POSTGRADUATE BULLETIN

DEPARTMENT OF MECHANICAL ENGINEERING

CHITTAGONG UNIVERSITY OF ENGINEERING & TECHNOLOGY (CUET)

Postgraduate Bulletin

Department of

Mechanical Engineering (ME)

Chittagong University of Engineering & Technology (CUET)

Chattogram-4349, Bangladesh

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Message from Vice-Chancellor

It is my immense pleasure to know that Department of Mechanical Engineering is going to publish a Post-graduate bulletin for their students. I really appreciate their great efforts. I do believe that this prospectus could be of great use for students, teachers, researchers and policy makers. It is my great pleasure to welcome your contributions to establish Chittagong University of Engineering & Technology (CUET) as "Centre of Excellence".

My special congratulation goes to faculty members, researchers, staff, and students. As we know, Chittagong University of Engineering & Technology (CUET) has started its journey with a core mission of producing quality human resources who could contribute nationally and globally, particularly in the field of engineering and technology. It has been functioning with a good reputation over the period of 47 years since its inception as engineering college in 1968.

Currently, this university runs various post-graduate programs, such as Master of Science (MSc), Master of Engineering (MEng), Master of Philosophy (MPhil), Post Graduate Diploma (PGD), and Doctor of Philosophy (PhD). Academic programs are harmonized with regularly updated global engineering curricula that help students to compete in the global job market.

To my best of knowledge, Mechanical Engineering (ME) is one of the affluent disciplines of studies to ensure the use of advanced technology for the betterment of human kind. Mechanical Engineering is the studies of energy, its transformation and utilization; and applied mechanics and design. It also focuses on fluid mechanics, applied mechanics, heat transfer, and environmental pollution. In CUET, Mechanical Engineering department has been one of the most prestigious departments since its inception in 1968. I deeply acknowledge their contributions in nation building, particularly to meet the challenges of 21st century, and to achieve the Millennium Development Goals (MDGs).

I appreciate the faculty members and staff of Mechanical Engineering department for their dedication, sincerity and hard working. I am sure that their efforts will bring glories to this university.

Wish you all the very best.

Prof. Dr. Mohammad Rafiqul Alam
Vice-Chancellor
Chittagong University of Engineering and Technology
Chattogram-4349

Message from Dean

Welcome to the Department of Mechanical Engineering at The Chittagong University of Engineering and Technology, where education and research are our highest priorities and excellence is the motto. The university is a major public provider of undergraduate and graduate engineering education in Southern part of Bangladesh.

Nearly half century old one of our Mechanical Engineering is one of the most prestigious departments in this university and even more it has been gaining popularity day by day. We emphasize close interaction with outstanding faculty to create an atmosphere truly conducive to learning. In the recent past we have added degree programs in Petroleum and Mining Engineering and Mechatronics and Industrial Engineering. The programs offer curricula that combine a strong theoretical background with hands-on experience in excellent labs, and focus on teamwork and communication skills.

The graduate programs (Master and doctoral) in this Department of Mechanical Engineering offer opportunities for advanced study and research designed to prepare students for leadership roles in engineering careers with industry, government, or educational institutions. They also provide a pathway toward self-improvement and life-long learning for practicing engineers.

We are one of the fastest growing universities of engineering in Bangladesh. If you are looking for an exceptional engineering educational experience in one of the most diverse and beautiful campus in Bangladesh, come join us as we will make you an excellent Mechanical Engineer for the days to come!

Prof. Dr. Jamal Uddin Ahamed
Dean
Faculty of Mechanical Engineering
Chittagong University of Engineering & Technology

Head of the Department

The Department of Mechanical Engineering is established to focus expertise and leadership to graduates. We are offering undergraduate and postgraduate programs to meet the need of the society and thus contributing to the economic growth of the country. The courses cover a wide range including electronics, computing, information processing, thermodynamics, industrial management, control theory etc to cope up with the today's interdisciplinary demand.

The Department of Mechanical Engineering is established to strive for excellence through the creation, preservation, transfer, and application of knowledge to her graduates. The engineering education in the Department of Mechanical Engineering, CUET is respected and valued for its research and education quality at both the national and international level. Along with an exceptional undergraduate program, here a substantial program is offered at the postgraduate level aimed at meeting the needs of industries and thus contributing to the economic growth of the country. The main objective of this department is to maintain a high standard of mechanical engineering education through excellent teaching-learning and innovative curricula that reflect the changing needs of the society, demonstrate and disseminate research outcomes through publications and undertake collaborative research to create opportunities for long term interaction with academia and industries. The Department of Mechanical Engineering is proud to have dedicated faculty members with high qualifications and accomplishments. The department's state of the art facilities and instrumentation provide the supporting tools for comprehensive educational and research activities. The course curriculum is updated regularly to provide quality education and moral values and to cope with the recent advancement in the field of engineering. The graduates from the Department of Mechanical Engineering have been very successful and have risen to distinguished positions in the industry, government, and academia at home and abroad.

Besides the academic activities, the Department of Mechanical Engineering usually organizes several national and international seminars, workshops and conferences. It proudly organizes the International Conference on Mechanical Engineering and Renewable Energy biannually (ICMERE). The department also conducts Roborace competition, mechanics Olympiad, CAD competition etc. I thank the faculty members, staffs and students for their spontaneous participation for making these events successful.

I thank and congratulate the faculty members for their priceless effort in publishing this bulletin. Hopefully, the publication will fulfill the requirements for the postgraduate students and the faculty members.

Prof. Dr. Kazi Afzalur Rahman
Head
Department of Mechanical Engineering
Chittagong University of Engineering and Technology
Chattogram-4349, Bangladesh

CHAPTER 1

General Information

1.1 Introduction

Chittagong University of Engineering and Technology (CUET) is one of the prominent and leading, autonomous self-degree awarding Universities of Bangladesh in the field of Engineering and Technological education. It is unique and incompatible due to its proximity of Chattogram, the major sea port and hill city of Bangladesh. The University is situated alongside the Chattogram-Kaptai road, 25 km away from the heart of commercial capital of Bangladesh. Moreover, attractive tourist spots of the country like the largest hydroelectric power plant at Kaptai, the natural lake of Kaptai, hills of Rangamati and Bandarban, and the longest sea beach of the world and tourist resort of Cox's Bazar are a few hours journey from the University. The University has a beautiful hill side land of about 163 acres with a panoramic natural view. The main vision of CUET is to send out graduates with trained and educated minds, to serve as a source of intellectual potentiality. To foster and promote a distinctive educational institute identity and spirit is one of the basic goals of the university.

1.2 Historical Backround

August 28, 1962: To meet the increasing demand of professional engineers for the national development, the national economic council of the Government of Pakistan decided to establish the Engineering College, Chittagong.

December 28, 1968: The college started functioning by admitting 120 students in its first academic session under the faculty of Engineering, University of Chittagong.

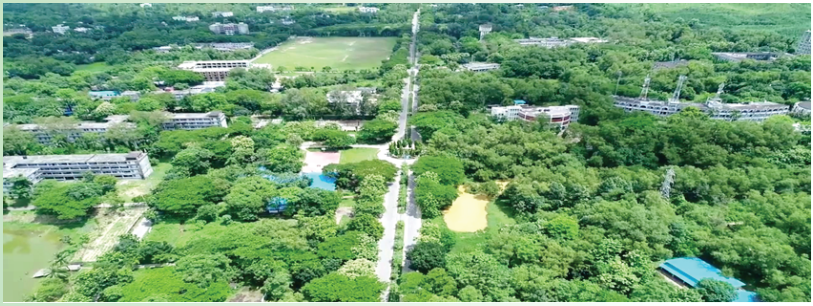
July 1, 1986: The college was declared as a self-degree awarding institution and was renamed "Bangladesh Institute of Technology (BIT), Chittagong".

September 1, 2003: To enlarge the engineering education, the institution was converted into a university named as "Chittagong University of Engineering and Technology (CUET)".

1.3 Faculties and Departments

The University has 18 teaching departments under five faculties. All departments except the department of Humanities offer degree programs; however some of them offer only postgraduate(PG) degrees. In addition the university has 3 institutes & 3 research centers. Faculty based list of the departments with the currently offered degree programs is given below:

Department	Offering degree programs
Faculty of Civil Engineering	
Department of Civil Engineering	UG and PG
Department of Disaster Engineering & Management	PG
Department of Water Resources Engineering	UG
Faculty of Mechanical Engineering	
Department of Mechanical Engineering	UG and PG
Department of Petroleum and Minning Engineering	UG
Department of Mechatronics & Industrial Engineering	UG
Faculty of Electrical & Computer Engineering	
Department of Electrical & Electronic Engineering	UG and PG
Department of Computer Science & Engineering	UG and PG
Department of Electronic & Telecommunication Engineering	UG and PG
Department of Biomedical Engineering	UG
Faculty of Architecture & Planning	
Department of Architecture	UG
Department of Urban & Regional Planning	UG
Department of Humanities	---
Faculty of Engineering & Technology	
Department of Physics	PG
Department of Chemistry	PG
Department of Mathematics	PG
Department of Materials Science & Engineering	UG
Department of Nuclear Engineering	PG
Institutes	PG
Institute of Energy Technology	PG
Institute of Earthquake Engineering Research(IEER)	PGD
Institute of Information & Communication Technology (IICT)	---
Research Centers	---
Center for Enviormental Science and Engineering (CESE)	---
Center for River, Harbor & Landslide Research (CRHLSR)	
Center for Industrial Problems Research (CIPR)	



1.4 University Administration

The Honorable President of the People's Republic of Bangladesh is the Chancellor of the University. The Vice-Chancellor is the chief executive officer of the University. The Syndicate is the principle executive body of the university and consists of sixteen members. The Academic Council, Finance Committee, Planning and Development Committee etc. assist the Syndicate. The Academic Council, comprising the faculty of the University and other external expert members, is the apex educational body of the University.

1.5 Academic Activities

Postgraduate studies and research are now one of the primary functions of this University. Department of Civil Engineering, Electrical & Electronic Engineering, Mechanical Engineering, Computer Science & Engineering, ETE, Physics, Mathematics, and Chemistry, DEM offers M.Sc. Engg./M.Engg./M.- Phil./Phd degrees. In addition to its own research programs, the University undertakes research programs sponsored by outside organizations. The expertise of the University teachers and the laboratory facilities of the university are also utilized to solve problems and to provide up-to-date engineering and technological knowledge to the various organizations of the country. The University is persistent in its effort to improve its research facilities, staff position, courses and curriculum to meet the growing technological challenges.

CUET at a Glance

Chancellor	Vice-Chancellor
Mr. Md. Abdul Hamid Hon'ble President of the People's Republic of Bangladesh	**Prof. Dr. Mohammad Rafiqul Alam**

1968: Year of Establishment	1986: Transformation into Bangladesh Institute of Technology (BIT), Chittagong	2003: Conversion into Chittagong University of Engineering & Technology (CUET)

Land	**Location**
171 acres of land blessed with natural lakes and hills	Along side of the Chattogram-Kaptai road, 25 kilometers from the center of Chattogram City

Faculty	**Departments**	**Students Intake**	
		Undergraduate Program (B.Sc. Engg./ B.Arch./ B.URP)	**Graduate Program (M.Sc. Engg./ M. Engg./ M.Phil./ Ph.D.) (Approx. no. of students)**
Faculty of Civil Engineering	Dept. of Civil Engineering (CE) Dept. of Disaster Engineering & Management (DEM) Dept. of Water Resources Engineering (WRE)	130 (CE) 30 (WRE)	35 (CE) 30 (DEM)
Faculty of Mechanical Engineering	Dept. of Mechanical Engineering (ME) Dept. of Petroleum & Mining Engineering (PME) Dept. of Mechatronics & Industrial Engineering (MIE)	180 (ME) 30 (PME) 30 (MIE)	50 (ME)
Faculty of Electrical & Computer Engineering	Dept. of Electrical & Electronic Engineering (EEE) Dept. of Computer Science & Engineering (CSE) Dept. of Electronics & Tele-Communication Engineering (ETE) Dept. of Biomedical Engineering (BME)	180 (EEE) 130 (CSE) 60 (ETE) 30 (BME)	30 (EEE) 50 (CSE) 30 (ETE)
Faculty of Architecture & Planning	Dept. of Architecture Dept. of Urban & Regional Planning (URP) Dept. of Humanities	30 (Architecture) 30 (URP)	- -
Faculty of Engineering & Technology	Dept. of Physics (Phy) Dept. of Chemistry (Chem) Dept. of Mathematics (Math) Dept. of Materials Science And Engineering (MSE) Dept. of Nuclear Engineering	30 (MSE)	15 (Phy) 20 (Chem) 10 (Math)
Total students intake per academic year		890	270 (Approx.)

Institutes & Centers	**Halls**
Institute of Earthquake Engineering Research (IEER) Institute of Information & Communication Technology (IICT) Institute of Energy Technology (IET) Language Center (LC) Directorate of Research & Extension (DRE) Center for River, Harbor & Lanslide Research (CRHLR) Center for Environmental Science & Engineering (CESE) Center for Industrial Problems Research (CIPR)	For Male Students : 05 (accommodation : 2564) For Female Students : 02 (accommodation : 740)

Current Students	**Graduated Students**
2946 (Undergraduate), 1094 (Graduate)	10449
Faculty Members	**Officers and Staffs**
293	502

CHAPTER 2

DEPARTMENT OF MECHANICAL ENGINEERING

2.1 Introduction

Mechanical Engineering is one of the degree awarding departments which creates leadership among its graduates. Mechanical Engineering is one of the degree awarding departments which and leadership to its graduates, it was started in 1968 through undergraduate program and later, Master's program was introduced in 1999. In every year, after completion of HSC examination, 180 students are enrolled here in undergraduate course which is a 4 years B.Sc. in ME degree program. Moreover, nearly 50 students are enrolled in postgraduate studies every year.

A strong program is offered at the postgraduate level aimed at meeting the needs of industries and thus contributing to the economic growth of the country. Mechanical Engineering is a very wide-ranging field of engineering that involves the application of physical principles for analysis, design, manufacture, installation, operation and maintenance of mechanical systems including internal combustion engines, pumps, fans, blowers, turbines, boilers, refrigerators and air-conditioners, condensers, etc. The major divisions of mechanical engineering are designs and controls, thermo-science and fluids, engineering mechanics and manufacturing. The courses cover a wide range of courses including electronics, computing, information processing, industrial management, control theory, etc. along with core Mechanical Engineering courses. The main objective of this department is to prepare graduates having the knowledge of mechanical engineering integrated with interdisciplinary subjects with an international perspective that ensue organizational competitiveness and growth in a dynamic technological and business environment.

The department of Mechanical Engineering has been recognized for its research and education quality at both national and international level. Our graduates have been very successful and have risen to distinguished positions in the industry, government and academia. The department's state-of-the-art facilities and instrumentation provide the supporting tools for comprehensive educational and research activities.

Vision

To provide a world-class education and to conduct innovative research that instill the professional, technical, critical-thinking, and communication skills necessary for students and faculty to make impactful contributions to society as well as for the whole universe.

Mission

Provide adequate undergraduate and post graduate education in mechanical engineering that equips the students with creativity, quality research and innovation, global outlook, life-long learning and professional ethics intended to meet the emerging needs of the society.

Objectives

- To maintain a high standard of mechanical engineering education through outstanding teaching-learning and innovative curricula that reflects the changing needs of the society.
- To demonstrate and disseminate research outcome through publications.
- To undertake collaborative research to create opportunities for long term interaction with academia and industries.

2.2 Faculty Members

Dr. Kazi Afzalur Rahman
Professor & Head

- **Qualification:** Ph.D. (Singapore)
- **Email:** afzal@cuet.ac.bd
- **Research Interest:** Thermo-fluid Engineering

Dr. Muhammad Mostafa Kamal Bhuiya
Professor

- **Qualification:** Ph.D. (Australia)
- **Email:** mkamal@cuet.ac.bd
- **Research Interest:** Thermal Engineering, Thermodynamics, Applied Thermodynamics, Heat Transfer, Operations Research, Industrial Management

Dr. Md. Tazul Islam
Professor

- **Qualification:** Ph.D. (BUET)
- **Email:** tazul2003@yahoo.com
- **Research Interest:** Fluid Mechanics, Air conditioning & Refrigeration, Renewable Energy

Md. Aminul Islam
Associate Professor

- **Qualification:** M.A.Sc. Engg. (Canada)
- **Email:** aislam@cuet.ac.bd
- **Research Interest:** Microprocessor & Interfacing, Communication, Wireless sensor network

Dr. Bodius Salam
Professor

- **Qualification:** Ph.D. (Scotland)
- **Email:** bodiussalam@yahoo.com
- **Research Interest:** Heat Transfer, Alternate Fuel

Dr. Md. Sanual Rabbi
Associate Professor

- **Qualification:** Ph.D. (Japan)
- **Email:** rabbi@cuet.ac.bd
- **Research Interest:** NDT, SHM, Composite Material, Mechatronics, Industrial Automation

Dr. Md. Mahbubul Alam
Professor

- **Qualification:** Ph.D. (Japan)
- **Email:** malam@cuet.ac.bd, mahbub87@yahoo.com
- **Research Interest:** Fluid Dynamics, CFD, Renewable Energy

Dr. Md. Arafat Rahman
Associate Professor

- **Qualification:** Ph.D. (Australia)
- **Email:** arafat@cuet.ac.bd
- **Research Interest:** Material Engineering, Electrochemistry, Energy Storage System, Nanoporous Materials, Lithium-ion and Air Batteries

Dr. Sajal Chandra Banik
Professor

- **Qualification:** Ph.D. (Japan)
- **Email:** baniksajal@yahoo.com, baniksajal@cuet.ac.bd
- **Research Interest:** Mechatronics, Robotics

Syed Masrur Ahmmad
Associate Professor

- **Qualification:** M.Sc. Engg. (Malaysia)
- **Email:** masrur@cuet.ac.bd
- **Research Interest:** AutoCAD, Mechatronics (Control and Robotics) and Applied Mechanics

Dr. Jamal Uddin Ahamed
Professor

- **Qualification:** Ph.D. (Malaysia)
- **Email:** jamal293@yahoo.com
- **Research Interest:** Air conditioning and Refrigeration, Heat transfer, Energy and Exergy analysis

Dr. Abu Shadat Muhammad Sayem
Associate Professor

- **Qualification:** Ph.D.(Australia)
- **Email:** a.sayem@cuet.ac.bd
- **Research Interest:** Emission Control, Sustainability Assessment & Sciences, Engineering Design, Automobile Engineering

Dr. Sheikh Muhammad Humayun Kabir
Professor

- **Qualification:** Ph.D. (South Korea)
- **Email:** humayun@cuet.ac.bd
- **Research Interest:** Advanced Solid Mechanics, Low-Cycle-Fatigue

Dr. Prasanjit Das
Associate Professor

- **Qualification:** Ph.D. (Australia)
- **Email:** prasanjit@cuet.ac.bd
- **Research Interest:** Fluid Dynamics, Fluid Machinery, CFD, Scale Suppression and Power Technology.

Dr. Mohammad Mizanur Rahman
Professor

- **Qualification:** Ph.D. (Australia)
- **Email:** mmrahman_me@cuet.ac.bd
- **Research Interest:** Catalytic Hydrogen, Fuel cell, Energy conversion, Renewable Energy

2.2 Faculty Members:

Dr. Md. Mamunur Roshid
Assistant Professor

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** mamuncuet2003@cuet.ac.bd
- **Research Interest:** Bubble Acoustics, Bubble Dynamics, Fluid Dynamics, Mathematical Modelling, Ocean Wave-power Machines

Mohammed Abdur Razzaq
Assistant Professor

- **Qualification:** M.Sc. Engg. (CUET)
- **Email:** a.razzaq@cuet.ac.bd , razzaqrazcuet@gmail.com
- **Research Interest:** Heat Transfer, Energy and Exergy, Thermofluids, Nanoaditives, Applied Thermodynamics, Biodiesel

Md. Kamrul Hasan
Assistant Professor

- **Qualification:** M.Sc. Engg. (Japan)
- **Email:** kamrul05@cuet.ac.bd
- **Research Interest:** Mechanics of Materials, Experimental and Computational Solid Mechanics, Materials Processing,Finite Element Analysis, Fracture Mechanics, olymers, Composites and Biomaterials

Mostafizur Rahman
Assistant Professor

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- **Research Interest:** Machine Dynamics & Vibration, Applied Mechanics, Advanced Materials Science and Production & Operation Management

Tilok Kumar Das
Assistant Professor

- **Qualification:** M.Sc. Engg. (Japan)
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- **Research Interest:** Power Plant Engineering, Mechatronics, Robotics, Automobile, Computer Programming, Machine Design.

Farida Ahmed Koly
Assistant Professor

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** farida@cuet.ac.bd
- **Research Interest:** Biomechanis,Biomaterial, Energy Storage System,CFD,Aerodynamics

Dr. Md. Abu Mowazzem Hossain
Assistant Professor

- **Qualification:** Ph.D. (South Korea)
- **Email:** mowazzem@cuet.ac.bd
- **Research Interest:** Advanced Manufacturing Proesses (Friction Stir Welding, Forming), Advanced Engineering Materials, Fracture Mechanics, Micro-fabrication, Automobile Engineering

Asma Ul Hosna
Lecturer

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** asma@cuet.ac.bd
- **Research Interest:** Solid Mechanics, Applied Engineering Mechanics, Energy Conversion, Thermodynamics

Md. Mehdi Masud Talukder
Assistant Professor

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** Mehdi@cuet.ac.bd
- **Research Interest:** Computational Mechanics, Computational Fluid Dynamics, Nano Fabrication, Gas Dynamics, Aerospace Engineering, Engineering Graphics.

Md. Imteaz Ahmed
Lecturer

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** imteaz@cuet.ac.bd
- **Research Interest:** IoT, Robotics, Control Engineering, Air Conditioning, Renewable Energy

Muhammed Kamrul Islam
Assistant Professor

- **Qualification:** M.Sc. Engg. (CUET)
- **Email:** kamrul@cuet.ac.bd
- **Research Interest:** Impact Dynamics, Engineering Mechanics, Vehicle Dynamics, Industrial Engineering, Fuzzy Modeling, Operation Management, Renewable Energy

Sourav Paul
Lecturer

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** sourav@cuet.ac.bd
- **Research Interest:** Computational Fluid Dynamics, Material Science, Strength of Materials, Aerodynamics

Ratan Kumar Das
Assistant Professor

- **Qualification:** M.Sc. Engg. (South Korea)
- **Email:** ratan.kumar@cuet.ac.bd
- **Research Interest:** Thermo-Fluids, Renewable Energy, Microplasma, Green Technology Production Process and Industrial Management

Md. Maruf Billah
Lecturer

- **Qualification:** B.Sc. Engg. (BUET)
- **Email:** maruf@cuet.ac.bd
- **Research Interest:** Engineering Mechanics, Solid Mechanics, Engineering Drawing, Composite Materials

Bably Das
Assistant Professor

- **Qualification:** M.Sc. Engg. (South Korea)
- **Email:** bably@cuet.ac.bd
- **Research Interest:** Materials Science, Nanomaterials, Battery Technology, Applied Thermodynamics, Structural Dynamics, Acoustics and Random Vibration

Safina-E-Tahura Siddiqui
Lecturer

- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** safina@cuet.ac.bd
- **Research Interest:** Material Science, Strength of material, Fluid Mechanics, Energy Storage system.

2.2 Faculty Members:

Afnan Hasan
Lecturer
- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** afnanhasan@gmail.com
- **Research Interest:** Artificial intelligence, Machine learning, Mechatronics Computer vision, Composite Materials

Radheshyam Nath Jisu
Lecturer
- **Qualification:** B.Sc. Engg. (CUET)
- **Email:** radheshyam@cuet.ac.bd
- **Research Interest:** Material Science, Composite Materials

2.3 Laboratory Facilities

The department of Mechanical Engineering provides outstanding facilities for laboratory work with modern equipment to enrich the teaching-learning approach for undergraduate and postgraduate engineering education of the students. The laboratories are well-equipped and are being constantly upgraded to keep pace with time. The facilities are geared towards the needs of the students in anticipation of them working in many industries, locally and abroad. The laboratory facilities provide sound environment for doing research activites at postgradute level. Our laboratory facilities consist of following laboratories:

- Incompressible Fluid Mechanics & Fluid Machinery Laboratory
- Compressible Fluid Mechanics & Renewable Energy Laboratory
- Thermodynamics & Air Conditioning Laboratory
- Heat Transfer Laboratory
- Heat Engine & Automobile Laboratory
- Strength of Materials Laboratory
- Applied Mechanics Laboratory
- Metallurgy & Metrology Laboratory
- Computer Laboratory
- Mechatronics & Control Engineering Laboratory
- Robotics & Research Laboratory
- Postgraduate Research Laboratory
- Drawing Laboratory
- Workshop (Machine Shop, Wood shop & Sheet Metal Shop)

CHAPTER 3

ACADEMIC RULES & REGULATIONS FOR THE POST GRADUATE STUDIES

[Effective from Session 2014- 15 and onwards]

Definitions:

In this Rules & Regulations, unless the context otherwise requires:

(a) "Academic Council" means the Academic Council of the University;

(b) "ACPGS" means Academic Committee for the Post-Graduate Studies of the respective departments;

(c) "ACRS" means Academic Committee for Research and Studies of the respective Institutes;

(d) "CHSR" means the Committee for Higher Studies and Research;

(e) "Controller" means the Controller of Examinations of the University;

(f) "Dean" means the Head of a Faculty of the University;

(g) "Department" means the Concerned Academic Department of the University;

(h) "Director" means the Director of the Institute;

(i) "Equivalence Committee" means the Equivalence Committee for determining the equivalence of undergraduate and postgraduate degrees;

(j) "Head" means the Head of the Academic Department;

(k) "Institute" means the Concerned Academic and Research Institute of the University

(l) "Registrar" means the Registrar of the University;

(m) "Rules & Regulations" means Academic Rules & Regulations for the Post-Graduate Studies;

(n) "Syndicate" means the Syndicate of the University;

(o) "Term/Semester" means program of study to be completed within a specific period of time, generally six months.

(p) "University" means the Chittagong University of Engineering & Technology, abbreviated as CUET;

(q) "Vice-Chancellor" means the Vice-Chancellor of the University;

1.0 Committees:

1.1 There shall be a Committee for Higher Studies and Research (CHSR), constituted as per provisions of the Section-10 of the First Statues of the University, consisting of the following members;

(i)	Vice-Chancellor or his/her nominated person	Chairman
(ii)	Deans of the Faculties	Members
(iii)	Director of the Institutes	Members
(iv)	Heads of the Departments	Members
(v)	One eminent Engineer to be nominated by the Vice-Chancellor	Member
(vi)	One Professor from any other University to be nominated by the Academic Council	Member
(vii)	Director (Research and Extension)	Member Secretary

Approval of the Academic Council is to be taken before the committee is made operative. The term of the nominated member shall be three years. The nominated member shall continue to act as a member till a substitute is nominated. In case of vacancy the Vice-Chancellor will take appropriate action. Presence of more than 50% of members will form quorum.

This Committee shall organize, co-ordinate, supervise and give directions to the Higher Studies and Research Programs to be conducted by the University through Academic Committee for Post-Graduate Studies (ACPGS) of various Departments and Academic Committee for Research and Studies (ACRS) of different Institutes.

1.2 There shall be another Committee named as the Academic Committee for the Post-Graduate Studies (ACPGS) in each Academic Department and as the Academic Committee for Research and Studies (ACRS) in each institute of the University as constituted under Art 3(2) of the First Statues of the University.

1.3 The composition of the Academic Committee for the Post-Graduate Studies (ACPGS) is as follows:

(i)	The Head of the Department	Chairman
(ii)	All Teachers conducting the courses of M. Sc. Engg./M. Engg./M. Sc./M. Phil/Ph. D.	Members
(iii)	All Professors and Associate Professors of the Department.	Members
(iv)	One Professor, to be nominated by the Vice-Chancellor, from amongst the Professors concerned associated with the subject from any other University.	Member
(v)	One expert in the subject actively associated with an organization of Commerce and Industries or Research, to be nominated by the Academic Council.	Member

Approval of the Academic Council is to be taken before the committee is made operative. A teacher may be nominated by the Head of the Department as Course Coordinator, who will be acting as Member Secretary of the Committee. Presence of more than 50% of members will form quorum.

1.4 The Academic Committee for Post-Graduate Studies (ACPGS) shall have following functions:

(i) To formulate the courses and syllabuses to award M. Sc. Engg./M. Engg, M. Sc., M. Phil and Ph. D. degrees;

(ii) To propose the names of paper setters and examiners for different Post-Graduate examinations to the Academic Council; and

(iii) To perform such other functions as may be conferred on it by CHSR, Faculty and Academic Council according to the provisions of Statutes and Rules.

1.5 The composition of the Academic Committee for Research and Studies (ACRS) of Institutes shall be as follows:

(i)	The Director of the Institute	Chairman
(ii)	All Teachers conducting the courses of Postgraduate Degree	Members
(iii)	All Professors and Associate Professors of the Institute.	Members
(iv)	One Professor, to be nominated by the Vice-Chancellor, from amongst the Professors concerned associated with the subject from any other University.	Member
(v)	One expert in the Subject actively associated with an organization of Commerce and Industries or Research,	

Approval of the Academic Council is to be taken before the committee is made operative. The postgraduate course coordinator will act as the Secretary of the Committee. Presence of more than 50% of members will form quorum.

1.6 The Academic Committee for Research and Studies shall have following functions:

(i) To formulate the courses and syllabuses to award M. Sc. Engg. / M. Engg, M. Phil and Ph. D. degrees;

(ii) To propose the names of paper setters and examiners for different Post-Graduate examinations to the Academic Council and

(iii) To perform such other functions as may be conferred on it by CHSR, Faculty and Academic Council according to the provisions of Statutes and Rules.

1.7 There shall be an Equivalence Committee for determining the equivalence of undergraduate/post-graduate degree consisting of the following members:

(i)	Vice-Chancellor or his/her nominated person	Chairman
(ii)	All Deans of the Faculties	Members
(iii)	Director of the Institute concerned	Member
(iv)	Head of the Department concerned	Member
(v)	One Professor from any other University to be nominated by the Vice-Chancellor	Member
(vi)	Controller of Examinations	Member Secretary

Approval of the Academic Council is to be taken before the committee is made operative.

Quorum: Simple majority will form quorum.

A. ACADEMIC RULES & REGULATIONS FOR THE MASTER'S DEGREE PROGRAM

(M. Sc., M. Sc. Engg. and M. Engg.)

1.0 Degree Offered:

The post graduate degrees to be offered under this ordinance are as follows:

1.1 Master of Science in

Civil Engineering	abbreviated as M. Sc. Engg. (Civil)
Computer Science and Engineering	abbreviated as M. Sc. Engg. (CSE)
Electrical & Electronic Engineering	abbreviated as M. Sc. Engg. (EEE)
Mechanical Engineering	abbreviated as M. Sc. Engg. (Mech)
Disaster Engineering & Management	abbreviated as M. Sc. Engg. (DEM)
Energy Technology	abbreviated as M. Sc. Engg. (ET)
Earthquake Engineering	abbreviated as M. Sc. Engg. (EQE)
Physics	abbreviated as M. Sc. (Phy)
Chemistry	abbreviated as M. Sc. (Chem)
Mathematics	abbreviated as M. Sc. (Math)

Any other degree that may be awarded by a department/institute on the approval of the Syndicate upon the recommendation of the Academic Council.

1.2 Master of Engineering in

Civil Engineering	abbreviated as	M. Engg. (Civil)
Computer Science and Engineering	abbreviated as	M. Engg. (CSE)
Electrical & Electronic Engineering	abbreviated as	M. Engg. (EEE)
Mechanical Engineering	abbreviated as	M. Engg. (Mech)
Energy Technology	abbreviated as	M. Engg. (ET)
Earthquake Engineering	abbreviated as	M. Engg. (EQE)

Any other degree that may be awarded by a department/institute on the approval of the Syndicate upon the recommendation of the Academic Council.

2.0 Admission Requirements:

2.1 For admission to the courses leading to a Master's degree (M. Sc. Engg. / M. Engg.), a candidate

a) must have at least one first class/first division or its equivalent in S. S. C. and H. S. C. examinations or its equivalent,

b) should have CGPA of a minimum of 2.50 out of 4.0 or its equivalent in B. Sc. Engg. in the relevant branch,

c) must not have third division or a CGPA less than 2.0 out of 5.0 in any one of S. S. C. and H. S. C. or equivalent examinations.

d) should submit a written research proposal.

2.2 For admission to the courses leading to the award of the degree of M. Sc. Engg. / M. Engg. in any branch, a candidate must have obtained a B. Sc. Engg. degree in the relevant branch or an equivalent degree from any recognized University/Institution. The Equivalence Committee shall examine the equivalence and suitability of a candidate for admission.

2.3 For admission to the courses leading to M. Sc. in Physics / Chemistry / Mathematics, an applicant

(a) must have at least 50% marks or a minimum CGPA of 2.5 out of 4.0 or its equivalent in four years B.S. / B. Sc. (Hons.)

(i) in Physics/ Applied Physics, Electronics and Communication Engineering, or B. Sc. Engg. in Electrical & Electronics / Materials & Metallurgical / Environmental Science / Environmental Science and Engineering or in a relevant discipline.

(ii) in Chemistry / Applied Chemistry / Biochemistry / Pharmacy or B. Sc. Engg. in Chemical / Environmental Chemistry / Environmental Science and Engineering or in a relevant discipline.

(iii) in Mathematics / Applied Mathematics / Physics / Statistics / Economics or B. Sc. Engineering in Civil / Electrical & Electronics / Mechanical / Computer Science and Engineering or in a relevant discipline,

Or

(b) must have at least second class or 50% marks or a minimum CGPA of 2.5 out of 4.0 or its equivalent in three years B. S. / B. Sc. (Hons.) or its equivalent and at least 50% marks or a minimum CGPA of 2.5 out of 4.0 or its equivalent in M.S. / M. Sc.

(i) in Physics / Applied Physics, Electronics and Communication Engineering, or in a relevant discipline.

(ii) in Chemistry / Applied Chemistry / Biochemistry / Pharmacy or in a relevant discipline.

(iii) in Mathematics / Applied Mathematics / Physics / Statistics / Economics or in a relevant discipline.

(c) must not have third division or a CGPA less than 2.0 out of 5.0 in any one of S. S. C. and H. S. C. or equivalent examinations.

d) should submit a written research proposal.

3.0 Admission Procedure:

3.1 Applications for admission to the above courses shall be invited through regular means of advertisement and shall be received by the Registrar office.

3.2 Before being finally selected for admission a candidate may be required to appear at an interview and / or admission test by an Admission Committee for the Postgraduate Studies as constituted by the CHSR. He/she will be required to take pre-requisite course as may be prescribed by the ACPGS/ACRS. Every selected candidate, unless he has already been registered, shall get himself/ herself registered with the University.

3.3 After admission each student shall be assigned, by the respective ACPGS/ACRS of the department/institute, an Adviser/ Supervisor from among the teachers of the relevant Department/Institute not below the rank of an Assistant Professor having a post graduate degree. In advance of each enrolment and course registration for any Term/Semester the Adviser/Supervisor shall check and approve student's schedule for subjects, prerequisites as recommended by the ACPGS/ACRS and total credit hours. The student is expected to consult his/her adviser/ supervisor on all academic problems but, it is the responsibility of the individual student to see that his/her schedule conforms to the academic rules & regulations.

3.4 Every registered candidate shall get himself/herself enrolled on payment of prescribed fees and other dues as fixed by the University before the commencement of each semester/term. Course registration must be completed within two weeks from the start of the Term/Semester; otherwise the student shall not be allowed to continue the course in the Term/Semester.

3.5 On the proposal of respective ACPGS of Departments/ ACRS of Institutes and upon the recommendation of the CHSR, the rules for admission into the University for postgraduate studies shall be framed/ reviewed time to time by the Academic Council.

4.0 Academic Requirements:

4.1 The minimum duration for full time students and part time students of the M. Sc. Engg., M. Engg. and M. Sc. shall normally be three and four terms/ semesters, respectively. There are two Terms/ Semesters in each academic year. The duration of each Term/Semester is generally six months including thirteen weeks of classes and the Term/ Semester final examination. A candidate for the Master's degree must complete all requirements for the degree within five academic years from the date of his first admission in the respective program.

4.2 Academic progress shall be measured in terms of credit hours earned by a student. One credit hour of a theory subject shall normally require one hour of class attendance per week for one Term/Semester; while one credit hour for thesis/project/laboratory should normally required three hours of work per week for one Term/Semester. The number of credit hours for each subject shall be as specified in the syllabus of the respective departments/institute.

4.3 (a) For awarding the degree of M. Sc. Engg. and M. Sc., a student must, in general, earn a minimum of 36 credit hours including a thesis for which 18 credit hours shall be assigned. However, for the department of Disaster and Environmental Engineering a student must earn a minimum of 48 credit hours including a thesis for which 21 credit hours shall be assigned.

(b) For awarding the degree of M. Engg., a student must earn a minimum of 36 credit hours including a project for which 6 credit hours shall be assigned.

4.4 There shall be two categories of students namely, full time students and part time students. Through the proper channel a student may apply to the respective Head/ Director to interchange his/her status between full time and part time studentship. Approval from the Academic Council is to be taken before the change is made operative. The status of studentship shall be reflected in his/her transcript.

4.5 Students, serving in organizations, including this University, may be admitted as part time students with a written consent of the employer. A part time student may be assigned a maximum of 9 credit hours of course work (theory course) in any Term/Semester. In case of Project / Thesis courses a maximum of 12 credit hours may be assigned for a part time student in any Term/Semester.

4.6 Full time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per Term/ Semester. A full time student shall not be allowed to be in the employment of any organization (even as part time employee). However, they may be employed as Teaching Assistant / Research Assistant / Research Associate at this University.

4.7 The subject(s) of study in the Department/ Institutes shall be proposed by the respective ACPGS/ACRS. Upon recommendation of CHSR the Academic Council of the University shall give the final approval after due consideration.

4.8 The courses to be offered in any term/ semester shall be as determined by the relevant Department/ Institute. The Department/ Institute may review the curriculum and courses from time to time and propose any change, as may be considered necessary to the CHSR.

5.0 Grading System:

5.1 Numerical marking may be made in answer scripts, tests etc., but all final grading to be reported to the Controller of Examinations shall be in the letter grade system as detailed below:

Mark Range				Letter Grade	Grade Point
90%	and	above		A+	4.0
85%	to	below	90%	A	3.75
80%	to	below	85%	A-	3.5
75%	to	below	80%	B+	3.25
70%	to	below	75%	B	3.0
65%	to	below	70%	B-	2.75
60%	to	below	65%	C+	2.5
55%	to	below	60%	C	2.25
50%	to	below	55%	D	2.0
below		50%		F	0.0
				I	Incomplete
				S	Satisfactory
				U	Unsatisfactory
				W	Withdrawn

5.2 Course(s) in which the student gets 'F' grade shall not be counted towards credit hour requirements and for the calculation of Grade Point Average (GPA).

5.3 'I' grade shall be given only when a student is unable to sit for the examination of a course at the end of the semester because of circumstances beyond his/her control. He/She must apply to the Head of the concerned Department within one week after examination to get an 'I' grade in that course. It must be completed within the next two terms/semesters, otherwise; the grade becomes an 'F' grade. He/She may, however, be allowed to register without further payment of tuition fees for that course.

5.4 Satisfactory or Unsatisfactory will be used only as final grades for thesis/project and non-credit courses. Grade for thesis / projects "In Progress" shall be so recorded, when it is to be continued. If however, thesis is discontinued, an 'I' Grade shall be recorded.

5.5 A student shall withdraw officially from a course within two working weeks of the commencement of the term / semester or else his/her grade in that course shall be recorded as 'F' unless he/she is eligible to get a grade of 'I'. A student may be permitted to withdraw and change his course within the specified period with the approval of his/her Adviser/ Supervisor and Head of the Department/ Director of the Institute and the respective teacher(s) concerned.

6.0 Conduct of Examinations:

6.1 In addition to tests, assignments and/or examinations during the term/ semester as may be given by the teacher(s) concerned, there shall be a written final examination for each of the courses offered in a term/ semester at the end of that Term/ Semester. The dates of the final examination shall be announced by the Controller of Examinations, as advised by the Chairman of the Examination Committee at least two weeks before the commencement of the examination. The final grade in a subject shall be based on the performance in all tests, assignments and examinations.

6.2 The Controller of Examinations shall keep up to date record of all grades obtained by a student in individual Academic Record Card and also in the Tabulation Book. Grades shall be announced by the Controller of Examinations at the end of each Term/Semester.

In addition, each student is entitled to get one official transcript of the University record without any fee at the completion of his/her academic program from the office of the Controller of Examinations on production of statement of clearance from all Departments/ Institutes/ Offices.

6.3 The Controller of Examinations shall prepare invigilation schedule and provide all logistic supports for holding the examinations. He shall receive examination answer scripts and distribute the same to the respective examiners with proper instructions.

6.4 The ACPGS/ACRS of the respective department/institute shall propose to the Academic Council for final approval of the names of the paper setters and examiners for the term/ semester final examinations of the courses at least two weeks before the date of commencement of the examination.

7.0 Qualifying Requirements:

7.1 The qualifying requirement for the degree of M. Sc. Engg./ M. Engg is that a student must earn a minimum grade point of 2.65 based on the weighted average in his/her course work.

7.2 The 'D' grades up to a maximum of one course may be ignored for calculation of Grade Point Average (GPA) at the written request of the student, provided the student has completed the total course credit hour requirement with a minimum weighted GPA of 2.65 in the remaining subjects. No course(s) shall be repeated unless it is a compulsory requirement for the degree as determined by the CHSR. Performance in all the subjects shall be reflected in the transcript.

7.3 In addition to successful completion of course works every student shall submit a thesis on his/her research work or report on his/ her project work, fulfilling the requirements as detailed below.

8.0 Thesis:

8.1 Research work for a thesis shall be carried out under the supervision of a full-time teacher not below the rank of Assistant Professor with postgraduate degree belonging to the relevant Department/ Institute. Co-supervisor(s) from within or outside the department/institute may be appointed, if necessary.

8.2 The thesis proposal (as per the prescribed format) shall be proposed by the respective ACPGS/ACRS of the relevant Department/ Institute for final approval of the Academic Council upon the recommendation of CHSR of the university. The thesis proposal shall preferably be approved before the end of the second Term/Semester of studies of the student concern.

If any change is necessary in the approved thesis proposal (title, content, cost, supervisor, co-supervisor etc.), it shall be submitted to the respective ACPGS/ ACRS of the Department/ Institute for final approval of the Academic Council upon the recommendation of the CHSR.

8.3 The research work shall be carried out in this University or at a place (s) approved by the Supervisor in consultation with the respective ACPGS/ ACRS of the Department/ Institute.

8.4 Every student through his/ her supervisor shall submit required number of computer composed copies of his/ her thesis in the approved format (As given in Appendix) to the Head of the Department or Director of the Institute. The Head of the Department/ Director of the Institute shall immediately send copies of the thesis to the Controller of Examinations. The Controller of Examinations shall send the same to all members of the Examination Board. Upon receipt of the written/ verbal consent, regarding the date of the oral examination, of all members of the Examination Board, the Controller of Examinations shall arrange the oral examination in consultation with the Chairman of the Examination Board.

8.5 The student shall certify that the research work has been done by him/her and that this work has not been submitted elsewhere for any other purpose, except for publication.

8.6 The thesis should demonstrate/reflect an evidence of satisfactory knowledge in the field of research undertaken by the student.

8.7 Oral Examination:

8.7.1 Every student, submitting a thesis in partial fulfilment of the requirements of a degree, shall be required to appear at an oral examination, on a date or dates fixed by the Controller of Examinations in consultation with the Chairman of the Examination Board.

8.7.2 Every student must satisfy the examiners that he/ she is capable of intelligently applying the results of this research to the solution of problems, of undertaking independent work, and also afford evidence of satisfactory knowledge related to the theory and technique used in his research work.

8.7.3 There shall be an Examination Board consisting of minimum four members for conducting oral examination for every M.Sc. Engg. and M. Sc. student. The Supervisor shall act as the Chairman and the Head of the Department / Director of the Institute will be an ex-officio member of the Examination Board. The Examination Board shall be proposed by the respective ACPGS/ ACRS of the relevant Department / Institute for final approval of Academic Council followed by the recommendation of CHSR.

The composition of the Examination Board shall be as follows:

i.	Supervisor	Chairman
ii.	Co-supervisor (s) (if any)	Member
iii.	Head of the Department/Director of the Institute (Ex-Officio)	Member
iv.	One or two teachers from within the Department/ Institute	Member
v.	One External member outside the student's Department/ Institute/University	Member (External)

Quorum: Presence of Supervisor, Head of the Department/ Director of the Institute and External Member shall form the quorum.

8.7.4 The Head of the Department/ Director of Institute will send the resolution taken by the Examination Board with his forwarding to the Controller of Examinations.

8.7.5 If any examiner is unable to accept the appointment or has to relinquish his appointment before the examination, the Vice-Chancellor shall appoint another examiner in his place, on suggestion from the Supervisor in consultation with the Head of the Department / Director of the Institute. This appointment will be reported to Academic Council.

8.8 Upon satisfactory completion of the oral examination, the student shall submit N+2, where N is the number of members of the Examination Board, hard copies of the corrected thesis as per the prescribed format and specification, duly certified by the Supervisor and Co-Supervisor (s) (if any) that all the corrections have been incorporated in the thesis as suggested by the Board of Examiners.

9.0 Project:

9.1 Project work shall be carried out under the supervision of a full-time teacher not below the rank of Assistant Professor with postgraduate degree belonging to the relevant Department/ Institute.

9.2 The project proposal (as per the prescribed format) shall be proposed by the respective ACPGS/ ACRS of the relevant Department/ Institute for final approval of Academic Council upon the recommendation of CHSR. The project proposal shall be preferably approved before the end of the second Term/ Semester of studies of the student concern. If any change is necessary in the approved project proposal (title, content, cost, supervisor, co-supervisor etc.), it shall be submitted to the respective ACPGS/ ACRS of the department/institute for final approval of Academic Council upon the recommendation of CHSR.

9.3 The project work must be carried out in this University or at a place approved by the supervisor in consultation with the Head of the Department/ Director of the Institute.

9.4 Every student through his/ her supervisor shall submit required number of computer composed copies of his/her thesis in the approved format (As given in Appendix) to the Head of the Department or Director of the Institute. The Head of the Department/ Director of the Institute shall send immediately copies of the thesis to the Controller of Examinations. The Controller of Examinations shall send the same to all members of the Examination Board. Upon receipt of the written/ verbal consent, regarding the date of the oral examination, of all members of the Examination Board, the Controller of Examinations shall arrange the oral examination in consultation with the Chairman of the Examination Board.

9.5 The student shall certify that the project work was done by him/her and that this work has not been submitted elsewhere or any other degree or diploma.

9.6 Oral Examination:

9.6.1 Every student submitting a project report in partial fulfilment of the requirements of a degree, shall be required to appear at an oral examination, on a date or dates fixed by the Controller of Examinations in consultation with the Chairman of the Examination Board.

9.6.2 Every student must satisfy the examiners that he/ she is capable of intelligently applying the results of this project to the solution of problems, of undertaking independent work, and also afford evidence of satisfactory knowledge related to the theory and technique used in his project work.

9.6.3 There shall be an Examination Board consisting of following members for conducting oral examination for every M. Engg. student. The Supervisor shall act as the Chairman and the Head of the Department will be an ex-officio member of the Examination Board. The Examination Board shall be proposed by the respective ACPGS/ ACRS of the relevant Department/ Institute for final approval of Academic Council followed by the recommendation of the CHSR.

The composition of the Examination Board shall be as follows:

i.	Supervisor	Chairman
ii.	Head of the Department/Director of the Institute (Ex-Officio)	Member
iii.	One Teacher from within the Department/ Institute	Member
iv.	One External member outside the student's Department/	
	Institute/University	Member (External)

Quorum: Presence of Supervisor, Head of the Department/ Director of the Institute and External Member shall form the quorum.

9.6.4 The Head of the Department/ Director of the Institute will send the resolution taken by the Examination Board with his forwarding to the Controller of Examinations.

9.6.5 If any examiner is unable to accept the appointment or has to relinquish his appointment before the examination, the Vice-Chancellor shall appoint another examiner in his place, on suggestion from the Supervisor in consultation with the Head of the Department/ Director of the Institute. This appointment shall be reported to the Academic Council.

9.7 Upon satisfactory completion of the oral examination, the student shall submit N+2, where N is the number members of the Examination Board, hard copies of the corrected thesis as per prescribed format and specification, duly certified by the Supervisor and Co- Supervisor (if any) that all the corrections have been incorporated in the thesis as suggested by the Board of Examiners.

10.0 Striking off and Removal of Names from the Rolls:

The name of the student be struck off and removed from the rolls of the University for the following grounds:

(i) Non-payment of dues within prescribed period. Post graduate students residing in the halls of residence shall be subject to the same conditions or rules as followed in the Ordinance regarding Student's Discipline Rules.

(ii) Failing to proceed with the program by the exercise of Articles 4.1 and/or 7.1 or 7.3 of this Rules & Regulations.

(iii) Failing to make satisfactory progress in his program as reported by the Adviser/Supervisor through the ACPGS/ACRS and approved by the CHSR

(iv) Forced to discontinue his studies under disciplinary rules.

(v) Withdrawn officially from all the courses including Thesis/Project.

11.0 Publication of Results:

11.1 A student who successfully completes the prescribed courses and all academic requirements for fulfilment of the postgraduate degree will have to apply to the Controller of Examinations through the Head of the Department for the award of degree.

11.2 The Controller of Examinations shall publish the result.

11.3 Provisional degree will be awarded, on completion of minimum credit and GPA requirements, by the Academic Council.

12.0 Academic Fees:

Academic fees shall be as per Appendix-I and shall be reviewed and determined from time to time by the appropriate authority of the University.

13.0 Return of Fees:

A student withdrawing officially from all courses registered in a term / Semester including project/thesis as per Art. 10 (v) is entitled to get a refund of 50% of the course registration fees of the term / semester provided he/she withdraws in writing through the respective Head of the Department before the expiry of two working weeks from the commencement of the classes; and in that case his/her grade in the courses registered shall be recorded as 'W'. If withdrawal is made after the expiry of two weeks from the commencement of classes no refund shall be allowed and the grade should be recorded as 'F' unless he is eligible to get a grade of 'I' as per Art. 5.3. Thesis/Project registration fees in any case are not refundable.

B. ACADEMIC RULES & REGULATIONS FOR DOCTOR OF PHILOSOPHY PROGRAM

1.0 Degrees Offered:

The degree of Doctor of Philosophy shall be offered by the University in the following Departments/Institutes:

Department of Civil Engineering;

Department of Computer Science and Engineering;

Department of Electrical & Electronic Engineering;

Department of Mechanical Engineering;

Department of Physics;

Department of Chemistry;

Department of Mathematics;

Institute of Earthquake Engineering Research;

Such other Department/ Institute as may be approved by the Academic Council and the Syndicate of the University.

The degree of Doctor of Philosophy shall be abbreviated as Ph.D.

2.0 Admission Requirements:

2.1 For admission to the courses leading to a Ph. D. degree a candidate

a) must have at least one first class/first division or its equivalent in S. S. C. and H. S. C. examinations or its equivalent,

b) must have at least second class/ division or CGPA of a minimum of 2.50 out of 4.0 or its equivalent in four years B. Sc. (Hons.) / B. Sc. Engg. / in the relevant branch,

c) must have an M. Sc. Engg. / M. Engg / M. Sc. with four-year bachelor degree / M. Phil. degree with minimum grades as stated in the following sub-sections,

d) must not have third division/class or GPA of minimum 2.0 out of scale of 5.0 in S. S. C. and H. S. C. examinations, and

e) must submit a written research proposal in a prescribed format.

2.2 For engineering, the minimum qualification for admission shall normally be an M. Sc. Engg. / M. Engg. degree with a minimum CGPA of 2.75 out of 4.0 in the relevant branch of engineering or its equivalent from any recognized Institution.

2.3 (a) For Physics, the minimum qualification for admission shall normally be an M.Sc with four-year B. Sc. (Hons.)./ M. Phil. degree in Physics / Applied Physics/ Environmental Science with a minimum GPA of 2.75 out of 4.0 or its equivalent from any recognized Institution.

Or

M. Sc. Engg. degree in Mechanical/Electrical & Electronic Engineering/ Electronics & Telecommunication Engineering/ Electronics and Communication Engineering / Computer Science & Engineering/ Materials & Metallurgical Engineering /Environmental Science and Engineering or in a relevant discipline with a minimum GPA of 2.75 out of 4.0 or its equivalent from any recognized Institution.

(b) For Chemistry, the minimum qualification for admission shall normally be an M.Sc with four-year B. Sc. (Hons.)./M. Phil. degree in Chemistry / Applied Chemistry / Biochemistry / Molecular Biology/Food and Nutrition / Environmental Chemistry with a minimum GPA of 2.75 out of 4.0 or its equivalent from any recognized Institution.

Or

M. Sc. Engg. degree in Chemical Engineering/ Environmental Science and Engineering or in a relevant Discipline with a minimum GPA of 2.75 out of 4.0 or its equivalent from any recognized Institution.

(c) For Mathematics, the minimum qualification for admission shall normally be an M. Sc. / M. Phil. degree in Mathematics/ Applied Mathematics / Physics / Statistics / Economics with a minimum GPA of 2.75 out of 4.0 or its equivalent from any recognized Institution.

Or

M. Sc. Engg. degree in Civil / Electrical & Electronics / Mechanical / Computer Science and Engineering with a minimum GPA of 2.75 out of 4.0 or its equivalent from any recognized Institution.

3.0 Admission Procedure:

3.1 Provisional Selection:

3.1.1 Applications for provisional admission to the Ph. D. program shall be received by the Registrar.

3.1.2 Before being provisionally selected for admission to the Ph. D. program a candidate may be required to appear at an oral and / or written test by an Admission Committee for the Postgraduate Studies as constituted by the CHSR.

3.1.3 A candidate provisionally selected by the Admission Committee may be required to pass the prerequisite non-credit courses as prescribed by the Admission Committee.

3.2 Final Selection:

A provisionally selected candidate shall be deemed to be eligible for final registration as a Ph. D. student with effect from the date of his provisional admission if and when he/ she qualifies the comprehensive examination (as per Art. 11.1.2).

4.0 Registration:

4.1 Every selected candidate, unless he/she has already been registered, shall get himself/herself registered with the University.

4.2 Every registered candidate (student) shall get himself/ herself enrolled on payment of prescribed fees and other dues as per University rules before the commencement of each term/semester. Course registration must be completed within two weeks from the start of the term/semester; otherwise the student shall not be allowed to continue the course in that term/ semester.

5.0 Appointment of a Supervisor:

On provisional admission, the respective ACPGS/ACRS shall propose a name of Supervisor who shall be a full-time member not below the rank of Assistant Professor having doctoral degree of the relevant Department/Institute and name (s) of Co-Supervisor (s) from within or outside the Department/Institute, if necessary. Final approval from the Academic Council shall be taken upon the recommendation of CHSR. The Supervisor shall prescribe a plan of study to be undertaken by the student and supervise the progress of the student's work.

6.0 Academic Requirements and Regulations:

6.1 The minimum duration of the Ph. D. course shall be four terms / semesters from the date of provisional admission. A student must complete all requirements for the Ph. D. degree within six academic years (session) from the date of his provisional admission.

6.2 Academic progress shall be measured in terms of credit hours earned by a student. One credit hour of a theory course shall normally requires one hour of class attendance per week for one Term/Semester; while one credit hour for thesis/project/laboratory should normally

requires three hours of work per week for one Term/Semester. The number of credit hours for each subject shall be as specified in the syllabus of the respective Department/ Institute. The duration of each Term/ Semester is generally six months including thirteen weeks of classes and Term/ Semester final examination.

6.3 A student must complete a minimum of 54 credit hours of which a minimum of 45 credit hours shall be assigned for a thesis.

6.4 There shall be two categories of students namely, full-time students and part-time students. Through the proper channel a student may apply to the respective Head/ Director to change his/ her status between full time and part time. Approval from the Academic Council is to be taken before the change is made operative. The status of studentship shall be reflected in his/ her transcript.

6.4.1 Students, serving in organizations, including this University may be admitted as part-time students with a written consent of the employer. A part-time student may be assigned maximum 9 credit hours of course work in any term / semester. In case of thesis course a maximum of 12 credit hours may be assigned for a part time student in any term/ semester.

6.4.2 Full-time student must register for a minimum of 12 credit hours and maximum of 15 credit hours per term / semester. A full-time student shall not be allowed to be in the employment of any organization (even as part-time employee). However, they may be employed as Teaching/Research Assistant or Research Associate at this University.

6.5 The subjects of study in the Department/ Institute shall be proposed by the respective ACPGS / ACRS. Upon recommendation of the CHSR, the Academic Council of the University shall give the final approval after due consideration.

6.6 The courses to be offered in any term/ semester shall be as determined by the relevant department/institute. The Department/Institute may review the curriculum and courses from time to time and propose any change, as may be considered necessary to the CHSR.

7.0 Grading System:

7.1 Numerical marking may be made in answer scripts, tests etc., but all final grading to be reported to the Controller of Examinations shall be in the letter grade system as detailed below:

Mark	Range			Letter Grade	Grade Point
90%	and	above		A+	4.0
85%	to	below	90%	A	3.75
80%	to	below	85%	A-	3.5
75%	to	below	80%	B+	3.25
70%	to	below	75%	B	3.0
65%	to	below	70%	B-	2.75
60%	to	below	65%	C+	2.5
55%	to	below	60%	C	2.25
50%	to	below	55%	D	2.0
below		50%		F	0.0
				I	Incomplete
				S	Satisfactory
				U	Unsatisfactory
				W	Withdrawn

7.2 'I' is given only when a student is unable to complete the course because of circumstances beyond his control. If must be made up by the close of next two term / semester or the incomplete grade becomes a failure. He may however be allowed to register without further payment of tuition fees for that course.

7.3 Satisfactory or Unsatisfactory shall be used only as final grades for thesis and non-credit courses. Grade for thesis "In Progress" shall be so recorded what it is to be continued. If, however, thesis is discontinued an "Incomplete" grade shall be recorded.

7.4 A student shall withdraw officially from a course within two working weeks of the commencement of the term / semester or else his grade in that course shall be recorded as F unless he is eligible to get a grade of I. A student may be permitted to withdraw and change his course within the specified period with the approval of his Supervisor, Head of the Department/Director of the Institute and the respective teacher(s) concerned.

8.0 Doctoral Committee:

8.1 The Doctoral Committee for every student shall be proposed by the respective ACPGS/ ACRS, in consultation with the Supervisor. Upon recommendation of the CHSR the Academic Council of the University shall give the final approval after due consideration. The Doctoral Committee shall be formed within six months from the date of the student's provisional admission. The Doctoral Committee should meet from time to time at the request of the Supervisor to review the progress of the student's work. In special circumstances, the CHSR may approve any addition and/or alteration in the Doctoral Committee on the recommendation of the respective ACPGS/ ACRS of the Department/ Institute.

8.2 The composition of the Doctoral Committee shall be as follows:

i.	Supervisor	Chairman
ii.	Co-supervisor (s) (if any)	Member
iii.	Head of the Department/ Director of Institute (Ex-officio)	Member
iv.	Three teachers from within the University (at least one teacher from outside the student's Department/ Institute) who have Ph.D. degree & minimum Associate Professor	Members
v.	One professor from outside the University	External Member

Quorum: Presence of five members will form quorum including supervisor, Head of the Department/ Director of the Institute and external members.

9.0 Thesis Proposal:

The student shall submit a thesis proposal to the Doctoral Committee, which shall examine the proposal and recommend it to the respective ACPGS/ ACRS of the Department/ Institute to take necessary steps for final approval from the Academic Council of the university. In special circumstances the Doctoral Committee may recommend through the respective ACPGS/ ACRS of the Department/Institute to CHSR for approval for any change of research topic/content, etc.

10.0 Conduct of Examinations for Course Work:

10.1 In addition to tests, assignments and /or examinations during the Term/Semester as may be given by the teacher(s) concerned, there shall be a written final examination for each of the course offered at the end of a Term/Semester. The dates of the Term/Semester final examinations shall be announced by the Controller of Examinations as advised by the Chairman of the Examination Committee at least two weeks before the commencement of the examination. The final grade in a course shall be based on the performance in all tests, assignments and/or examinations.

10.2 The Controller of Examinations shall keep up to date record of all the grades obtained by a student in individual Academic Record Card. Grades shall be announced by the Controller of Examinations at the end of each term / semester. In addition, each student is entitled to get one official transcript of the University record without any fee at the completion of the academic program from the office of the Controller of Examinations on production of statement of clearance from all Department/Institute Offices.

10.3 The ACPGS/ACRS of the respective department/institute shall propose to the Academic Council for final approval of the names of the paper setters and examiners for the term/ semester final examinations of the courses at least two weeks before the date of commencement of the examination.

11.0 Qualifying Requirements:

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

11.1 Comprehensive Examination:

Every student shall pass the comprehensive examination before starting the thesis work. The comprehensive examination shall comprise a written examination and/ or an oral examination to test the knowledge of the student in his/ her field of study. The Doctoral Committee shall conduct the comprehensive examination. If a student fails to qualify in a comprehensive examination he/she shall be given one more chance to appear at the examination as scheduled by the Doctoral Committee. The date and time of the comprehensive examination shall be fixed by the Doctoral Committee on the request of the Supervisor. Comprehensive Examination shall ordinarily be held after the completion of the course work by the student.

11.2 Course work:

To qualify for the degree a student must earn a minimum grade point of 2.75 based on the weighted average in his/her course work.

11.3 Thesis:

11.3.1 Research work for the thesis shall be carried out in the University or at a place(s) approved by the Doctoral Committee in consultation with the Supervisor.

11.3.2 The student shall certify that the research work was done by him/her and that this work has not been submitted elsewhere for any other purpose (except for publication).

11.3.3 At the end of the student's research work the student shall submit a thesis which must be an original contribution to engineering or physical science and worthy of publication. Every student through his/ her supervisor shall submit required number of computer composed copies of his/ her thesis in the approved format (as given in Appendix) to the Head of the Department or Director of the Institute. The Head of the Department/ Director of the Institute shall immediately send copies of the thesis to the Controller of Examinations. The Controller of Examinations shall send the same to all members of the Examination Board (as constituted in Art. 11.2.6). In addition, the thesis shall be referred to two experts (at least one member shall be from abroad) nominated by the Academic Council. The respective ACPGS/ ACRS shall propose a panel of experts to the Academic Council, in addition to the Examination Board (Art. 11.3.6).

11.3.4 The expert shall preferably send his/ her evaluation report in a prescribed format within two months from the date of receipt of the thesis. The expert may include in his/ her report an overall assessment, preferably chapter-wise, placing the thesis in any one of the following categories:

11.3.4.1 Recommend the acceptance of the thesis in its present form and classify as HIGHLY RECOMMENDED/ RECOMMENDED.

11.3.4.2 Recommend the acceptance of the thesis with minor corrections. In this case, the student shall incorporate the corrections in the thesis and submit the corrected copy to the respective member (s), if required.

11.3.4.3 Defer the recommendation at this stage and the student shall incorporate the suggested modifications in the thesis and the corrected thesis along with the student's clarifications shall be sent to the respective examiner (s).

11.3.4.4 Reject the thesis for the reasons set out in the detailed report.

11.3.5 Upon receipt of the thesis evaluation reports from the experts in sealed envelopes, the Controller of Examinations shall fix a suitable date with prior consent of all members of the Examination Board for oral examination. The Controller of Examinations shall handover the thesis evaluation reports to the Chairman of the Examination Board just before the oral examination. The Controller of Examinations shall assist the Examination Board for conducting the oral examination as constituted in Art. 11.3.6. Any addition, revision, modification, etc., suggested by the experts and the examination board members shall be carried out by the student before submitting the corrected thesis to the office of the Controller of Examinations as per Art. 11. 4.

11.3.6 Oral Examination:

There shall be an Examination Board consisting of minimum six members for conducting the oral examination for every doctoral student. The Supervisor shall act as the Chairman and the Head of the Department will be an ex-officio member of the Examination Board. The Examination Board shall be proposed, in consultation with the Supervisor, by the respective ACPGS/ ACRS of the relevant Department/ Institute, for final approval of the Academic Council followed by the recommendation of the CHSR.

APPENDIX-I

Academic Fees

University Registration Fee	Taka ……..
Admission / Enrolment Fee	Taka ……..
Course Registration Fee	Taka ……..per credit hour with a maximum of Taka……..…… per Semester, Payable in 2 instalments.v
Project Registration Fee	Taka ……. (on 1st Project registration).
Fees for each additional copy of Transcript	Taka ……..
Medical Fees	Taka …… per semester
Caution Money at first enrolment	Taka ……..
Library Caution Money	Taka ……..

* Caution money may be refunded if the student withdraws officially from all the courses including project or at the end of his academic program and the amount will be determined from the statement of clearance from all Departments/ Institutes/ Offices.v

APPENDIX-II

Format for Thesis of Ph. D. Degree M. Phil., M. Sc. and Project Report of M. Engg., PG. Dip.,

The following set of instructions may be followed as standard format for the thesis / project report.

1. Size and Thickness of Paper:

Thesis / Project is to be printed on A4 size quality offset paper and minimum weight of paper should be 70 gm.

2. Typing or Print:

The typeface should be consistent and the copy must be clean for both text and illustration. Dot matrix printers should not be used unless giving near letter quality. The general text of the thesis / project report should be spaced at one and a half with single spacing for footnotes or lengthy quotations. Triple or larger spacing may be used where necessary to set off headings, subheadings or illustrations. The thesis / project report must be in "letter quality" print and laser printing is recommended. And standard type (font) may be used but it must be consistent throughout. The print size should be at least 10 points (or equivalent) not exceeding 12 points.

3. Margins and Layout of Text:

There must be a margin of 4 cm to allow for binding on the left hand side of the paper. Minimum margins of 3 cm are required at the top and the bottom. A 2.5 cm margins is required at the right hand side. This also applies to table and figures.

4. Pagination:

The text is to be numbered consecutively in the top right hand corner of the page, beginning with the first page of the text. The page numbers are to be approximately 2.5 cm (1 inch) from the right hand edge of the page. The number does not appear on the first page of the text although is understood to be a numeral '1'. All figures, tables, appendices and similar materials are numbered as pages of the text through to the end of the thesis / project. Material preceding the first page of the text is to be numbered in small roman numerals centered at the bottom of each page. The title page is considered to be page but it is not so indicated.

5. Word Spacing and Division:

Text should be set to ensure an even spacing between words for any particular line. Word division at the ends of lines (hyphenation) should be avoided if possible.

6. Illustrations:

Tables, figures, photographs, and other illustrations must always be referred to in the text. They should be arranged neatly and effectively. They should be in black ink. or be high quality photocopies, photo-offset, or photographs. They should be presented on paper of similar weight to that used in the thesis / project report. Oversize maps charts or diagrams must be folded so that they can be bound with the pages or inserted in a pocket. Original photographs or photo-offset must be provided in all required copies of the thesis / project report. They should be properly pasted on paper with permanent non-wrinkle glue. Photographs printed on 21.5 cm X 28 cm (8 ½ in X 11 in) photographic paper or photo-offsets are preferred rather than being pasted on. High quality computer graphics (black and white or colour) and high-quality colour photocopies are acceptable. All required copies must be identical.

The title of a table must be above the table and the title on the figure, below the figure. The student should consult with the thesis / project supervisor if any difficulty arises in the placing of illustrations.

7. Computer Disks:

If a student wishes to include computer disks as a part of his data, he must submit a disk for each required copy of his thesis. These must be submitted loosely. If is not necessary to submit them at the time he schedule his defence. In this case there should be a pocket in the thesis / project report on the inside back cover. He should also indicate the presence of computer disks in his Table of Contents.

8. Binding and Colour:

Sewn and bound in strong, waterproof cloth. Not more than 6.5 cm thick. Maroon colour for Ph. D., Black for M. Engg., M.Sc. Engg. or M.Phil. degree.

9. Lettering:

In golden on spine only.

Top	:	Degree
Middle	:	Name of author (initials and surname)
Foot	:	Year of Presentation.
Cover Page	:	In golden on Cover.
Positioning	:	Centre Justified, Title, Name, Dept.

10. Order of Items:

10.1 Title Page:

The student should follow the following instruction for title page:

10.1.1 The title of the thesis should appear in 12 point boldface upper and lower case letters.

10.1.2 The word 'by' should in lower case letters.

10.1.3 The name of the author should be in upper and lower case letters, and should be identical to the one in the copyright page. The name used must be the student's legal name as it appears on the University records.

10.1.4 Write out the full name of the degree in uppercase letters for which the work is presented, e.g. DOCTOR OF PHILOSPHY, MASTER OF SCIENCE IN CIVIL ENGINEERING, MASTER OF SCIENCE IN COMPUTER SCIENCE & ENGINEERING.

10.1.5 Under major subject, the student should write the name of the department in full e.g. Civil Engineering.

10.1.6 Type in CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY in uppercase letters.

10.1.7 The date of the title page should indicate only the year of the defence.

10.2 Certification page of Thesis / Project Report Approval:

The certification page of Thesis / Project Report Approval should be as per the format of Annexure I of this Appendix-II

10.3 Declaration Page:

The Declaration page should be as per the format of Annexure II of this Appendix-II

10.4 Dedication (optional)

10.5 Table of Contents:

The decimal system is advised for mentioning the headings and sub headings of the chapter. Each headings and subheadings appearing in the Table of Contents must appear in the text of the thesis / project report.

10.6 List of Tables and Figures:

A List of Tables and Figures should follow the Table of Contents. Each should appear on separate page with the appropriate page numbers. However, if the lists are very short they may be combined on one page under the title "List of Tables and Figures". It is advised that the decimal system (e.g. figure 3.2 is the second figure in chapter 3) be used for figures if this system is followed for headings.

10.7 List of Abbreviations of Technical Symbols and Terms:

Page of the list of Abbreviations of Technical Symbols and Terms should be incorporated following the page of list of Tables and Figures. In this respect the student is advised to consult information sources such as Abbreviations Published by the American Standards Association and other information sources available in the Central Library. These abbreviations are also frequently found listed at the back of standard texts on technical writing.

10.8 Acknowledgements:

These should be given on a page following the List of Abbreviations of Technical Symbols and Terms. The student should acknowledge advice, service encouragement, library and information service support and source of financial support.

10.9 Abstract:

The student is required to incorporate an abstract following the page of acknowledgement. The abstract must be no longer than can be accommodated in single space type on one side page only.

10.10 Main Body of Text:

10.10.1 Heading and Sub-headings:

Headings and subheadings of the text must be consistent and correspond to the headings given in the Table of Contents. Each major chapter should begin on a new page.

10.11 Reference/Bibliography:

Notes and bibliography/references should be typed in single spacing. A consistent policy should be used, interesting the notes at the foot of page or at the end of each chapter or at the thesis/project report. References must be complete, clear and exact and must be give sufficient information to enable any person reading the thesis/project report to find the references quickly and easily. A reference to an article in a journal must include author's name and initials, the title of articles, the title of the journal, date/year, volume if applicable, issue number if applicable and inclusive pages. A reference to a book must include the name of the author with initials, title of the book, title of article in the book, volume if applicable, editor if applicable, place of publication if applicable, publishers if applicable, year of publication and Specific page number. If titles of journals are abbreviated, they must follow a standard form as used in a reputed research journal. All references listed in the reference section must be cited in the text. References to conference proceedings must include the date and location of conference. The student is all allowed a certain freedom of choice, since methods of handing references in the text and listing them varies. However, the student is advised to use that employed in the most reputed journals in his field. Above all, they must be consistent in format. Alphabetical listing of references by author is preferable.

10.12 Appendices:

Appendices are included to provide detailed information that would otherwise detract the readability of the main body of the text. Computer programs, lengthy tables and detailed laboratory procedures etc. are a few examples of material to be included in the Appendix. Appendices must be paginated in accordance with the text. All tables and figures in the Appendices must be appropriately labelled and listed in the Lists of Tables and Figures.

ANNEXURE-III

The dissertation/thesis/project titled.....

.....

.....

.....

submitted by .....

Roll No. ..... Session .....

has been accepted as satisfactory in partial fulfilment of the requirement for the degree of .....

..... on .....

BOARD OF EXAMINERS

1. (Signature) — Chairman
   Name of the Supervisor
   Designation & Address
2. (Signature) — Member
   Name of the Co-Supervisor (if any)
   Designation & Address
3. (Signature) — Member
   Name of the Internal Member
   Designation & Address
4. (Signature) — Member
   Name of the Internal Member
   Designation & Address
5. (Signature) — Member (Ex-Offico)
   Name of the Head of the Dept.
   Designation & Address
6. (Signature) — Member (External)
   Name of the External Member
   Designation & Address

ANNEXURE-IV

CANDIDATE'S DECLARATION

It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

Signature of the Candidate

Name of the Candidate

সংশোধনী

সিদ্ধান্ত-১০৩/১১(গ) ঃ (iii) স্নাতকোত্তর পর্যায়ের শিক্ষার্থীরা 'I' Grade প্রাপ্ত হলে তা Academic Transcript এ প্রতিফলিত হবে না।

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CHAPTER 4

COURSE REQUIREMENTS FOR POSTGRADUATE MECHANICAL ENGINEERING STUDENTS

4.1 Courses Offered in Different Semester M.Sc./M. Engineering (Mechanical) /Ph.D Degree

The postgraduate students of the Mechanical Engineering Department have to follow the courses offered below.

Course No.	Course Title	Contact hour/ week	Credits
	GENERAL		
ME6300	PROJECT/THESIS	3	6/18
ME6302	ARTIFICIAL INTELLIGENCE	3	3
ME6303	APPLIED STATISITCS	3	3
ME-6304	ADVANCED NUMERICAL ANALYSIS	3	3
21-40	THERMOFLUID		
ME6321	ADVANCED THERMODYNAMICS	3	3
ME6322	ADVANCED HEAT TRANSFER I	3	3
ME6323	ADVANCED HEAT TRANSFER II	3	3
ME6324	MECHANICS OF INVISCID INCOMPRESSIBLE FLUID	3	3
ME6325	I. C. ENGINES AND COMBUSTION I	3	3
ME6326	REFRIGERATION ENGINEERING I	3	3
ME6327	I. C. ENGINES AND COMBUSTION II	3	3
ME6328	ENERGY CONVERSION	3	3
ME6329	VISCOUS FLUID FLOW	3	3
ME6330	REFRIGERATION ENGINEERING II	3	3
ME-6331	AIR CONDITIONING	3	3
ME6332	FLUID AND GAS DYNAMICS	3	3
ME6333	EXPERIMENTAL FLUID MECHANICS	3	3
ME6334	TURBULENCE	3	3
ME6335	RENEWABLE ENERGY	3	3
ME6336	SOLAR ENERGY	3	3

ME6337	ADVANCES IN ADSORPTION TECHNOLOGY	3	3
40-60	APPLIED MECHANICS AND MATERIALS		
ME6341	APPLIED ELASTICITY	3	3
ME6342	THEORY OF PLATES AND SHELLS	3	3
ME 6343	APPLIED PLASTICITY	3	3
ME6344	EXPERIMENTAL STRESS ANALYSIS	3	3
ME6345	THEORY OF ELASTIC STABILITY	3	3
ME6346	MECHANICAL BEHAVIOR OF ENGINEERING MATERIALS	3	3
ME 6347	CONTROL AND AUTOMATION ENGINEERING	3	3
ME6348	MICROSYSTEMS ENGINEERING	3	3
ME6349	THEORY OF VIBRATIONS	3	3
ME6350	EXPERIMENTAL METHODS IN MATERIALS ENGINEERING	3	3
ME6351	ADVANCE CORROSION ENGINEERING	3	3
ME6352	THERMODYNAMICS FOR MATERIALS ENGINEERING	3	3
ME6353	MAGNETIC MATERIALS	3	3
ME6354	COMPOSITE MATERIALS	3	3
ME6355	WAVE PROPAGATION IN SOLIDS	3	3
61-90	PRODUCTION ENGINEERING AND MANAGEMENT		
ME6361	OPERATIONS RESEARCH I	3	3
ME6362	OPERATIONS RESEARCH II	3	3
ME6363	ENGINEERING ECONOMIC ANALYSIS	3	3
ME6364	FACILITY PLANNING AND LAYOUT DESIGN	3	3
ME6365	HUMAN RESOURCES MANAGEMENT	3	3
ME6366	PROJECT MANAGEMENT	3	3
ME6367	SYSTEMS DYNAMICS MODELLING AND INDUSTRIAL APPLICATIONS	3	3
ME6368	ADVANCED PRODUCTION MANAGEMENT	3	3
ME6369	ECONOMIC PRINCIPLES AND ENGINEERING ECONOMY	3	3
ME6370	FUNDAMENTALS OF MANAGEMENT OF TECHNOLOGY	3	3
ME6371	COMPUTER METHODS IN INDUSTRIAL ENGINEERING	3	3
ME6372	ADVANCED INDUSTRIAL MANAGEMENT	3	3
ME6373	INDUSTRIAL ROBOTICS	3	3
ME6388	ENERGY STORAGE SYSTEMS	3	3

Each course offered by the department has a four digit number with prefix (ME) which stands for the name of the department. The first digit indicates the level of the courses (6 for M. Sc. / M. Engineering in Mechanical Engineering). The second digit indicates department. (Civil Engineering Department 1, Electrical & Electronics Engineering Department -2, Mechanical Engineering Department -3).

Remaining two digits indicate serial number assigned to a departmental course such as 00-20 for general courses, 21-40 for thermo-fluid, 41-60 for applied mechanics and materials, 61-90 for production engineering and management.

4.3 Course Details

4.3.1 GENERAL COURSES

ME 6302 ARTIFICIAL INTELLIGENCE
3 Credits, 3 periods/week
Over view of Artificial Intelligence (AI), Production system and AI, Solving problems by searching, Heuristic Search Technology, Knowledge presentation, Learning, Formal Learning theory, Neutral Net learning and Genetic learning, Connectionist models, Expert system architecture.

ME 6303 APPLIED STATISTICS
3 Credits, 3 periods/week
Basic concepts of probability, random variables, probability distribution; descriptive statistics; statistical estimation and inference; linear regression analysis; time series analysis; forecasting and decision making; Poisson processes; optimality conditions, khun-tucker theorem; examples of statistical and forecasting applications for decision making.

ME 6304 ADVANCED NUMERICAL ANALYSIS
3 Credits , 3 periods/week
Algorithms. Methods of undetermined coefficients. Numerical differentiation and integration. Solution of ordinary differentia1 equations. Solution of linear and initial value problems. Numerical solution of partial differential equations. Eigen value problems

4.3.2 Thermo Fluid

ME 6321 ADVANCED THERMODYNAMICS
3 Credits, 3 periods/week
Laws of thermodynamics. Steady and unsteady flows with energy transactions. Thermodynamic relations. Evaluation of properties of pure substance. Chemical equilibrium. Real gases. Non-reactive and reactive mixtures. Phase equilibrium. Unconventional systems, Principles of irreversible thermodynamics.

ME 6322 ADVANCED HEAT TRANSFER I
3 Credits, 3 periods/week
Steady state conduction. Systems with internal generation of heat. Non-steady conduction. Heat transfer with moving boundaries. Numerical methods. Radiation properties and laws. Radiation through black and gray bodies. Electrical analogy. Radiation through gases. Solar radiation.

ME 6323 ADVANCED HEAT TRANSFER II
3 Credits, 3 periods/week
Conversion equations. Laminar and turbulent boundary layer concepts. Dimensional analysis. Analogy between heat, mass and momentum transfer. Free convection caused by body and centrifugal forces on different bodies. Forced convection inside tubes, ducts and over exterior surfaces. Tube bundles in cross flow. Boiling and condensation. Designing of heat exchangers. Numerical methods Mass transfer coefficients. Interface mass transfer. Drying of solids. Humidification, and dehumidification Cooling towers.

ME 6324 MECHANICS OF INVISCID INCOMPRESSIBLE FLUID 3Credits, 3 periods/week
Kinematics of a fluid medium, the fundamental hydrodynamic equations for an ideal fluid: The simplest cases of motion of an ideal fluid: Vortex motion of an ideal fluid: The plane motion of a body in an ideal fluid; The three dimensional motion of a body in an ideal fluid.

ME 6325 I. C. ENGINES AND COMBUSTION I
3 Credits, 3 periods/week
Combustion problems in I. C. Engines, combustion process in S. I. and C. I. Engines. Delay period. Engine knock. Effect of operating parameters on knocking. Knock reduction. Fuel requirement and ratings. Alternate fuels. Carburetion and fuel injection. Combustion chamber design. Engine cooling. Modem development in I. C. Engines. Rotary piston engine. High specific output engines, Multi-fuel engines.

ME 6326 REFRIGERATION ENGINEERING I
3 Credits, 3 periods/week
Thermodynamic properties of pure and mixed refrigerants and their selection. Thermodynamics of refrigeration systems. Air cycle refrigeration. Aircraft refrigeration systems. Multi-pressure systems. Cascade systems. Manufacture of dry ice, desalination of sea-water. Vapour-absorption cycle. Thermodynamics of refrigerant absorbent combinations. Analysis of simple and industrial vapour absorption system using various working fluids. Two-stage vapour absorption systems. Intermittent vapour absorptin system using solar energy, Ejector refrigeration system. Low temperature refrigeration systems.

ME 6327 I. C. ENGINES AND COMBUSTION II
3 Credits, 3 periods/week
Thermodynamics of fuel-air cycle. Actual cycle. Use of combustion charts for cycle analysis. Power improvement of engines. Supercharging problems in modern turbocharged engines. Two stroke engines. Scavenging. Porting calculations. Fuel injection system. Atomization and spray formation computer simulation.

ME 6328 ENERGY CONVERSION
3 Credits, 3 periods/week
Survey of energy conversion problem. Basic science of energy conversion. Physics of semiconductor junctions for photo-voltaic and photo-electrochemical conversion of solar energy. Fabrication and evaluation of various solar cells. Application of solar cells in photovoltaic power generation systems. Technology and physics of thermo-electric generators. Thermo-electric materials and optimization studies. Basic concepts and design consideration of MHD generation. Cycle analysis of MHD systems. Thermo□ ionic power conversion and plasma. Thermodynamics and performance of fuel cells and their applications.

ME 6329 VISCOUS FLUID FLOW
3 Credits, 3 periods/week
Governing equations in differential form. Navier-stokes equations and applications. Review of boundary layer prediction methods. Transition and turbulence. Turbulent boundary layers. Drag on bodies. Free turbulent flows. Jets, wakes and separated flows. Turbulent boundary layer prediction methods.

ME 6330 REFRIGERATION ENGINEERING II

3 Credits, 3 periods/week

Introduction to vapor-compression and vapor-absorption system components. Compressors: Analysis and thermal design of reciprocating, centrifugal and screw compressors. Computer simulation of compressor. Expansion devices thermal design of capillary, automatic and thermostatic expansion valves. Evaporators thermal design of D-X and flooded evaporators. Extended surface of evaporators. Augmentation of boiling heat transfer. Thermal design of water cooled and air cooled condensers. Thermal design of vapor absorption system components-absorber, generators and heat exchangers. Design of intermittent absorption systems. Types of cooling towers and their design.

ME 6331 AIR CONDITIONING

3 Credits, 3 periods/week

Psychrometry. Air-conditioning calculations. Comfort scales and measures. Concept of effective temperature. Solar radiation. Solar heat gain through glass. Sol-air temperature. Internal and system heat gain. Heat storage, diversity and stratification.

Dehumidification and humidification equipment. Cooling towers, spray washers, cooling end humidifying coils. Design of air duct system. Room air distribution principles. Various types of air conditioning systems. Temperature pressure and humidity controls. Various types of system controls.

ME 6332 FLUID AND GAS DYNAMICS

3 Credits, 3 periods/week

Introduction and definitions. Equations of motion for three-dimensional flow. Navier-stokes equations. Circulation and vorticity Potential for problems. Flow around bodies (cylinders and aerofoils).

Transformation of circles into aerofoil. Prediction of velocity and pressure distribution. Boundary layer problems. Laminar and turbulent boundary layers. Separation criteria.

Introduction to compressible flow. Velocity of sound and mach number. Isentropic flow. Flow with friction and heat transfer. Analysis of flows with normal and oblique shock waves. Supersonic flows. Unsteady flows.

ME 6333 EXPERIMENTAL FLUID MECHANICS

3 Credits, 3 periods/week

Physics of Fluids: Control volume analysis, Newtonian viscuss fluid, Flow Visualization experiments; Measurable quantifies and their physical significance: Characteristics of pitot and static tube in incompressible flow; hot wires, film and thermistors.

ME 6334 TURBULENCE

3 Credits, 3 periods/week

Introduction to origin of Turbulence, Equation of Reynolds stress, Estimation of Reynolds stresses for different boundary conditions, Homogeneous and Isotropic Turbulence, Co-relations between Turbulence quantities, Integral Scale of Turbulence, Taylor's one dimensional energy spectrum, Hot wire Techniques in the measurement of Turbulence flow.

ME 6335 RENEWABLE ENERGY

3 Credits, 3 periods/week

Reserves of non-renewable fuels; prospects of renewable energy and its sources end pattern of usage; characteristic of renewable sources, intermittent, low power density etc.; use of renewable energy in small scale systems.

Current technology: wind, wave, tidal, passive and active solar, biological, and examples of devices; Energy management interaction of non-technical requirements (social, economical, political, environmental) in engineering design and innovation; case study.

ME 6336 SOLAR ENERGY

3 Credits, 3 periods/week

Solar Radiation, Solar Geometry, Theory of Flot, Plate collectors, Flat-Plate Collector performance concentrating collectors, Energy Storage, System thermal calculations and experiments.

4.3.3 Applied Mechanics and Materials

ME 6341 APPLIED ELASTICITY

3 Credits, 3 periods/week

Analysis of stress and strain. Linear elasticity. Variational principles. Torsion, of shafts. Stress analysis of plates and rotating discs. Beams and plates on elastic foundation. Introduction to analysis of shells. Thermo-□elasticity. Thermal, stresses in turbine rotors. Piping and pressure vessels. Transient thermal stresses.

ME 6342 THEORY OF PLATES AND SHELLS

3 Credits, 3 periods/week

Classical Theory of Plates (isotropic and orthotropic); Large deflection theory of plates. Membrane theory of shells. Bending theory of shells applied to cylindrical shells.

ME 6343 THEORY OF PLASTICITY

3 Credits, 3 periods/week

Phenomenological nature, stress analysis, strain analysis, Yield criteria of metals, stress-strain relations, strain hardening characteristics, plasticity conditions, deformation equations, buckling, necking, some methods of solving forming problems, extrusions, drawing, slip-line solution. -

ME 6344 EXPERIMENTAL STRESS ANALYSIS

3 Credits, 3 periods/week

Resistance strain gauges and associated circuits, strain gauge rosettes, Semiconductor strain gauges. Other electrical, mechanical, pneumatic, and optical strain measuring devices. Recording of dynamic strain measurements. Stress probing, Residual stress. Principles of photo-elasticity, iso-clinic and isochromic fringes. Compensation techniques. Stress freezing oblique incidence and scattered light methods, photo-□ elastic coating techniques. Brittle lacquer technique. Analysis of experimental results.

ME 6345 THEORY OF ELASTIC STABLTTY

3 Credits, 3 periods/week

General stability theory: Discrete and continuous system. Introduction to calculus of variations, Approximate methods. Buckling of Column Frames, Flexural elements plates and shells.

ME 6346 MECHANICAL BEHAVIOR OF ENGINEERING MATERIALS

3 Credits, 3 periods/week

Deformation, elastic behavior, plastic behavior, creep and creed rupture; Non-elastic behavior, fatigue fracture, brittle fracture, ductile fracture. ' .

ME 6347 CONTROL AND AUTOMATION ENGINEERING

3 Credits, 3 periods/week

This subject covers advanced technique for modeling, analysis and design of systems suited to multi□ variable, adaptive or optimal control. Laboratory projects are conducted on a continuous basis throughout the semester. Topics include: direct and inverse Nyquist arrays, characteristic locus, robust control, pole shifting techniques, identification algorithms, minimum variance control, self tuning adaptive regulator, linear quadratic regulator design, state estimation and the Kalman filter.

ME6348 MICROSYSTEMS ENGINEERING

3 Credits, 3 periods/week

Microsystems: Microsystems technologies, Introduction to MEMS, film deposition, Pattern transfer, Layer removal, Precision machining, Lithography, Structuring, Dry etching, Laser processing, Silicon micromechanics, LIGA process, Fabrication of ICs. Microactuator: Actuators type, Energy conversion, Electromagnetic actuators, Electrostatic micromotors, Piezoelectric actuators, Thermomechanical actuators, Friction and Wear. Sensors: Types of sensors, Intelligent sensor, Signal detection and Signal processing, Piezoresistive sensors, Capacitive sensors, Surface wave sensors, Chemical and Biosensors, Sensor interfacing and multi-component analysis. System Integration: Functions of system integration, Switching characteristics, Energy dissipation, CMOS technology, Signal transmission, Interconnection and Wiring density, Yield and Testing, Reliability analysis.

ME 6349 THEORY OF VIBRATIONS

3 Credits, 3 periods/week

Kinematics of vibrational motion, Fourier series expansion of periodic function, Vibrations of small amplitudes, Free un-damped vibrations, Free vibrations of systems with viscous damping, Forced vibrations of undamped systems under harmonic loading, Forced vibrations of viscous damped systems under harmonic loading, Harmonic motion of displacement excitation of the system, Vibration isolation, active and passive, Harmonic loading, Free vibrations of two DOF and multi DOF undamped systems, Forced vibrations of two DOF and multi DOF undamped systems, Free vibrations of two DOF and multi DOF damped systems, Forced vibrations of two DOF and multi DOF damped systems. Systems with semi definite potential energy, Vibration absorber.

ME6350 EXPERIMENTAL METHODS IN MATERIALS ENGINEERING

3 Credits, 3 periods/week

Introduction and definitions of advance techniques used in materials science. Various materials characterization techniques for metals, ceramics, polymers and composites for instance, Scanning electron microscopy (SEM), Transmission Electron Microscopy (TEM), X – ray and neutron diffraction, Thermal analyses (DSC, TGA) and quantitative metallography including practical applications.

ME6351 ADVANCE CORROSION ENGINEERING

3 Credits, 3 periods/week

Introduction and definitions of advance techniques used in corrosion measuring and prevention using various electrochemical and other methods including practical applications.

ME6352 THERMODYNAMICS FOR MATERIALS ENGINEERING

3 Credits, 3 periods/week

Introduction, The structure of thermodynamics, The laws of thermodynamics, Thermodynamic Variables and relations, Equilibrium in thermo dynamic systems, Statistical thermodynamics, Unary heterogeneous system, Multi-component, Homogeneous non-reacting systems, Solvates, Multicomponent heterogeneous systems, Thermodynamics of phase diagram, Multicomponent multi-phase reacting system, Capillarity effects in thermodynamics, Defects in crystals, Equilibrium in continuous system, Thermodynamics effects, Electrochemisty.

ME6353 MAGNETIC MATERIALS

3 Credits, 3 periods/week

Definition and units, Experimental methods, Diamagnetism and Para magnetism, Ferromagnetism, ant magnetism, Magnetic anisotropy, Induced magnetic anisotropy, Fine particles and thin films, Commercial magnetic materials.

ME 6354 COMPOSITE MATERIAL

3 Credits, 3 periods/week

Introduction, Materials, Manufacturing process, Micromechanics, Ply Mechanics. Machromechanics failure and Strength, Beams, Plates and stiffened panels, Shells.

4.3.4 Production Engineering and Management

ME 6361 OPERATIONS RESEARCH I

3 Credits, 3 periods/week

Introduction to OR, Historical development and nature of OR projects. Phases of OR study. Model building and various types of OR problems.
Linear deterministic optimization models - linear programming formulation and solution, Revised SIMPLEX method. Duality in L.P. end their solution. Degeneracy. Assignments. Transportation and transshipment models. Industrial applications of L.P. Post-optimality analysis in L.P. Non-linear programming-Quadratic, separable-convex programming Integer L.P. Chance constrained programming. Case studies in L.P. goal Programming.

ME 6362 OPERATIONS RESEARCH II

3 Credits, 3 periods/week

Waiting line models. Single and multiple channel models. Priority queues. Application of waiting line theory to industrial and service sectors. Replacement and maintenance models. Simulation: Basic concepts, discreet event simulation, generation of random numbers and events using Monte Carlo method. Simulation of queuing systems. Variance reduction techniques. Validation. Application to business, Industry and service systems.

ME 6363 ENGINEERING ECONOMIC ANALYSIS

3 Credits, 3 periods/week

Cash flow, Time value of money, Comparisons of alternatives, Inflation and cost estimation, replacement analysis, bonds, After tax economic analysis, Break even sensitivity and risk analysis establishing minimum attractive rate of return, economic analysis of projects, decision models, Decision making for large capital movement.

ME 6364 FACILITY PLANNING AND LAYOUT DESIGN

3 Credits, 3 periods/week

Facilities designing functions, pre-requisites for an efficient plant layout; Designing material flaw, Basic flow systems, Locating production and service facilities, Facility location models, Layout concepts, Layout planning, Developing the process layout, The product layout and the group technology layout, Cellular layout, Space determination and area allocation, Evaluating and implementing of alternative layouts, Computerized layout design.

ME 6365 HUMAN RESOURCES MANAGEMENT

3 Credits, 3 periods/week

Human relations and Organizational behavior in technology-based organizations investments in human resources; nature and function of personnel managements and human resources development, new technology and job design, performance appraisal, training and management development strategies; case studies.

ME 6366 PROJECT MANAGEMENT

3 Credits, 3 periods/week

Project Planning, Project Analysis-market and demand analysis, Technical Analysis, Financial Analysis, Project cash flow, Appraisal criteria, Analysis of risk, social cost benefit analysis, operation and flexibility, Implementation-network technique far project Management, PERT/ CPM, Resource scheduling, Resource levelling, crushing, Project monitoring, Case studies using PERT/CPM methodology.

ME 6367 SYSTEMS DYNAMICS MODELLING AND INDUSTRIAL APPLICATIONS

3 Credits, 3 periods/week

Introduction to system dynamics. casual-loop diagramming. Flow diagramming. Positive feedback structure. Negative feedback structure. S-shaped growth structure. Delays.
Applications in planning and policy design for production systems. Dynamics created by interaction with company suppliers, labour, customers and competitors. System dynamics models to evaluate financial performance of organizations. Dynamics created by capacity expansion and professional resource expansion.

ME 6368 ADVANCED PRODUCTION MANAGEMENT

3 Credits, 3 periods/week

Operations strategy and competitiveness, Forecasting – Qualitative and Quantitative techniques, Forecasting methods based on time series analysis, Moving average and exponential techniques, ARIMA models, BOX and Jenkinson technique, Casual models, Simple and Multivariate regression methods, Measurement of forecasting accuracy, Monitoring and controlling of forecasts, Planning for operations and capacity, Aggregate planning, MRP, MRP II, Inventory models - deterministic and stochastic, JIT Manufacturing, operation scheduling, Detailed scheduling, Managing for quality, Total quality Management, Product liability, Productivity improvement, Ergonomic case studies.

ME 6369 ECONOMIC PRINCIPLES AND ENGINEERING ECONOMY
3 Credits, 3 periods/week

Economic organization, utility and indifference curve; elements of supply and demand; theory of production; theory of cost; theory of price under different market structures; theory of general economic equilibrium, welfare economics.

Basic concept in engineering economy; equivalence and derivation of formulae; evaluation of methods for selection among alternatives; depreciation and taxation; risk and uncertainty, inflation; revenue requirement method; economic analysis and engineering economy related issues.

ME 6370 FUNDAMENTALS OF MANAGEMENT OF THCHNOLOGY
3 Credits, 3 periods/week

The concept of technology, technology and development, technology transfer and technological change; technology and the firm; marketing of technology; the need for the effective management of technology. R & D planning, International technology transfer, Technology forecasting & diffusion.

ME 6371 COMPUTER METHODS IN INDUSTRIAL ENGINEERING
3 Credits, 3 periods/week

Computers and modes of storage memory. Access time for different data storage system. Software of a computer: Executive, Macros, Library system, monitoring and editing of a program, batch processing, time sharing, paging, Computer languages; FORTRAN, GPSS, DYNAMO. Use of computers in production planning and control, Information system, inventory management, inventory management, simulation etc.

ME 6372 ADVANCED INDUSTRIAL MANAGEMENT
3 Credits, 3 periods/week

Management and Society, Global and competitive management, Management by objectives, SWOT Matrix; Effective organizing, organizational cultural and behavior. Financial management, Ratio analysis, Working capital management, Leveraging of a firm.; Financial through capital market, Profitability and Risk, Capital asset pricing model, MIS, Application of computer software for managing information, Sharing of information through satellite communication; transfer of technology across geographical barrier, Management of Technology for the development of the country.

ME 6373 Industrial Robotics

3 Credits, 3 periods/week

Introduction: Definition of robot, Basic concepts, Robot configurations, Types of robot drives, Basic robot motions, Point to point (PTP) Control, Continuous path control, work envelop; Components and Operations: Basic control system concepts, Control system analysis, Robot actuation and feed back, Manipulators: Direct kinematics, Inverse Kinematics, Coordinates transformation, robot dynamics, Types of robots, effectors, grippers,Tools as end effectors, Robot/end-effort interface; Sensing and Machine Vision: Selection criteria of sensors for robotic uses, Range sensing, proximity sensing,Touch sensing, force and torque sensing, Introduction to machine vision sensing, Digitizing image processing,Image analysis; Robot Programing: Methods and Languages, Capabilities and limitation, Artificial intelligence, Knowledge representation, Search techniques -A1 and robotics; Industrial Application: Applications of robots in machining, Robots-in welding, assembly, Material handling, Loading and unloading, CIM, Hostile and remote environment, Agricultural industries, Medical uses, Collaborative Tasks.

ME 6388 Energy Storage Systems

3 Credits, 3 periods/week

Energy storage overview, Types and features of energy storage systems, Ionic battery (Lithium-ion battery, Lithium-air battery, Zinc-air battery, Magnesium-air battery, Aluminum-air battery, Sodium-ion battery, materials for Lithium batteries), Fuel cell / regenerative fuel cell, Capacitor, Super-capacitor, Thermodynamics and Reaction kinetics of various energy storage systems, Charge and mass transport, Electrochemical characterization (Charge-discharge cycling, Electrochemical Impedance Spectroscopy, Cyclic voltammetry).

DEPARTMENT OF MECHANICAL ENGINEERING