamentals

3 Credit Hours, 3 Contact Hours per Week

Introduction to sources of energy: Steam generating units with accessories and mountings; steam turbines.

Introduction to internal combustion engines and their cycles, gas turbines.

Refrigeration and air conditioning: applications; refrigerants, different refrigeration methods.

Fluid machinery: impulse and reaction turbines; centrifugal pumps, fans, blowers and compressors.

Basics of conduction and convection: critical thickness of insulation.

ME268 Mechanical Engineering Fundamentals Sessional

1.5 Credit Hours, 3 Contact Hours per Week

Sessional based on ME 267.

4.5.4 Industrial and Production Engineering

IPE 493 Industrial Management

3 Credit Hours, 3 Contact Hours per Week

Management Functions and Organization: Evolution, management function: organization, theory and structure, span of control, authority delegation, manpower planning.

Personal Management: Importance, need hierarchy, motivation, leadership, wage incentives, performance appraisal, participative management.

Operation Management: Production planning and control (PPC) functions, quantitative methods applied in production, quality management, location and layout planning safety and loss management.

Cost and Financial Management: Elements of cost products, cost analysis, investment analysis, benefit cost analysis, risk analysis.

Management Accounting: Cost planning and control, budget and budgetary control.

Marketing Management: Concepts, strategy, sales promotion, patent laws.

Technology Management: Management of innovation and changes, technology life cycle.

Case studies.

4.5.5 Physics

PHY 121 Waves and Oscillations, Optics and Thermal Physics

3 Credit Hours, 3 Contact Hours per Week

Waves and oscillations: Differential equation of simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, spring mass system, torsional pendulum; two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, progressive wave, power and intensity of wave, stationary wave, group and phase velocities.

Optics: Defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Theories of light; Interference of light: Young's double slit experiment, displacement of fringes and its uses, Fresnel bi-prism, interference in thin films, Newton's rings, interferometers; Diffraction: Diffraction by single slit, diffraction from a circular aperture, resolving power of optical instruments, diffraction at double slit and N-slits, diffraction grating; polarization: Production and analysis of polarized light, Brewster's law, Malus law, polarization by double refraction, Nicol prism, optical activity, Polarimeters.

Thermal Physics: Heat and work- the first law of thermodynamics and its applications; Kinetic Theory of gases- Kinetic interpretation of temperature, specific heats of ideal gases, equipartition of energy, mean free path, Maxwell's distribution of molecular speeds, reversible and irreversible processes, Carnot's cycle, second law thermodynamics, Carnot's theorem, entropy, Thermodynamic functions, Maxwell relations, Clausius and Clapeyron equation.

PHY 102 Physics Sessional

1.5 Credit Hours, 3 Contact Hours per Week

Laboratory experiments based on PHY 121.

PHY 165 Electricity and Magnetism, Modern Physics and Mechanics

3 Credit Hours, 3 Contact Hours per Week

Electricity and magnetism: Electric charge and Coulomb's Law, Electric field, Concept of electric flux and the gauss's Law - some applications of gauss's Law, Gauss's Law in vector form, Electric potential, Relation between electric field and electric potential, Capacitance and dielectrics, Gradient, Laplace's and Poisson's equations, Current, Current density, Resistivity, The magnetic field, Ampere's Law, Biot-savart Law and their applications, Laws of electromagnetic induction- Maxwell's equations.

Modern Physics : Galilean relativity and Einstein's special theory of relativity; Lorentz transformation equations, Length contraction, Time dilation and mass-energy relation, Photoelectric effect, Compton effect; de Broglie matter waves and its success in explaining Bohr's theory, Pauli's exclusion principle, Constituent of atomic nucleus, Nuclear binding energy, Different types of radioactivity, Radioactive decay Law; Nuclear reactions, Nuclear fission, Nuclear fusion, Atomic power plant.

Mechanics: Linear momentum of a particle, Linear momentum of a system of particles, Conservation of linear momentum, Some applications of the momentum principle; Angular momentum of a particle, Angular momentum of a system of particles, Kepler's Law of planetary motion, The Law of universal gravitation, The motion of planets and satelites, Introductory quantum mechanics; Wave function, Uncertainity principle, Postulates, Schrodinger time independent equation, Expectation value, Probability, Particle in a zero potential, Calculation of energy.

4.5.6 Chemistry

CHEM 101 Chemistry I

3 Credit Hours, 3 Contact Hours per Week

Atomic Structure, quantum numbers, electronic configuration, periodic table. Properties and uses of noble gases. Different types of chemical bonds and their properties. Molecular structures of compounds. Selective organic reactions.

Different types of solutions and their compositions. Phase rule, phase diagram of monocomponent system. Properties of dilute solutions. Thermochemistry, chemical kinetics, chemical equilibria. Ionization of water and pH concept. Electrical properties of solution.

CHEM 114 Inorganic, Quantitative Analysis Sessional

1.5 Credit Hours, 3 Contact Hours per Week

Volumetric analysis: acid-base titration, oxidation-reduction titrations, determination of Fe, Cu and Ca volumetrically.

4.5.7 Mathematics

MATH 157 Calculus I

3 Credit Hours, 3 Contact Hours per Week

Differential Calculus: Limits, continuity and differentiability. Successive differentiation of various types of functions. Leibnitz's theorem. Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms. Lagrange's form of remainders. Cauchy's form of remainders. Expansion of functions, evaluation of indeterminate forms of L' Hospital's rule. Partial differentiation. Euler's theorem. Tangent and normal. Subtangent and subnormal in cartesian and polar co-ordinates. Determination of maximum and minimum values of functions. Curvature. Asymptotes. Curve tracing.

Integral Calculus: Integration by the method of substitution. Standard integrals. Integration by successive reduction. Definite integrals, its properties and use in summing series. Walli's formulae. Improper integrals. Beta function and Gamma function. Area under a plane curve and area of a region enclosed by two curves in cartesian and polar co-ordinates. Volumes and surface areas of solids of revolution.

MATH 159 Calculus II

3 Credit Hours, 3 Contact Hours per Week

Complex Variable: Complex number system. General functions of a complex variable. Limits and continuity of a function of complex variable and related theorems. Complex differentiation and the Cauchy-Riemann equations. Infinite series. Convergence and uniform convergence. Line integral of a complex function. Cauchy's integral formula. Liouville's theorem. Taylor's and Laurent's theorem. Singular points. Residue. Cauchy's residue theorem.

Vector Analysis: Multiple product of vectors. Linear dependence and independence of vectors. Differentiation and integration of vectors together with elementary applications. Line, surface, and volume integrals. Gradient of a scalar function, divergence and curl of a vector function, various formulae. Integral forms of gradient, divergence and curl. Divergence theorem. Stoke's theorem, Green's theorem and Gauss's theorem.

MATH 257 Ordinary and Partial Differential Equations

3 Credit Hours, 3 Contact Hours per Week

Ordinary Differential Equations: Degree and order of ordinary differential equations, formation of differential equations. Solution of first order differential equations by various methods. Solution of general linear equations of second and higher orders with constant coefficients. Solution of homogeneous linear equations. Solution of differential equations of the higher order when the dependent or independent variables are absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method.

Partial Differential Equations: Introduction. Linear and non-linear first order equations. Standard forms. Linear equations of higher order. Equations of the second order with variable coefficients. Wave equations. Particular solution with boundary and initial conditions.

MATH 259 Linear Algebra

3 Credit Hours, 3 Contact Hours per Week

Introduction to systems of linear equations. Gaussian elimination. Definition of matrices. Algebra of matrices. Transpose of a matrix and inverse of matrix. Factorization. Determinants. Quadratic forms. Matrix polynomials. Euclidean n-space. Linear transformation from IRn to IRm. Properties of linear transformation from IRn to IRm . Real vector spaces and subspaces. Basis and dimension. Rank and nullity. Inner product spaces. Gram-Schmidt process and QR-decomposition. Eigenvalues and eigenvectors. Diagonalization. Linear transformations. Kernel and Range. Application of linear algebra to electric networks.

MATH 357 Probability and Statistics

3 Credit Hours, 3 Contact Hours per Week

Introduction. Sets and probability. Random variable and its probability distributions. Treatment of grouped sampled data. Some discrete probability distributions. Normal distribution. Sampling theory. Estimation theory. Tests of hypotheses. Regression and correlation. Analysis of variance.

4.5.8 Humanities

HUM 127 Sociology

3 Credit Hours, 3 Contact Hours per Week

Introduction: Society, Science and Technology- an overview; Scientific Study of Society; Social Elements, Society, Community, Association and Institution; Mode of Production and Society Industrial Revolution, Development of Capitalism.

Culture and Socialization: Culture; Elements of Culture; Technology and Culture; Cultural Lag; Socialization and Personality; Family; Crime and Deviance; Social Control. Technology, Society and Development; Industrialization and Development; Development and Dependency Theory; Sustainable Development; Development and Foreign Borrowing; Technology Transfer and Globalization, Modernity and Environment; Problem and Prospects.

Pre-industrial, Industrial and Post-industrial Society: Common Features of Industrial Society; Development and Types of Social Inequality in Industrial Society; Poverty, Technology and Society; Social Stratification and Social Mobility; Rural and Urban Life, and their Evaluation.

Population and Society: Society and Population; Fertility. Mortality and Migration; Science, Technology and Human Migration; Theories of Population Growth-Demographic Transition Theory, Malthusian Population Theory; Optimum Population Theory; Population Policy.

HUM 135 English

3 Credit Hours, 3 Contact Hours per Week

General discussion: Introduction, various approaches to learning English.

Grammatical Problems: Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.

Reading Skill: Discussion readability, scan and skin reading, generating ideas through purposive reading, reading of selected stories.

Writing Skill: Principles of effective writing; Organization, planning and development of writing; Composition, precis writing, amplification.

General strategies for the writing process: Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.

Approaches to Communication: Communication today, business communication, different types of business communication.

Listening Skill: The phonemic systems and correct English pronunciation.

Speaking Skill: Practicing dialogue; Story telling; Effective oral presentation.

Report Writing: Defining a report, classification of reports, structure of a report, and writing of reports.

HUM 137 Professional Ethics

3 Credit Hours, 3 Contact Hours per Week

Definition and scopes of Ethics. Different branches of Ethics. Social change and the emergence of new technologies. History and development of Engineering Ethics. Science and Technology- necessity and application. Study of Ethics in Engineering. Applied Ethics in engineering.

Human qualities of an engineer. Obligation of an engineer to the clients. Attitude of an engineer to other engineers. Measures to be taken in order to improve the quality of engineering profession.

Ethical Expectations: Employers and Employees; inter-professional relationship: Professional Organization- maintaining a commitment of Ethical standards. Desired characteristics of a professional code. Institutionalization of Ethical conduct.

HUM 272 Developing English Skills Laboratory

1.5 Credit Hours, 3 Contact Hours per 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, inferencing; 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, complains, apologies, describing people and places, narrating events.

HUM 277 Fundamentals of Economics

3 Credit Hours, 3 Contact Hours per Week

Introduction to economics. Economics and engineering. Different economic systems. Fundamental economic problems. Basic elements of demand, supply and product market. Theory of utility and preferences, consumer’s surplus. Theory of production and cost. Theory of the firm and market structure. Optimization.

Introducing macroeconomics. National income accounting, the simple Keynesian analysis of national income, employment and inflation. Savings, investment and decision making. Fiscal policy and monetary policy- money and interest rate, income and spending.

Economics of development and planning.

HUM 279 Financial and Managerial Accounting

3 Credit Hours, 3 Contact Hours per Week

Financial Accounting: Objectives and importance of accounting, branches of accounting, accounting as an information system, computerized system and applications in accounting. Recording System: Double entry mechanism, accounts and their classification, accounting equation, accounting cycle journal, ledger, trial balance. Preparation of financial statements considering adjusting and closing entries. Accounting concepts and conventions. Financial statements analysis and interpretation: ration analysis- tests for profitability, liquidity, solvency and overall measure.

Costs and Management Accounting: Cost concept and classification. Segregation and mixed cost. Overhead cost: meaning and classification, allocation of overhead cost, overhead recovery method. Job order costing: preparation of job cost sheet and quotation price. Inventory valuation: absorption costing and variable costing technique. Cost volume profit analysis: meaning, breakeven analysis, contribution margin approach, sensitivity analysis. Short-term investment decisions: Relevant and differential cost analysis; Linear programming. Long-term investment decisions: Capital budgeting, various techniques of evaluation of capital investment, investment appraisal under uncertainty, risk management, capital rationing. Concept of working capital, need for working capital, management of cash, stock debtors.

4.6 Equivalence of Old Courses with New Courses

4.6.1 Equivalence of EEE Courses

Course Number of Previous Course	Course Number of Present Course
EEE 101 Electrical Circuits I	EEE 101 Electrical Circuits I
EEE 105 Electrical Circuits II	EEE 105 Electrical Circuits II
EEE 106 Electrical Circuits Laboratory	EEE 102 Electrical Circuits Laboratory I and EEE 106 Electrical Circuits Laboratory II
EEE 110 Electrical Circuits Simulation Laboratory	EEE 110 Electrical Circuits Simulation Laboratory
EEE 201 Electronics I	EEE 201 Electronic Circuits I
EEE 203 Energy Conversion I	EEE 203 Energy Conversion I
EEE 205 Energy Conversion II	EEE 205 Energy Conversion II
EEE 206 Energy Conversion Laboratory	EEE 206 Energy Conversion Laboratory
EEE 207 Electronics II	EEE 207 Electronic Circuits II
EEE 208 Electronics Laboratory	EEE 208 Electronic Circuits Laboratory
EEE 209 Engineering Electromagnetics	EEE 209 Engineering Electromagnetics
EEE 210 Electronic Circuits Simulation Laboratory	EEE 210 Electronic Circuits Simulation Laboratory
EEE 212 Numerical Technique Laboratory	EEE 212 Numerical Technique Laboratory.
EEE 301 Continuous Signals and Linear Systems	EEE 211 Continuous Signals and Linear Systems
EEE 303 Digital Electronics	EEE 303 Digital Electronics
EEE 304 Digital Electronics Laboratory	EEE 304 Digital Electronics Laboratory

EEE 305 Power System I	EEE 305 Power System I
EEE 306 Power System I Laboratory	EEE 306 Power System I Laboratory
EEE 307 Electrical Properties of Materials	EEE 307 Electrical Properties of Materials
EEE 309 Communication Theory	EEE 309 Communication Systems I
EEE 310 Communication Laboratory	EEE 310 Communication Systems I Laboratory
EEE 311 Digital Signal Processing I	EEE 311 Digital Signal Processing I
EEE 312 Digital Signal Processing I Laboratory	EEE 312 Digital Signal Processing I Laboratory
EEE 314 Electrical Services Design	EEE 414 Electrical Services Design
EEE 315 Microprocessor and Interfacing	EEE 415 Microprocessors and Embedded Systems
EEE 316 Microprocessor and Interfacing Laboratory	EEE 416 Microprocessors and Embedded Systems Laboratory
EEE 400 Project/Thesis	EEE 400 Thesis/Project
EEE 401 Control System I	EEE 317 Control System I
EEE 402 Control System I Laboratory	EEE 318 Control System I Laboratory
EEE 413 Solid State Devices	EEE 313 Solid State Devices
Elective Interdisciplinary Courses and Laboratories	
Course Number of Previous Course	**Course Number of Present Course**
EEE 421 Control System II	EEE 421 Control System II
EEE 422 Control System II Laboratory	EEE 422 Control System II Laboratory
EEE 423 Numerical Methods	EEE 423 Numerical Methods
EEE 424 Numerical Methods	EEE 424 Numerical Methods

Laboratory	Laboratory
EEE 425 Biomedical Instrumentation	EEE 425 Biomedical Signals, Instrumentation and Measurement
EEE 426 Biomedical Instrumentation Laboratory	EEE 426 Biomedical Signals, Instrumentation and Measurement Laboratory
EEE 427 Measurement and Instrumentation	EEE 427 Measurement and Instrumentation
EEE 428 Measurement and Instrumentation Laboratory	EEE 428 Measurement and Instrumentation Laboratory
Elective Communication Courses and Laboratories	
Course Number of Previous Course	**Course Number of Present Course**
EEE 331 Random Signals and Processes	EEE 331 Random Signals and Processes
EEE 431 Digital Signal Processing II	EEE 431 Digital Signal Processing II
EEE 433 Microwave Engineering	EEE 433 Microwave Engineering
EEE 434 Microwave Engineering Laboratory	EEE 434 Microwave Engineering Laboratory
EEE 435 Optical Fiber Communication	EEE 435 Optical Fiber Communication
EEE 437 Digital Communication	EEE 439 Communication System II
EEE 438 Digital Communication Laboratory	None
EEE 439 Mobile Cellular Communication	EEE 499 Wireless and Mobile Networks
EEE 441 Telecommunication	EEE 441 Telecommunication

Engineering	Engineering
Elective Electronics Courses and Laboratories	
Course Number of Previous Course	**Course Number of Present Course**
EEE 351 Analog Integrated Circuits	EEE 351 Analog Integrated Circuits
EEE 431 Solid State Devices	EEE 313 Solid State Devices
EEE 451 Processing and Fabrication Technology	EEE 451 Processing and Fabrication Technology
EEE 453 VLSI I	EEE 453 VLSI I
EEE 454 VLSI I Laboratory	EEE 454 VLSI I Laboratory
EEE 455 Compound Semiconductor and Hetero-Junction Devices	EEE 455 Compound Semiconductor and Hetero-Junction Devices
EEE 457 VLSI II	EEE 457 VLSI II
EEE 458 VLSI II Laboratory	EEE 458 VLSI II Laboratory
EEE 459 Optoelectronics	EEE 459 Optoelectronics
EEE 461 Semiconductor Device Theory	EEE 461 Semiconductor Device Theory
Elective Power courses and Laboratories	
Course Number of Previous Course	**Course Number of Present Course**
EEE 371 Power System II	EEE 371 Power System II
EEE 471 Energy Conversion III	EEE 471 Energy Conversion III
EEE 473 Power Electronics	EEE 315 Power Electronics
EEE 474 Power Electronics Laboratory	EEE 316 Power Electronics Laboratory
EEE 475 Power Plant Engineering	EEE 475 Power Plant Engineering

EEE 477 Power System Protection	EEE 477 Power System Protection
EEE 478 Power System Protection Laboratory	EEE 478 Power System Protection Laboratory
EEE 479 Power System Reliability	EEE 479 Power System Reliability.
EEE 481 Power System Operation and Control	EEE 481 Power System Operation and Control
EEE 483 High Voltage Engineering	EEE 483 High Voltage Engineering
EEE 484 High Voltage Engineering Laboratory	EEE 484 High Voltage Engineering Laboratory

4.6.2 Equivalence of Non-EEE Courses

Course Number of Previous Course	**Course Number of Present Course**
Core Courses and laboratories offered By Department of CSE to all EEE Students	
CSE 109 Computer Programming	CSE 109 Computer Programming
CSE 110 Computer Programming Sessional	CSE 110 Computer Programming Sessional
Elective courses and laboratories offered by Department of CSE to EEE students	
CSE 451 Computer Networks	CSE 451 Computer Networks
CSE 452Computer Networks Laboratory	CSE 452 Computer Network Laboratory
Course offered By the Department of CE to all EEE students	
CE 106 Engineering Drawing	CE 106 Engineering Drawing
Courses and laboratories offered By the Department of ME to all EEE students	
ME 267 Mechanical Engineering Fundamentals	ME 267 Mechanical Engineering Fundamentals

ME 268 Mechanical Engineering Fundamentals Sessional	ME 268 Mechanical Engineering Fundamentals Sessional
Course Offered By the Department of Industrial Production Engineering to all EEE students	
IPE 493 Industrial Management	IPE 493 Industrial Management
Courses and laboratories Offered By the Department of Physics to all EEE students	
PHY 121 Waves and Oscillations, Optics and Thermal Physics	PHY 121 Waves and Oscillations, Optics and Thermal Physics
PHY 102 Physics Sessional	PHY 102 Physics Sessional
PHY 165 Electricity and Magnetism, Modern Physics and Mechanics.	PHY 165 Electricity and Magnetism, Modern Physics and Mechanics
PHY 104 Physics Sessional	None
Courses and laboratories offered By the Department of Chemistry to all EEE students	
CHEM 101 Chemistry	CHEM 101 Chemistry
CHEM 114 Inorganic, Quantitative Analysis Sessional	CHEM 114 Inorganic, Quantitative Analysis Sessional
Courses Offered By the Department of Mathematics to all EEE students	
MATH 157 Calculus I	MATH 157 Calculus I
MATH 159 Calculus II	MATH 159 Calculus II
MATH 257 Ordinary and Partial Differential Equations	MATH 257 Ordinary and Partial Differential Equations
MATH 269 Linear Algebra.	MATH 259 Linear Algebra.
MATH 357 Probability and Statistics	MATH 357 Probability and Statistics
Courses and laboratories offered By the Department of Humanities to all EEE students	
HUM 127 Sociology	HUM 127 Sociology

HUM 135 English	HUM 135 English
HUM 137 Professional Ethics	HUM 137 Professional Ethics
HUM 272 Developing English Skills Laboratory	HUM 272 Developing English Skills Laboratory
HUM 277 Fundamentals of Economics	HUM 277 Fundamentals of Economics
Hum 279 Financial and Managerial Accounting	HUM 279 Financial and Managerial Accounting

Chapter 5

EEE COURSES FOR OTHER DEPARTMENTS

The courses offered by the Department of Electrical and Electronic Engineering for undergraduate students of other departments of BUET are following.

5.1 Computer Science and Engineering

EEE 163 Introduction to Electrical Engineering

3 Credit Hours, 3 Contact Hours per Week

Direct Current: voltage, current, resistance and power. Laws of electrical circuits and methods of network analysis; Introduction to filters: passive and active filters. Alternating current: instantaneous and rms values of current, voltage and power, average power, for various combination of R, L, and C circuits, phasor representation of sinusoidal quantities, Balanced three phase circuits. Ideal operational amplifier circuits.

EEE 164 Introduction to Electrical Engineering Sessional

1.5 Credit Hours, 3 Contact Hours per Week

Experiments based on EEE163.

EEE 263 Electronic Circuits

4 Credit Hours, 4 Contact Hours per Week

Ideal device characteristics of diode, bipolar junction transistor (BJT), metal oxide semiconductor field effect transistor (MOSFET).

Wave shaping circuits, diode wave shaping techniques, clipping and clamping circuits, comparator circuits, switching circuits.

Amplifiers: BJT and MOSFET amplifiers.

Linear Integrated Circuits: Op-Amps, Oscillators, Timers (555), Function generators, Phase Locked Loop (PLL), analogue switches.

Digital Circuits: Logic gates, Logic families; TTL and CMOS Logics; Flip Flops, counters and registers, memory systems; A/D and D/A converters, S/H circuits.

EEE 264 Electronic Circuits Sessional

1.5 Credit Hours, 3 Contact Hours per Week

Experiments based on EEE 263.

EEE 269 Electrical Drives and Instrumentation

3 Credit Hours, 3 Contact Hours per Week

Introduction to three phase circuits, alternators and transformers; Principles of operation of DC, synchronous, induction, universal and stepper motors; Thyristor and microprocessor based speed control of motors.

Instrumentation amplifiers: differential, logarithmic, and chopper amplifiers; frequency and voltage measurements using digital techniques; recorders and display devices, spectrum analyzers and logic analyzers; data acquisition and interfacing to microprocessor based systems; Transducers: terminology, types, principles and application of photovoltaic, piezoelectric, thermoelectric, variable resistance and optoelectronic transducers; Noise reduction in instrumentation.

EEE 270 Electrical Drives and Instrumentation Sessional

3 Credit Hour, 3 Contact Hours per Week

Experiments based on EEE 269

EEE 463 Optical Communications

3 credit Hours, 3 Contact Hour per week

Introduction to Optical communication; guided and un-guided optical communication system, light propagation through guided medium; Optical fibres: SMF and MMF, SI Fibres and GI Fibres. Transmission impairments: fibre loss, chromatic dispersion in fibre, polarization mode dispersion (PMD), different types of fibres: DSF, DCF, dispersion compensation schemes, fibre cabling process, fibre joints/connectors and couplers. Optical transmitters: LED and Laser: Operating principle and characteristics. Optical receivers: PN, PIN and APD detectors. Noise at the receivers, SNR and BER. IM/DD and coherent communication systems. Non-linear effects in optical fibres. Optical amplifiers, optical modulators, multi-channel optical systems: Optical FDM, OTDM and WDM. Light wave networks: WDMA, FDMA, TDMA and CDMA, Optical Access Network, Optical network access protocol, Optical link design.

EEE 465 Telecommunication Systems

3 Credit Hour, 3 Contact hours per week

Introduction: Principle, evolution and telecommunication networks, National and International regulatory bodies. Basic elements of telecommunication, message source and bandwidth, Transmission medium: twisted pair cable, coaxial cable, wireless channel and electromagnetic spectrum, satellite channel and fibre optic cable, transmission impairment, noise and noise to signal ratio, transmission capacity. Analogue and digital transmission, telephone apparatus, telephone exchanges, subscriber loop, supervisory tones, PSTN. Switching systems. Introduction to analogue system, strowger and crossbar switching system, stored program controlled system (SPC), Digital switching system, space division switching, time division switching. Traffic analysis, traffic characterization, grade of service, network blocking probabilities, delay system and queuing. Integrated service digital network (ISDN); N-ISDN and B-ISDN, architecture of ISDN, B-ISDN implementation. Digital subscriber loop (DSL), Wireless local loop (WLL), FTTx, PDH and SONNET/SDH, WDM network, IP telephony and VoIP, ATM network and next generation network (NGN).

5.2 Biomedical Engineering

EEE 171 Electrical Circuits

3 Credit Hours, 3 Contact Hour per week

Introduction to electric circuit: laws and theorems for dc circuit; AC circuit; AC circuit: circuit analysis techniques with phasors for single phase sinusoidal circuits (RL, RC and RLC), transient response of capacitor and inductor circuits, sinusoidal steady state response, resonance, four wire system of generated emfs, balanced poly phase circuits, three phase three wire system, power in balanced three phase systems; Filter circuits: active and passive; ideal operational amplifier circuits; magnetic circuits; Transformers.

EEE 172 Electrical Circuits Sessional

1.5 Credit Hours, 3 Contact Hour per week

Experiment based on EEE 171.

EEE 273 Basic Electronic Devices and Circuits

3 Credit Hours, 3 Contact Hour per week

Introduction to semiconductors; p-type and n-type semiconductors; p-n junction diode characteristics; Diode applications; half and full wave rectifiers; clipping and clamping circuits; regulated power supply using zener diode, Bipolar Junction Transistor (BJT); principle of operation; I-V characteristics; Transistor circuit configurations (CE, CB, CC), BJT biasing; load lines; BJTs at low frequencies, Hybrid model, h parameters, simplified hybrid model; Small signal analysis of signal analysis of single and multi-stage amplifiers; frequency response of BJT amplifiers; Field Effect Transistors (FET); principle of operation of JFET and MOSMET; Depletion and enhancement type NMOS and PMOS; biasing FETs; Low and high frequency models of FETs, Switching circuits using FETs; Introduction to CMOS. Operational Amplifiers (OpAmp); linear applications of OpAmps, gain input and output impedances; active filters; frequency response and noise.

EEE 274 Basic Electronic Devices and Circuits Sessional

1.5 Credit Hours, 3 Contact Hour per week

Experiments Based on EEE 273.

EEE 375 Digital Signal Processing

3 Credit Hours, 3 Contact Hour per week

Introduction to digital signal processing. Sampling and signal reconstruction. Analysis of discrete-time system in the time domain: impulse response model, difference equation model. Correlation of signals with biomedical applications. Z-transform and analysis of LTI systems. Frequency analysis of discrete-time signals: discrete Fourier series and discrete-time Fourier transform (DTFT). Frequency analysis of LTI systems. Discrete Fourier transform (DFT) and fast Fourier transform (FFT). Calculation of spectrum of biomedical signals. Digital filter design-linear phase filters, specifications, design using window, optimal methods; IIR filters-specifications, design using impulse invariant, bi-linear z-transformation, least-square method.

EEE 376 Digital Signal Processing Sessional

3 Credit Hours, 3 Contact Hour per week

Experiments Based on EEE 375.

EEE 377 Random Signals and Process

3 Credit Hours, 3 Contact Hour per week

Probability and Random variables: Sample space, set theory, probability measure, conditional probability, total probability, Bayes theorem, independence and uncorrelatedness. Expectation, Variance, moments and characteristic functions. Commonly used distribution and density functions. Central limit theorem. Transformation of a random variables: one, two and N random variables. Joint distribution, density, moments and characteristic functions, system reliability. Random Processes: Correlation and covariance functions. Process measurements. Gaussian, and Poisson random processes. Markov Process. Noise models. Stationarity and Ergodicity. Spectral Estimation. Correlation and power spectrum. Cross spectral densities. Response of linear systems to random inputs, Optimal filters: Wiener and matched filters, Statistical Estimation Techniques (ML, MMSE, MAP).

5.3 Civil Engineering

EEE 165 Basic Electrical Technology

3 Credit Hours, 3 Contact Hours per week

Electrical units and standards. Electrical networks and circuit solution: series, parallel, node and mesh analysis. Instantaneous current, voltage and power, effective current and voltage, average power. Sinusoidal single phase RLC circuits: phasor algebra, balanced three phase circuits. Electrical wiring for residential and commercial loads. Introduction to transformers and induction motors.

5.4 Water Resources Engineering

EEE 165 Basic Electrical Technology

3 Credit Hours, 3 Contact Hours per week

Electrical units and standards. Electrical networks and circuit solution: series, parallel, node and mesh analysis. Instantaneous current, voltage and power, effective current and voltage, average power. Sinusoidal single phase RLC circuits: phasor algebra, balanced three phase circuits. Electrical wiring for residential and commercial loads. Introduction to transformers and induction motors.

5.5 Mechanical Engineering

EEE 159 Fundamentals of Electrical Engineering
3 Credit Hours, 3 Contact Hours per week

Laws of Electric Circuit: Ohm's law, Kirchhoff's voltage and current laws, delta wye transformation. Electrical networks: network analysis methods of branch and loop currents, method of node pair voltages, Thevenin's and Norton's theorems, magnetic concepts and units: magnetic field, right hand rule, magnetic flux density, Biot-Savart law, magnetic field intensity, measurement of magnetic flux, energy of magnetic field, characteristic of ferromagnetic materials, theory of ferromagnetism, B-H curve, hysteresis loss, eddy current and eddy current loss, total core loss, introduction to magnetic circuits. Electromagnetic forces: forces upon a current carrying conductor and charges particle moving in a magnetic field. Electromagnetic torque; electric motor. Electromagnetic induction and emf; Lenz's law, Blv rule, elementary ac generator.

General concepts and definitions. Instantaneous current, voltage and power, R, L, C, RL, RC, and RLC branches, Effective value, average value, form factor, crest factor, power real and reactive. Introduction to vector algebra. Impedance in polar and Cartesian forms. Sinusoidal single phase circuit analysis. Impedance in series, parallel branches, series parallel circuits. Network analysis- Thevenin's theorem. Balanced poly phase circuits: three phase, four wire system of generated emfs, three phase three wire systems, balanced Y loads, balanced delta loads, power in balanced systems, power factor.

EEE 160 Fundamentals of Electrical Engineering Sessional

0.75 Credit Hours, 3 Contact Hours per alternate week

Laboratory experiments based on EEE 159.

EEE 259 Electrical and Electronic Technology

4 Credit Hours, 4 Contact Hours per week

Balanced three phase circuit analysis and power measurement. Single phase transformer- equivalent circuit and laboratory testing, introduction to three phase transformers. DC generator principle, types, performances and characteristics. DC Motor: principles, types of motor, performances, speed control, starters and characteristics. AC Machines: three phase induction motor principles, equivalent circuit. Introduction to synchronous machines and fractional horse power motors.

Semiconductor diode, transistor characteristics, equivalent circuits, self biasing circuits, emitter follower amplifiers, push pull amplifier. Introduction to silicon controlled rectifier and its application. Oscilloscope. Transducers: strain, temperature, pressure, speed and torque measurement.

EEE 260 Electrical and Electronic Technology Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 259.

5.6 Chemical Engineering

EEE 155 Electrical Engineering Fundamentals

3 Credit Hours, 3 Contact Hours per week

Electrical units and standards, electrical networks and circuit theorems, introduction to measurement and instrumentations.

Alternating current, RLC series, parallel circuits, magnetic concepts and magnetic circuits.

EEE156 Electrical Engineering Fundamentals Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 155.

EEE 267 Electrical and Electronic Technology

3 Credit Hours, 3 Contact Hours per week

Balanced three phase circuits. Introduction to single phase and three phase transformers. Principles of construction, operation and applications of DC generator, DC motor, synchronous generator, synchronous motor and induction motor. Semiconductor diode, transistors, operational amplifiers (Op-Amps), silicon controlled rectifiers (SCRs): principles of operation and applications. Oscilloscope. Transducers: temperature, pressure, flow rate, speed and torque measurements.

EEE 268 Electrical and Electronic Technology Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 267.

5.7 Materials and Metallurgical Engineering

EEE 155 Electrical Engineering Fundamentals
3 Credit Hours, 3 Contact Hours per week

Electrical units and standards, electrical networks and circuit theorems, introduction to measurement and instrumentations.

Alternating current, RLC series, parallel circuits, magnetic concepts and magnetic circuits.

EEE 156 Electrical Engineering Fundamentals Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 155.

EEE 267 Electrical and Electronic Technology

3 Credit Hours, 3 Contact Hours per week

Balanced three phase circuits. Introduction to single phase and three phase transformers. Principles of construction, operation and applications of DC generator, DC motor, synchronous generator, synchronous motor and induction motor. Semiconductor diode, transistors, operational amplifiers (Op-Amps), silicon controlled rectifiers (SCRs): principles of operation and applications. Oscilloscope. Transducers: temperature, pressure, flow rate, speed and torque measurements.

5.8 Naval Architecture Marine Engineering

EEE 161 Electrical Engineering Principles

3 Credit Hours, 3 Contact Hours per week

Direct Current: Theorems of electric circuit, electrical network analysis, measuring instruments.

Alternating current: AC quantities and waveforms, phasor algebra, AC circuit analysis, three phase circuits. Transformers: Single phase and three phase, auto transformer.

Fundamentals of DC generators, DC motors: principle and operation.

EEE 261 Electrical and Electronic Technology for Marine Engineers

3 Credit Hours, 3 Contact Hours per week

Three phase induction motors. AC generators, synchronous motor, speed control of three phase motors.

Diodes, BJTs, diode and BJT circuits, BJT, MOSFET and SCR as power switching devices, controlled rectifiers and inverters.

Radar and wireless equipment, electronic navigation aids, LORAN, RDF and Decca Chain.

EEE 262 Electrical and Electronic Technology for Marine Engineers Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 261.

5.9 Industrial Production Engineering

EEE 167 Basic Electrical and Electronic Circuits

4 Credit Hours, 4 Contact Hours per week

Direct Current Circuits: laws and theorems, DC network analysis.

Alternating current: AC quantities and sinusoidal waveforms, phasors, AC circuit analysis: series and parallel branches RL, RC and RLC. Balanced three phase circuits.

Semiconductor diode: operation, characteristics and applications.

Introduction to bipolar transistor (BJTs): characteristics, common emitter (CE), common base (CB) and common collector (CC) amplifier configurations.

EEE 168 Basic Electrical and Electronic Circuits Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 167.

EEE 271 Electrical Machines and Electronics

3 Credit Hours, 3 Contact Hours per Week

Single phase transformer. DC motor: principle and applications. Three phase induction motor: principle and applications. Introduction to synchronous motors and fractional horse power motors.

Introduction to operational amplifiers (Op-Amps) and applications. Silicon controlled rectifier (SCR): operation and characteristics. Power control using SCR. Transducers: strain, temperature, pressure, speed and torque measurements.

EEE272 Electrical Machines and Electronics Sessional

1.5 Credit Hours, 3 Contact Hours per week

Laboratory experiments based on EEE 271.

5.10 Architecture

EEE 373 Basic Electrical Engineering for Architects

2 Credit Hour, 2 Contact Hour per week

Introduction to electricity; basic principles, electrical circuit theorems for DC and AC. Illumination: Lighting fundamentals, various light sources, lighting for various applications, Introduction to electrical distribution wiring system, substation layout and renewable energy system in a building.