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University of
Engineering and
Technology

COURSE CURRICULUM FOR POSTGRADUATE STUDIES

Second Edition

Department of Civil Engineering
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PREFACE

It gives me great pleasure to publish the updated course curriculum for the postgraduate studies of the Department of Civil Engineering.

I would like to express my thanks and gratitude to all my colleagues of the Department. Special thanks are due to Prof. Dr. Md. Hadiuzzaman, Dr. Shameem Ahmed (BPGS Secretary), Dr. Provat Kumar Saha, Bayezid Baten and Mashiat Hossain for their all-out effort and help in different stages of preparation of this booklet.

This booklet presents the rules and regulations of the course system, course requirements and contents of the postgraduate programme of the Department of Civil Engineering. It is an essential companion for students of this Department as well as their advisers for smoothly carrying out their academic activities. Although the current booklet retains the overall characteristics of its previous version, efforts have been made to incorporate key modifications related to regulations and course content. Special care has been taken in Chapter 3 where, summary of the list of actions and required documents for M.Sc. Engg., M. Engg., and Ph.D. degree in Civil Engineering are included.

As with the practice of any Course System, it is likely that some of the rules and regulations published in this booklet may be modified in future. Students are, therefore, strongly advised to be in touch with their advisers regarding modifications, if any, that may be introduced by the university.

It is expected that the information provided in this booklet will be useful to the advisers and postgraduate students of the Department of Civil Engineering.

Dhaka
September, 2019

Dr. Ahsanul Kabir
Professor and Head
Department of Civil Engineering
BUET

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Chapter 1

General Information

1.1 Historical Background

Bangladesh University of Engineering and Technology, abbreviated as BUET, is the oldest institution for the study of Engineering and Architecture in Bangladesh. The history of this institution dates back to the days of Dhaka Survey School which was established at Nalgola in 1876 to train surveyors for the Government of Bengal of British India. As the years passed, the Survey School became the Ahsan Ullah School of Engineering, offering three-year diploma courses in Civil, Electrical and Mechanical Engineering. In 1948, the School was upgraded to Ahsan Ullah Engineering College (on its present premises) as a Faculty of Engineering under the University of Dhaka, offering four-year Bachelor's courses in Civil, Electrical and Mechanical Engineering with a view to meet the increasing demand for engineers in the country and to expand the facilities for advancement of engineering education. In order to create facilities for post graduate studies and research, Ahsan Ullah Engineering College was upgraded to the status of a University under the name of East Pakistan University of Engineering and Technology in the year 1962. After independence of Bangladesh in 1971, it was renamed as the Bangladesh University of Engineering and Technology. Starting with two faculties, the university has now been enlarged into five faculties. The faculty of Civil Engineering opened in 1980.

The BUET campus is in the heart of the city of Dhaka. It has a compact campus with halls of residence within walking distances of the academic buildings. The physical expansion of the University over the last few years has been impressive with construction of new academic buildings, auditorium complex, students' halls of residences, medical center, etc.

Initially, the university had no campus or a building of their own and rather resorted to a rented building to carry out institutional works. But with initiatives and help from the Government, its first own building was constructed, some place near the present Shahidullah Hall. Even a few days back, a tall chimney located at the later bore the symbol of its first establishment. In 1920, the university was shifted to the present location.

After the Second World War, the then Government undertook major plans for industrializations of the Bengal. However, difficulties arose during the implementations of such plans as inexperience of the people was a major issue. People did not have adequate training to perform the works. It was obvious that a solution to this problem became a necessity. Therefore, the Government selected a committee with the purpose of establishing an engineering college for the admission of 120 students in Mechanical, Electrical, Chemical and Agricultural Engineering in 4 year degree courses and also to transfer the school to the Palashi Barrack with an aim to enroll a further 480 students in civil, mechanical and chemical engineering for 3 year diploma courses. By the year 1947, in the month of August, the Ahsan Ullah Engineering School was promoted to Ahsan Ullah Engineering College and Mr. Hakim Ali was appointed as the principal.

In February 1947, the then East Pakistan Government approved the college and gave permission to offer degrees in Civil, Mechanical, Electrical, Chemical, Agricultural and Textile Engineering and diplomas in Civil, Mechanical and Electrical Engineering. However, in the end, Agricultural and Textile departments were withdrawn, and students were admitted in the Department of Metallurgical Engineering. During this period, the college was an affiliate of Dhaka University.

As time passed, the growth of Ahsan Ullah Engineering College amplified. The semester system and a new curriculum were introduced in the year 1956. The prospectus became even better when the number of available seats in degree course was doubled from 120 to 240 in 1957. The diploma course was terminated in 1958.

Already, Mr. T. H. Mathewman in 1951 and Dr. M. A. Rashid in 1954 joined as principals in the college. Over the years, the number of teachers kept proliferating. At this time, an exchange program was established between Texas A&M College (now a university) and Ahsan Ullah Engineering College. Some teachers arrived here from Texas College and played a crucial role in improving the teaching quality, laboratory and the curriculum. For ensuring the quality of teaching and further development, some of the teachers from the Ahsan Ullah Engineering College were transferred to Texas A&M College as exchange students for obtaining their postgraduate degrees. The knowledge gained could then be channelized among the students of the country so that they can flourish. Meanwhile, the Asian foundation donated some essential books and the rental library system was launched which is operational to date. The present Dr. M. A. Rashid building (main hostel) and Nazrul Islam Hall (South Hostel) were used as residences back then. In 1958, Ahsan Ullah Hall was built. In 1961, Dr. M. A. Rashid joined as Director of Technical Education and Dr. Wakar Ahmed took charge as the Principal.

In order to create opportunities for higher education and the required infrastructure and facilities for research, the Ahsan Ullah Engineering College upgraded its status to East Pakistan University of Engineering and Technology on 1st July 1962. Dr. M. A. Rashid was appointed as the first Vice Chancellor of the university, from his previous position as the Director of Technical Education. Not to mention, his shear discipline, dynamic nature of leadership and near perfect code of conduct gave a solid foundation to the university right at the beginning. Professor A. M. Ahmed became the Dean of Civil Engineering Department. Back then, the main hostel (currently Dr. M. A. Rashid Hall) served as the university's administrative office. Furthermore, the eminent mathematician Mr. M. A. Jabbar became the first registrar and Mr. Momotajuddin Ahmed became the first comptroller of the university.

However, the institution did not have adequate space to house the students seeking for rooms in halls. To accommodate them, three new residential halls viz. Quaid-e-Azam Hall (at present Titumir Hall), Sher-e-Bangla Hall

year 1962, Architecture Department under the Architecture and Planning Faculty was opened, and some experienced teachers flew from Texas A&M College to join the department. Thus, the university set the foot out for a glorious journey ahead comprising the Engineering and Architecture Faculty which in turn constituted of Civil, Mechanical, Electrical, Chemical and Metallurgical, and Architecture departments.

During 1969 to 1970, the university could house 420 students. In that period, the Architecture and Planning faculty had an undergraduate intake of only 30 students. Later on, in the 1976-77-78 session, the number of seats in Engineering Faculty, and Architecture and Planning Faculty was increased to 510 and 50, respectively. In addition, a quota of 50 seats was allowed for foreign, ethnic and security force groups. Gradually the seat number was increased and in the 1997-98 session, the Engineering Faculty could accommodate a total of 725 seats along with 85 seats for the Architecture and Planning faculty. In the 2006-07 academic year, the number of seats in Engineering Faculty was further increased to 800 along with a total capacity of 885. Still, it was not enough to meet the needs of a developing country with rapidly growing population. As a result, the authority and hence the university was compelled to increase number of seats again in the 2009-2010 academic year in various departments of the Engineering Faculty.

All the departments opted to offer undergraduate programs keeping in mind the demand of engineers, architect and planners within the country. In 1995-96 session, undergraduate classes commenced with an intake of 30 students in the Department of Urban and Regional Planning. A year later, for the first time, Department of Industrial and Production Engineering enrolled students for undergraduate studies whereas the previously halted undergraduate classes, began in the Department of Water Resources Engineering once again. The university also took into account the necessity of experts in glass and ceramic industry within the country and launched a new department named the Department of Glass and Ceramic Engineering. All in all, the academic expansion of the university received a major thrust.

As we all know, in 1971, the whole nation plunged into the Liberation War in Bangladesh and waged a mass resistance. Students, teachers, officers and staffs of this university joined in the revolutionary independence war to rise

against the attack by West Pakistan Army. Among those, students and staffs who died as martyrs in the liberation war are listed below:

Name	Identity	Hall/Workplace
Iqbal Ahmed	Reg No. 68077	Suhrawardi Hall
A. K. Sharafuddin Ahmed (Dulal)	Reg No. 68052	Ahsan Ullah Hall
Mufti Mohammed Kashed	Reg No. 67147	Titumir Hall
Mohammed Ahsanul Habib	Reg No. 66234	Titumir Hall
A. K. M. Aminul Islam	Reg No. 69185	Titumir Hall
Salauddin Ahmed Chowdhury	Reg No. 66270	Nazrul Islam Hall
Abu Selim Shahiduzzaman	Reg No. 66128	Sher-e-Bangla Hall
Abul Kashem Molla	Reg No. 68386	Suhrawardi Hall
Abu Ahmed Asadullah	Reg No. 68155	Sher-e-Bangla Hall
Shamsuddin Ahmed	Reg No. 67253	Titumir Hall
Mohammed Habib Ullah	Reg No. 68150	Titumir Hall
Mohammed Golam Nobi	Reg No. 6828	Titumir Hall
Jalal Uddin Ahmed	Reg No. 67298	Titumir Hall
Mohammed Mahfuzul Haque	Reg No. 67298	Nazrul Islam Hall
Mohammed Bodiul Alam	Reg No. 66102	Ahsan Ullah Hall
Mohammed Anwarul Azim	Reg No. 67032	Ahsan Ullah Hall
Mohammed Rafiq Uddin Ahmed (Bulbul)	----	Ahsan Ullah Hall
Mohammed Abdus Sobhan Akhanda	Lab Attendant	Mechanical Department
Abdus Sobhan	Gardener	Suhrawardi Hall
Sri Shiddipodo Ghosh	Steno-typist	Students Directorate

The university's first convocation in Independent Bangladesh was held in 1973. The then Chancellor of the university, Justice Abu Sayeed Chowdhury, Honorable President of the People's Republic of Bangladesh was the Chief Guest and gave away the certificates in the first convocation. It is to be noted that, Father of Nation Bangabandhu Sheikh Mujibur Rahman was present in the first convocation as specially invited personality. He delivered an exceedingly eloquent speech highlighting the expected role of BUET in the development of emergent Bangladesh. The Second Convocation took place in 1976 and Justice Abu Sadat Mohammed Sayem, the Honourable President of Bangladesh and Chancellor of BUET conferred the degrees and gave away the certificates. After a long stretch of 16 years, the third and fourth convocation ceremonies were eventually held on 29th of February 1992 and 8th of May 1993. In these two events, certificates were distributed among the graduates by the then Chancellor and Honorable Prime Minister of Bangladesh Government, Begum Khaleda Zia. The 5th and 6th convocation ceremony were held in 1997 and 2001 respectively where certificates were given by the then Chancellor of the Engineering University, the Honorable Prime Minister of the Government of Bangladesh, Sheikh Hasina. The 7th, 8th and 9th convocation ceremonies were subsequently held on 15th March of 2004, 30th January of 2005 and 3rd January of 2006 respectively and certificates were given by the then Chancellor and the Prime Minister of the Government of Bangladesh, Begum Khaleda Zia. The university's 10th convocation certificates were presented among the students by the then Chancellor and the Honorable President, Late Zillur Rahman on 3rd February of 2011. Eventually, the 11th convocation ceremony was subsequently held on 19th March, 2019 where certificates were given by the current Chancellor and Honourable President, Md. Abdul Hamid.

In the meantime, the Engineering University flourished with new opportunities and facilities. Academic expansion followed through the construction of civil building in 1968, current library in 1975, auditorium complex in 1983 and E.M.E building in 1984. By the year 1978, Shahid Smrity Hall was completed, and it was opened for the students in 1979. The university's first girls' hall was inaugurated in 1986 and was named the "Chattri Hall". Moreover, the university chose to honour Dr. M. A. Rashid, the founder Vice Chancellor of BUET and constructed a hall in his name for the students. Expansion works proceeded on a continuous basis and further extension of the Civil Building was made by 1992 while the construction of

the Academic Council building was finished in 1993. To expedite the developments further, the seventh floor of Civil Engineering building and the sixth floor of E.M.E building were simultaneously completed by 1996. The first building of the Department of Urban and Regional Planning was constructed in 2002 whereas an office building was set up for the controller of examinations in 2003. In 2005, supports and initiative from the Ministry of Communication of the Government of Bangladesh helped founding an institute, equipped with modern facilities, called the "Accident Research Institute". The main objectives of the Institute are to carry out scientific research and investigation to ascertain the causes of accidents on roads, railways and waterways in Bangladesh. Moreover, the Government of Japan came forward and provided financial supports and subsequent initiatives from the Government of Bangladesh saw the establishment of BUET-Japan Institute of Disaster Prevention and Urban Safety (BUET-JIDPUS) in Palashi. A multistoried academic building, called ECE building, was also constructed in the same place which is still in operation.

Infrastructural developments occurred rapidly, and modernization of the curriculum and research facilities also took place simultaneously. As of now, optical fiber cable is installed within the campus and a backbone network is established. The backbone not only tied together diverse networks within a department but also formed a connectivity among the departments and offices within the campus area. At present, BUET is connected worldwide through internet by means of submarine cable and its own VSAT (Very Small Aperture Terminal). The government also decided and henceforth funded to upgrade the computer center into an institute. The institute was later named Institute of Information & Communication Technology (IICT).

Through years of relentless efforts from the students, teachers, officers and staffs, Bangladesh University of Engineering and Technology has reached its present state. Its fame as an ideal institution and a symbol of remarkable success has not only spread within the territory of Bangladesh but has also firmly rooted well beyond. Let it be our oath to preserve the vast and prestigious tradition of this institution and to enforce our paramount effort and endeavor towards its completeness.

Some of the photographs of the key structures of BUET campus are displayed as folows:

Department of Civil Engineering

Dr. M. A. Rashid Bhaban

Department of Architecture

ECE Building

Department of Urban and Regional Planning

BUET Shahid Minar

EME Building

1.2 Academic Activities

Undergraduate courses in the faculties of Engineering, Civil Engineering, Electrical and Electronic Engineering, and Mechanical Engineering usually extend over four years and lead to a B.Sc. Engineering degree in Civil, Electrical and Electronic, Mechanical, Chemical, Metallurgical Engineering, Computer Science and Engineering, and Naval Architecture and Marine Engineering. In the faculty of Architecture and Planning, the

degree of Bachelor of Architecture is usually obtained in five years and Bachelor of Urban and Regional Planning (BURP) in four years.

Postgraduate studies and research are now among the primary functions of this University. Most of the departments under the different faculties offer M.Sc. Engg. and M. Engg. degrees and some departments have started offering the Ph.D. degree. Postgraduate degrees in Architecture (M. Arch.) and Urban and Regional Planning (MURP) are offered by the Faculty of Architecture and Planning. In addition to its own research programmes, the University undertakes research programmes sponsored by various organizations such as UN Organizations, Commonwealth Secretariat, and University Grants Commission (UGC). The expertise of the teachers and 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 and course curricula to meet the growing technological challenges confronting the nation.

1.3 Faculties and Teaching Departments

The University has sixteen teaching departments under five faculties. All departments, except for the department of Humanities, offer both Undergraduate (UG) and Postgraduate (PG) degree programs; however, some of them offer postgraduate (PG) degrees only. Faculty wise list of the departments with the status of the degrees offered is given below:

Faculty of Civil Engineering

Department of Civil Engineering:	UG and PG
Department of Water Resources Engineering:	UG and PG

Faculty of Architecture and Planning

Department of Architecture:	UG and PG
Department of Urban and Regional Planning:	UG and PG
Department of Humanities:	No degree offered

Faculty of Electrical and Electronic Engineering

Department of Electrical and Electronic Engineering:	UG and PG
Department of Computer Science and Engineering:	UG and PG
Dept. of Biomedical Engineering (BME):	UG and PG

Faculty of Engineering

Department of Chemical Engineering:	UG and PG
Department of Material and Metallurgical Engineering:	UG and PG
Department of Petroleum and Mineral Resources Engineering:	PG
Department of Chemistry:	PG
Department of Mathematics:	PG
Department of Physics:	PG

Faculty of Mechanical Engineering

Department of Industrial and Production Engineering:	UG and PG
Department of Mechanical Engineering:	UG and PG
Department of Naval Architecture and Marine Engineering:	UG and PG

1.4 University Administration

Vice Chancellor:	Dr. Saiful Islam

List of Administrative Officers

Registrar:	Dr. S.M. Mahbubur Rahman
Controller of Examinations:	Dr. Quazi Deen Mohd Khosru
Comptroller:	Md. Jasim Uddin Akond

Director, Directorate of Students Welfare:	Dr. Md, Mizanur Rahman
Director, Directorate of Advisory, Extension & Research Services:	Dr. Sheikh Reaz Ahmed
Director, Bureau of Research, Testing and Consultation (BRTC):	Dr. Md. Shamsul Hoque
Director, Directorate of Planning and Development:	Dr. G M Tarekul Islam
Librarian:	Dr. Mohammad Mamum

Deans of Faculties

Dean of Civil Engineering:	Dr. K. A. M. Abdul Muqtadir
Dean of Architecture & Planning:	Dr. Khandaker Shabbir Ahmed
Dean of Electrical & Electronic Engineering:	Dr. Md. Saifur Rahman
Dean of Mechanical Engineering:	Dr. Muhammad Mahbubul Alam
Dean of Engineering:	Dr. Md. Rafique Ullah

Provosts of Residential Halls

Provost, Ahsanullah Hall:	Dr. Mohammad Shahjahan Mondal
Provost, Chattri Hall:	Dr. Umme Kulsum Navera
Provost, Nazrul Islam Hall:	Dr. Mohammed Abdul Basith
Provost, Shahid Smrity Hall:	Dr. Md. Shahidul Islam
Provost, Sher-e-Bangla Hall:	Dr. Md. Zafar Iqbal Khan
Provost, M.A. Rashid Hall:	Dr. Md. Elias
Provost, Suhrawardy Hall:	Dr. Shaikh Anowarul Fattah
Provost, Titumir Hall:	Dr. Jiban Podder

Chapter 2

The Department of Civil Engineering

2.1 Introduction

The Faculty of Civil Engineering consists of two academic departments: The Department of Civil Engineering, and the Department of Water Resources Engineering.

The Department of Civil Engineering comprises four major divisions: Environmental Engineering, Geotechnical Engineering, Structural Engineering, and Transportation Engineering. The divisions offer basic and advanced optional courses in the aforementioned disciplines. Research on the above fields is important in the national context. These include areas like behavior of high-rise buildings, and road materials with emphasis on indigenous materials, bridge engineering, microwave and transmission tower design with foundation, structural retrofitting, engineering soil properties of various regions of the country, low-cost cyclone resistant housing, seismic zoning of Bangladesh, waste management, environmental pollution control, environmental impact assessment, traffic simulation, transport system modeling, traffic safety studies etc. The results of some of these research works have been incorporated in the revised Bangladesh National Building Code. Some research projects of more fundamental nature, e.g. application of finite element techniques in solving engineering problems, dynamic behavior of multi-storied buildings, soil-structure interaction, concrete technology pursued in this department have greatly contributed to advancement of knowledge. To meet the national demand, the Department of Water Resources Engineering trains engineers specializing in hydrology, hydraulics, river morphology, salinity intrusion, irrigation, drainage, flood control, land reclamation, bank protection, river stabilization, ground water, sedimentation problems and coastal engineering.

2.2 List of Faculty Members of Department of Civil Engineering

Professor & Head

Ahsanul Kabir: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Strathclyde, Glasgow, U.K. (Structural Engineering)

Professors

K. A. M. Abdul Muqtadir: B.Sc. Engg. (Civil), BUET; M.S., Virginia Polytechnic Institute and State University, U.S.A.; Ph.D., University of Arizona, U.S.A. (Geotechnical Engineering)

Syed Fakhrul Ameen: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Strathclyde, U.K. (Geotechnical Engineering)

M. Habibur Rahman: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Strathclyde, U.K. (Environmental Engineering)

Md. Delwar Hossain: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Strathclyde, U.K. (Environmental Engineering)

Abu Siddique: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Surrey, U.K. (Geotechnical Engineering)

Md. Shafiul Bari: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Glasgow, U.K. (Structural Engineering)

A. B. M. Badruzzaman: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Virginia, U.S.A. (Environmental Engineering)

Md. Zakaria Ahmed: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; M.S., University of Cincinnati, U.S.A.; Ph.D., University of Arizona, U.S.A. (Structural Engineering)

Md. Abdul Jalil: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; D. Eng., University of Tokyo, Japan (Environmental Engineering)

Ishtiaque Ahmed: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Sheffield, U.K. (Structural Engineering)

Hasib Mohammed Ahsan: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; D. Eng., University of Tokyo, Japan (Transportation Engineering)

Sarwar Jahan Md. Yasin: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan (Geotechnical Engineering)

Moazzem Hossain: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Southampton, U.K. (Transportation Engineering)

Eqramul Hoque: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan (Geotechnical Engineering)

Bashir Ahmed: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Nottingham, U.K. (Structural Engineering)

Khan Mahmud Amanat: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; D. Eng., Nagoya University, Japan (Structural Engineering)

Mehedi Ahmed Ansary: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan (Geotechnical Engineering)

Md. Shamsul Hoque: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Southampton, U.K.(Transportation Engineering)

Tahmeed Malik Al-Hussaini: B.Sc. Engg. (Civil), BUET; M. Engg., AIT, Thailand; Ph.D., State University of New York at Buffalo, U.S.A. (Geotechnical Engineering)

Md. Mafizur Rahman: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan (Environmental Engineering)

Mohammed Kabirul Islam: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., Johns Hopkins University, USA; Ph.D., University of Sydney, Australia (Geotechnical Engineering)

Rowshan Mamtaz: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D, University of Strathclyde, U.K. (Environmental Engineering)

Abdul Jabbar Khan: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Strathclyde, U.K. (Geotechnical Engineering) [on Deputation]

Muhammad Ashraf Ali: B.Sc. Engg. (Civil), BUET; M. Sc. Engg., Carnegie Mellon University, U.S.A.; Ph.D., Carnegie Mellon University, U.S.A. (Environmental Engineering)

Tahsin Reza Hossain: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of London, U.K.; DIC, Imperial College London, U.K. (Structural Engineering)

Munaz Ahmed Noor: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan (Structural Engineering) [on Deputation]

Raquib Ahsan: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan (Structural Engineering)

A.F.M. Saiful Amin: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., Saitama University, Japan (Structural Engineering)

Syed Ishtiaq Ahmad: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., Nagoya University, Japan (Structural Engineering)

Md. Mizanur Rahman: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., Yokohama National University, Japan (Transportation Engineering)

Mohammad Shariful Islam: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., Saitama University, Japan (Geotechnical Engineering)

Mahbuba Begum: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Alberta, Canada (Structural Engineering)

Md. Jahangir Alam: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D, University of Tokyo, Japan (Geotechnical Engineering) [on leave]

Tanvir Manzur: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Texas at Arlington, U.S.A. (Structural Engineering) [on leave]

Md. Hadiuzzaman: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Alberta, Canada (Transportation Engineering)

Mohammad Al Amin Siddique: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., The University of Western Ontario, Canada (Structural Engineering)

Tanvir Ahmed: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., Massachusetts Institute of Technology, U.S.A. (Environmental Engineering)

Associate Professors

Mahbuboor Rahman Choudhury: B.Sc. Engg. (Civil), M.Sc. Engg., BUET; Ph.D., Carnegie Mellon University, U.S.A. (Environmental Engineering) [on leave]

Shohel Rana: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Tokyo, Japan(Structural Engineering)

Md. Raquibul Hossain: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Queensland, Australia – UQ (Structural Engineering)

Shameem Ahmed: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of New South Wales (UNSW), Australia (Structural Engineering)

Assistant Professors

Snigdha Afsana: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; (Environmental Engineering)

Md. Ruhul Amin: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering)

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Rupak Mutsuddy: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET; Ph.D., University of Alberta, Canada (Structural Engineering)

Warda Bint Ashraf: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering) [on leave]

Rahnuma Shahrin: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering) [on leave]

Shams Tanvir: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Transportation Engineering) [on leave]

Md. Faizus Salehin: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Transportation Engineering) [on leave]

Md. Ferdous Alam: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Geotechnical Engineering) [on leave]

Md. Abul Bashar Emon: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering) [on leave]

Md. Maksimul Islam: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Environmental Engineering) [on leave]

Sadia Afrin: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Environmental Engineering) [on leave]

Shohana Iffat: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering) [on leave]

Shamsunnahar Suchana: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Environmental Engineering) [on leave]

S. M. Faisal Mahmood: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., University of Melbourne, Australia (Structural Engineering) [on leave]

Sanjana Hossain: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Transportation Engineering) [on leave].

Rowshon Jadid: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Geotechnical Engineering) [on leave]

Rubaiya Rumman: B.Sc. Engg. (Civil), BUET, M.Sc. Engg., BUET (Structural Engineering)

Md. Azijul Islam: B.Sc. Engg. (Civil), BUET, M.Sc. Engg., BUET (Geotechnical Engineering) [on leave]

Sumaiya Afroz: B.Sc. Engg. (Civil), BUET, M.Sc. Engg., BUET (Structural Engineering) [on leave]

Azmayeen Rafat Shahariar: B.Sc. Engg. (Civil), BUET, M.Sc. Engg., BUET (Geotechnical Engineering) [on leave]

Radin Md. Mahirul Haque: B.Sc. Engg. (Civil), BUET, M.Sc. Engg., BUET (Structural Engineering)

Sk. Md. Mashrur: B.Sc. Engg. (Civil), BUET, M.Sc. Engg., BUET (Transportation Engineering)

Lecturers

Baishakhi Bose: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering) [on leave]

Bayezid Baten: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Structural Engineering)

Anindya Samya Saha: B.Sc. Engg. (Civil), BUET (Structural Engineering)

Mashiat Hossain: B.Sc. Engg. (Civil), BUET; M.Sc. Engg., BUET (Environmental Engineering)

Mohammad Irfan Hossain: B.Sc. Engg. (Civil), BUET (Structural Engineering)

Omar Faruqe Hamim: B.Sc. Engg. (Civil), BUET (Transportation Engineering)

Tausif-E-Elahi: B.Sc. Engg. (Civil), BUET (Geotechnical Engineering)

Ahmed Farhan Ahnaf Siddique: B.Sc. Engg. (Civil), BUET (Structural Engineering)

2.3 Division In-Charges

The following faculty members act as the in-charge of the four divisions of the Civil Engineering Department:

Structural Engineering:	Prof. Dr. Ishtiaque Ahmed
Geotechnical Engineering:	Prof. Dr. Sarwar Jahan Md. Yasin
Environmental Engineering:	Prof. Dr. Rowshan Mamtaz
Transportation Engineering:	Prof. Dr. Hasib Mohammed Ahsan

2.4 Divisional Course Advisors (Postgraduate Study)

The following faculty members act as postgraduate course advisors of the four divisions of the Department of Civil Engineering:

Structural Engineering:	Prof. Dr. Syed Ishtiaq Ahmad
Geotechnical Engineering:	Prof. Dr. Mehedi Ahmed Ansary
Environmental Engineering:	Prof. Dr. Muhammad Ashraf Ali
Transportation Engineering:	Prof. Dr. Md. Shamsul Hoque

2.5 Laboratory In-Charges

Different Laboratory in-Charges, responsible for managing the various laboratories of the Civil Engineering Department are as follows:

Laboratories	Laboratory in Charges
Structures and Materials Laboratory	Dr. Syed Ishtiaq Ahmad
Concrete Laboratory	Dr. Mohammad Al Amin Siddique
Under Graduate Environmental Engineering Laboratory	Dr. Sheikh Mokhlesur Rahman
Post Graduate Environmental Research Laboratory	Dr. A.B.M. Badruzzaman
Geotechnical Engineering Laboratory	Dr. Abu Siddique
Transportation Engineering Laboratory	Dr. Md. Hadiuzzaman
Traffic Engineering Laboratory	Dr. Md. Mizanur Rahman
Survey and GIS Laboratory	Dr. Moazzem Hossain
Civil Engineering Computer Laboratory	Dr. Shohel Rana

2.6 Laboratory Facilities

The Department of Civil Engineering is equipped with a number of laboratories to pursue routine academic programmes and research. Presently there are five laboratories under the Department of Civil Engineering. Civil Engineering students also use laboratory facilities of the Department of Water Resources Engineering, Physics, and Chemistry. Facilities of the various workshops under the university are also available to the students. A brief description of the various laboratories in the Department of Civil Engineering is given below.

Structures and Materials Laboratory: The structures and materials laboratory is housed in the ground floor of the Civil Engineering Building and has a floor area of 6,000 sft. It has facilities for routine strength tests of various civil engineering materials such as steel, timber, rubber, plastic, etc. Models of structural frames and various structural components can also be tested to simulate prototype behaviour. A number of universal testing machines are available in the laboratory which includes a 400,000 lb machine. Strain measuring devices and data acquisition facilities are also available.

Testing Facilities in Structures and Materials Laboratory

Concrete Laboratory: This is situated in the north-east part of the ground floor of the Civil Engineering Building and has a floor area of 6,000 sft. It has sufficient space and facilities to cast experimental beams, slabs and miscellaneous concrete structural elements. Besides, it is well equipped for carrying out routine tests of concrete and concrete making materials. This laboratory provides facilities for prestressing and non-destructive testing of concrete. Facilities are also available for cutting concrete core and testing in the laboratory.


Concrete Laboratory

Environmental Engineering Laboratory: This laboratory spreads over a floor area of 1,600 sft. and is located in the 3rd floor of the Civil Engineering Building. It is well equipped for making routine physical, chemical and bacteriological analyses of water and wastewater. Facilities are available for making bench scale treatment plant studies.

Environmental Engineering Laboratory

Students performing titration in Environmental laboratory

Environmental Research Laboratory: This laboratory has a floor area of 1600 sft and is located on the 3rd floor of the Civil Engineering Building. This laboratory is primarily used for post-graduate research. This laboratory is equipped with modern equipment for analyses of water and wastewater. Instruments in this laboratory include among others, an Atomic Absorption Spectrophotometer, a TOC analyzer, and a modern Spectrophotometer.

Transportation Engineering Laboratory: This laboratory is situated in the ground floor of the Old Academic Building and has a floor area of about 2,000 sft. It has equipment for carrying out routine tests of various highway materials such as soil, aggregate and bitumen.

Transportation Engineering Laboratory

Traffic Engineering and GIS Laboratory: Traffic Engineering and Geographic Information System (GIS) lab is housed in the 5th floor of the Civil Engineering Building and has a floor area of 1,700 sft. It facilitates analysis and interpretation of field traffic studies and observational works of traffic behaviour, which form an essential part of lecture/sessional courses as well as research in the fields of traffic and transportation engineering both at undergraduate and postgraduate levels. It also facilitates detail geometric design of road links, bridge approaches, intersections, signals, modeling for the study of traffic and pedestrian behavior, synthesis of alternative traffic schemes. This laboratory is being equipped further with modern tools such as GIS, remote sensing technology, video image processing and devices for measuring and monitoring the road environment.

Geotechnical Engineering Laboratory: The Geotechnical Engineering Laboratory housed in the 2nd floor of the Civil Engineering Building has a floor area of 4,250 sft. It provides routine soil testing facilities such as those for soil classification, particle characteristics and geotechnical characterization. Facilities are available for soil sample preparation and development of equipment for specialized tests. A number of triaxial testing equipment are available for routine as well as specialized soil testing. Testing facilities for small scale models of foundation elements are also available.

Geotechnical Engineering Laboratory

2.7 Laboratory Protocol and General Safety Guidelines

Safety is a collective responsibility that requires the full cooperation of everyone in the laboratory. However, the ultimate responsibility for safety rests with the person actually carrying out some type of procedure. Accidents often result from an indifferent attitude, failure to use common sense, or failure to follow instructions. Each student should be aware of the doings of the other students because all can be victims of one individual's mistake. Do not hesitate to point out to other students that they are engaging in unsafe practices or operations. If necessary, report it to the instructor. In the final assessment, students have the greatest responsibility to ensure their own personal safety.

The following are general guidelines for all laboratory students:

(a) Follow all safety instructions carefully.

(b) Be familiar with the location of emergency equipment, fire alarm, fire extinguisher, emergency eye wash, and safety shower. Know the appropriate emergency response procedures.

(c) Become familiar with the hazards associated with the machine/ instrument/ chemicals being used, and know the safety precautions and emergency procedures before undertaking any work.

(d) Always wear proper eye protection in chemical work, handling and storage areas. Normally, contact lenses should not be worn. Fitted goggles are essential if, for therapeutic reason, contact lenses must be worn.

(e) Always wear appropriate protective clothing. Do not wear high-heeled shoes, open-toed shoes, sandals or shoes made of woven material.

(f) Always wash hands and arms with soap and water before leaving the work area. This applies even if you have been wearing gloves.

(g) Never perform unauthorized work.

(h) Use equipment and hazardous materials only for their intended purposes.

(i) Never leave an experiment unattended.

(j) Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous materials are handled or stored.

(k) Laboratory water sources and deionized water should not be used for drinking water.

(l) If you plan to work after regular office hours in a laboratory, get written permission from your supervisor and laboratory in-charge.

(m) Report any accident, however minor, immediately.

2.8 Computing Facilities

Civil Engineering Computer Laboratory:
The Civil Engineering Computer Laboratory was initiated in 1986 with only one IBM 8088 computer. At present it has flourished into two separate laboratories with four different rooms along with a capacity of 150 computers. Of the 150 available computers, eighty (80) of them have been incorporated with Core i5 processors along with Dual Core processors for the other seventy (70). A computer network has been installed to facilitate computer usage and to achieve maximum benefit.

The faculty members, doctoral and masters students are allowed to work in the laboratory during the regular working hours. The regular working hours of the computer laboratory is between 9 a.m. to 5 p.m. during weekdays while remaining closed during weekends. However, the users are allowed to work beyond the regular working hours with written permission from the Head of the Department and/or Laboratory in-charge. A duty-teacher remains present during the regular working hours to assist the users. To prevent the network system from being infected with virus, the users are required to use unformatted disks in this laboratory.

Undergraduate computer lab

2.9 Library Facilities

Civil Engineering Library

The Department of Civil Engineering has its own library, which is located on the fourth floor of the Civil Engineering Building. The Civil Engineering Library has a collection of specialized texts, reference books, valuable documents and reports on various fields of Civil Engineering. It has a good collection of research reports, conference proceedings, design manuals and theses. The Civil Engineering Library also maintains volumes of issues of the ASCE, ACI and other journals. The CE Library is open for all postgraduate students of the department during weekdays with a recess from 1:00 pm to 2:30 pm.

2.10 Departmental Records

Any student, whose home address is changed, even temporarily, should inform the Departmental office and his/her supervisor immediately. Otherwise important communication related to student's progress may go astray or lost.

Chapter 3

Postgraduate Study and Research

3.1 Degrees Offered

The post graduate degrees offered by the Civil Engineering Department are as follows:

- Doctor of Philosophy abbreviated as Ph.D.
- Master of Science in Civil Engineering (Environmental) abbreviated as M.Sc. Engg. (Civil & Environmental)
- Master of Science in Civil Engineering (Geotechnical) abbreviated as M.Sc. Engg. (Civil & Geotechnical)
- Master of Science in Civil Engineering (Structural) abbreviated as M.Sc. Engg. (Civil & Structural)
- Master of Science in Civil Engineering (Transportation) abbreviated as M.Sc. Engg. (Civil & Transportation)
- Master of Science in Environmental Engineering abbreviated as M.Sc. Engg. (Environmental)
- Master of Engineering in Civil Engineering (Environmental) abbreviated as M. Engg. (Civil & Environmental)
- Master of Engineering in Civil Engineering (Geotechnical) abbreviated as M. Engg. (Civil & Geotechnical)
- Master of Engineering in Civil Engineering (Structural) abbreviated as M. Engg. (Civil & Structural)
- Master of Engineering in Civil Engineering (Transportation) abbreviated as M. Engg. (Civil & Transportation)
- Master of Engineering in Environmental Engineering abbreviated as M. Engg. (Environmental)

3.2 Fields of Study

Major Divisions

Education on Civil Engineering is provided under four major sub-disciplines: Environmental Engineering, Geotechnical Engineering, Structural Engineering, and Transportation Engineering.

Environmental Engineering

Environmental Engineering is a branch of Civil Engineering that studies the causes and effects of manmade development activities on environment around us and its protection. Environmental engineering can also be described as a branch of applied science and technology that addresses the issues of energy preservation, protection of assets and control of waste from human and animal activities. Civil engineers are particularly involved in such activities as water supply and sewerage, management of surface water and groundwater quality, remediation of contaminated sites and solid waste management. The objective is to ensure that societal development and the use of water, land and air resources are sustainable.

The environmental engineering division has been providing teaching and education for more than three decades in diverse areas including water supply; water, wastewater and industrial waste quality treatment; solid and hazardous waste management; biogas technology; air and noise pollution; environmental management planning; environmental auditing; environmental site assessment, and environmental impact assessment and monitoring. Over the years, the division has gained considerable expertise and experience in these areas and has developed a solid reputation both at national and international levels. Currently, more than 10 faculty members specialized in environmental engineering are involved in teaching and research in the department. The group of highly qualified teaching professionals of this division has immense teaching and research experiences at home and abroad. The faculty members of the division are carrying out collaborative research with reputed universities of North America, Europe and Asia; including MIT of USA, and EAWAG of Switzerland. The collaborative research with MIT and EAWAG on groundwater arsenic contamination yielded publications in reputed journals including SCIENCE, Nature, and Environmental Science and Technology.

Geotechnical Engineering

Geotechnical engineering is a sub-discipline of civil engineering that deals with soil and rock behaviour from an engineering perspective due to construction of a building or structure. It is very important in civil engineering, but also has applications in military, mining, petroleum and other engineering disciplines that are concerned with construction occurring on the surface or within the ground. Geotechnical engineering is also related to coastal engineering. In this discipline, students are taught how to make a building or structure stand firmly on ground with adequate safety and withstand adverse effect of environmental forces e.g., wind, earthquake, landslide, soil liquefaction and soil erosion etc.

Geotechnical engineering division covers different sectors of sustainable development of the society. Other than foundation design for buildings, roads, bridges, embankments, canals and hundreds of other construction projects. Nowadays bio-engineering has also become a common practice in this branch for hill slope management, land development, protection of road slope, riverbank and Char land. Geotechnical Engineering Division is serving the rural society of Bangladesh by constructing earthen building, low cost housing and by land reclamation over a long period of time. The specialism of this sector also involves ground improvement/modification, assessment of seismic spectrum, retaining structures; earthworks include embankments, tunnels, dikes and levees, channels, reservoirs, deposition of hazardous waste and sanitary landfills.

Currently nine faculty members of the department have specialization in geotechnical engineering carrying high quality of research with the collaboration of Asian, North American, Australian and European Universities.

Structural Engineering

Structural engineering is concerned with understanding, analysis and design of the 'bones and muscles' of a physical body like buildings, towers, bridges, expressways, dams etc. It is a major field of civil engineering dealing with the analysis and design of structures that support or resist loads and keeps the structure in its shape and service. Structural engineering theory is based upon physical laws and empirical knowledge of the structural performance of different materials and geometries.

Structural engineering division has the largest group of faculty members in the Civil Engineering Department comprising about twenty four faculty members of which twelve are professors. This is a highly qualified group of academicians having a wide range of teaching and research experiences at home and abroad. The division is equipped with the state-of-the-art laboratories and software facilities for carrying out academic and research activities.

Faculty members of this division are engaged in experimental and theoretical researches which are receiving accolades at national and international level. Current research of structural division includes design optimization of bridges, development of rheological model of high damping rubber bearing with first application in the construction of major bridges in Bangladesh, development of repair and retrofitting methodology of buildings and structures using local aggregates and recycled aggregates, collaborative research with international organizations like JICA and JST as well as Tokyo University, Osaka University, Tohuko University and Daido University for development of strengthening methodology for buildings in Bangladesh, development of weathering steel composition for local environment, investigation on prediction of concrete strength of existing buildings made with brick aggregate concrete, development of durable concrete for coastal areas in Bangladesh.

Transportation Engineering

Transportation engineering deals with systems relating to the movement of people and goods. Engineers specializing on this branch seek innovative but practical solutions to meet urban or regional mobility needs. Specific areas include pavements and materials, transport management systems, planning and land development, geometric design of highways, traffic and signal design, and capacity analysis.

The transportation engineering division comprises nine faculty members and is one of the strongest transportation engineering groups in the country. The research expertise revolves around five notable pillars of transportation research: 1) Transportation planning and travel demand modelling, 2) Transit demand and supply, 3) Pavement Engineering, 4) Traffic engineering, and 5) Safety and sustainability. The faculty members are active in researching various transportation topics, and boasts comprehensive physical laboratory for pavements and materials research as

well as the latest computing technology and software applications for transportation design. Recent research activities include modernization of signaling and safety features of railway, modeling of urban transportation in general and public transportation in particular, modeling cyclone evacuation decision, modeling trip-chaining and mode choice relationships, modeling of urban commercial freight vehicle movement, estimating OD matrices for urban commercial freight vehicles, development of overtaking decision model for heterogeneous traffic operation, video image based heterogeneous traffic detection, vehicle trajectory reconstruction, socio technical approach to road safety using Accimap, STAMP approach, human driver simulation, use of waste plastic modified bitumen in flexible pavement construction, wet weather road maintenance, evaluation and maintenance approaches for airfield and highway pavements.

3.3 Financial Assistance for Postgraduate Students

The University provides financial assistance in the form of Teaching Assistantship (TA) and fellowship to limited number of postgraduate students each year. Limited number of full-time Master's students of the department are awarded Teaching Assistantship while fellowships are awarded to doctoral students. Teaching Assistants should be full-time students and cannot undertake any other job during the tenure of his assistantship. Teaching Assistants work under the guidance of a teacher of the department. Enquiries regarding TA/fellowship may be made at the office of the Director, Advisory, Extension and Research Services (DAERS) of BUET.

3.4 Registration for Thesis, Appointment of Supervisor, Preparation and Format of Thesis Proposal and Thesis

A student is required to register for the required number of credit hours for thesis work on completion of the requisite course works. A student may register for thesis simultaneously with other courses only in his final semester of course work, provided that total number of credit hours do not exceed 15. However, the student should consult the respective divisional course adviser prior to registration of thesis work. A student shall apply to the BPGS, stating his choice of supervisor or choice of field of study, for

appointment of a supervisor. All students of Ph.D. and M.Sc. Engg. degrees having registered for thesis after having a thesis supervisor appointed, shall submit a research proposal to the CASR for approval through the BPGS. Students of M. Engg. degree need to submit a project proposal for approval by the Vice Chancellor through the BPGS. The research proposal must be submitted in the specified format, available at the DAERS office.

All theses should be printed, using a word processor, on A4 size (210 mm × 297 mm) 80-gram white offset paper. The left margin should be kept at 4.0 cm (1.55 inch) and all other margins (top, bottom, and right) should be fixed at 2.50 cm (1 inch). The text should be preferably typed using Times New Roman with 12 point font size and with one and a half spacing between lines. In writing thesis, British spelling should be followed. In all cases, SI unit should be used. In case FPS system is used, it has to be supplemented by appropriate conversions in the text as well as in the figures. Standard format for thesis writing is available in the department office. One must collect the template from the office before start writing. The thesis should be hard bound with black cover for MSc. Engg., Blue for M. Engg. and Maroon for Ph.D. Reference published in literature should be cited in the text by the last name of the author(s) and the year of publication of the reference (e.g., Choi and Kim, 1989) and the list of references should be compiled in alphabetic order of the last name of the author(s) at the end of the thesis. References should be listed in the following style:

Journal: Choi, C. K. and Kim, S. H. (1989), "Coupled use of reduced integration and nonconforming modes in improving quadratic plate element", Int. J. Num. Meth. Eng., Vol. 28(4), 1909-1928.

Book: Salvadori, M. G. and Baron, M. L. (1961), Numerical Methods in Engineering, Prentice Hall, Englewood Cliffs, NJ.

Proceedings: Choi, C. K. and Kim, S. H. (1989), "Coupled use of reduced integration and nonconforming modes in improving quadratic plate element", Int. J. Num. Meth. Eng., Vol. 28(4), 1909-1928.

Tables 3.1, 3.2 and 3.3 summarize the list of actions and required documents for M.Sc. Engg., M. Engg., and Ph.D. degrees in Civil Engineering, respectively.

Table 3.1: List of actions and required documents for M.Sc. Engg. degree in Civil Engineering from admission onward

Actions	Timelines (When required by Dept./University)	Who Initiates & Required Forms
Submission of admission related documents	Before the beginning of the first semester of enrollment	Student is responsible for submitting all official documents (e.g., transcripts/marksheets, certificates, testimonials from DSW or Proctor, NOCs) to the Department
Appointment of Advisor	Beginning of the first semester of enrollment	Department will assign an advisor for each student and student should meet the advisor on regular basis.
Course Registration	Beginning of each semester according to the schedule declared by the university	• Initiated by the student through the BIIS Portal (http://biis.buet.ac.bd/) for approval by Advisor, Head of the Department, and Registrar. • Student must inform the adviser after submitting online course registration form. • Full time student must register minimum 12 credit hours and may register maximum 15 credit hours • Part-time student may register maximum of 9 credit hours. • For enrolling a course offered by other department (non-CE), student must consult with advisor/supervisor, Head of the Department of Civil Engineering and Head of the Department of concerned department. • Student may enroll for a non-credit audit course and must inform this to the course teacher and Head of the department with written application.

Course Add/Drop	After the registration period, according to the schedule declared by the university	Initiated by the student through the BIIS Portal (http://biis.buet.ac.bd/) for approval of Advisor, Head of the Department, and Registrar. Student must consult with concerned course teacher(s).
Course withdrawal	Within 2 working weeks of the commencement of the semester	Initiated by the student in prescribed form with the approval of Advisor, Head of the Department, and the respective course teacher(s).
Application for I (Incomplete) Grade	Within one week of the examination	Initiated by the student in prescribed form for approval of Head of the Department. Grade-I is given only when a student has attended over 60% class, submitted the class assignments certified by course teacher but unable to sit for the examination of a course at the end of the semester because of circumstances beyond his/her control like illness, accident etc. and substantiated by documents.
Term Withdrawal	Within one week of the term-final examination	Initiated by the student in prescribed form for approval of Head of the Department
Appointment of Thesis Supervisor	After completion of first semester	Initiated by the student in prescribed form with the consent of requested supervisor for approval of BPGS
Change of Thesis Supervisor	–	Initiated by the student in prescribed form with the consent of existing and requested supervisors for approval of BPGS
Change of Status (e.g., Part-time to Full-time)	Beginning of a semester	Initiated by the student in prescribed form with the consent of advisor/supervisor for approval of BPGS

Change of Program (e.g., M.Sc. Engg. to M. Engg.)	Beginning of a semester	Initiated by the student in prescribed form with the consent of advisor/supervisor for approval of BPGS
Thesis Proposal	After completion of at least 12 credit hours of course work	Initiated by the student in prescribed template with the recommendation of BPGS for approval of CASR.
Time Extension	3 months before ending of the maximum program duration, which is 5 academic years from the date of the first admission in the respective program.	Initiated by the student in prescribed form with the recommendation of BPGS for approval of CASR.
Thesis Examination Board	After approval of thesis proposal by CASR	Initiated by the supervisor with the recommendation of Head of the Department for approval of CASR.
Thesis Defense (Oral Examination)	After approval of thesis proposal and board of examination by CASR	• Student shall be required to appear at an oral examination on a date (within approved time duration) fixed by the Head of the Department. • Student shall submit a draft copy of his/her thesis to all examiners at least two weeks prior to the oral examination date.
Thesis Submission	After oral examination, on or before a date to be fixed by	Student must submit a required number of printed thesis (at least 2 copies, one for central library and other for CE library) in the approved

	the Head of the Department with consultation of concerned supervisor.	format (available in central library or CE department office).Student must submit an electronic version of thesis to the central library for archival.
Degree Requirements	–	• Student must earn a minimum of 36 credit hours including a thesis for which 18 credit hours is assigned. • Student must earn a minimum CGPA of 2.65 in the course work and satisfactory grade(s) in thesis.
Application of Degree Award	After completion of all degree requirements	Initiated by the student by submitting an application of Degree Award Form (Blue form) with the following documents: i) Forwarding letter form Head of the Department ii) M.Sc. Engg. Result Verification Form from academic section (white form) iii) Certificate of approval of thesis by board of examiners iv) Acknowledgement of thesis submission to the central library v) CASR resolutions vi) Copy of B.Sc. Engg. Certificate
Termination of the Program		Student shall not be allowed to continue in the program if he/she obtains three or more F grades in the same or different subjects and/or at the end of the second or any subsequent semester CGPA falls below 2.5.

Table 3.2: List of actions and required documents for M. Engg. degree in Civil Engineering

Actions	Timelines (When Required by Dept./University)	Who Initiates & Required Forms
Submission of admission related documents	Before the beginning of the first semester of enrollment	Student is responsible for submitting all official documents (e.g., transcripts/mark sheets, certificates, testimonials, from DSW or proctor, NOCs) to the Department
Appointment of Advisor	Beginning of the first semester of enrollment	Department will assign an advisor for each student and student should meet with the advisor on regular basis.
Course Registration	Beginning of each semester according to the schedule declared by the university	• Initiated by the student through the BIIS Portal (http://biis.buet.ac.bd/) for approval by Advisor, Head of the Department, and Registrar. • Student must inform the adviser after submitting online course registration form. • Full time student must register minimum 12 credit hours and may register maximum 15 credit hours • Part-time student may register maximum of 9 credit hours. • For enrolling a course offered by other department (non-CE), student must consult with advisor/supervisor, Head of the Department of Civil Engineering and Head of the Department of concerned department. • Student may enroll for a non-credit course/audit course and must inform this to the course teacher and Head of the department in writing.

Actions	Timelines (When Required by Dept./University)	Who Initiates & Required Forms
Course Add/Drop	After the registration period over, according to the schedule declared by the university	Initiated by the student through the BIIS Portal (http://biis.buet.ac.bd/) for approval of Advisor, Head of the Department, and Registrar. Student must consult with concerned course teacher(s).
Course withdrawal	Within 2 working weeks of the commencement of the semester	Initiated by the student with prescribed form with the approval of Advisor, Head of the Department, and the respective course teacher(s).
Application for I (Incomplete) Grade	Within one week of the examination	Initiated by the student in prescribed form for approval of Head of the Department. Grade-I is given only when a student has attended over 60% class, submitted the class assignments (certified by course teacher) but unable to sit for the examination of a course at the end of the semester because of circumstances beyond his/her control like illness, accident etc. and substantiated by documents.
Term Withdrawn	Within one week of the term-final examination	Initiated by the student in prescribed form for approval of Head of the Department
Appointment of Supervisor	After completion of first semester	Initiated by the student in prescribed form with the consent of requested supervisor for approval of BPGS
Change of Supervisor	–	Initiated by the student in prescribed form with the consent of existing supervisor and requested supervisor for approval of BPGS

Change of Status (e.g., Part-time to Full-time)	Beginning of a semester	Initiated by the student in prescribed form with the consent of advisor/supervisor for approval of BPGS
Change of Program (e.g., M. Engg. To M.Sc.)	Beginning of a semester	Initiated by the student in prescribed form with the consent of advisor/supervisor for approval of BPGS
Project Proposal	After completion of at least 12 credit hours of course work	Initiated by the student in prescribed template with the recommendation of BPGS for approval of Vice Chancellor
Time Extension	Before ending of the maximum program duration, which is 5 academic years from the date of the first admission in the respective program.	Initiated by the student with prescribed form with the recommendation of BPGS for approval of CASR.
Project Examination Board	After approval of project proposal	Initiated by the supervisor with the recommendation of BPGS for approval of Vice Chancellor.
Project Defense (Oral Examination)	After approval of project proposal and board of examination	• Student shall be required to appear at an oral examination on a date fixed by the Supervisor • Student shall submit a draft copy of project report to all examiners at least two weeks prior to the oral examination date.

Project Report Submission	After oral examination, on or before a date to be fixed by the examination board	• Student must submit a required number of printed project report (at least 2 copies, one for central library and other for CE library) in the approved format. • Student must submit an electronic version of project report to the central library for archival
Degree Requirements		• Student must earn a minimum of 36 credit hours including a project for which 6 credit hours shall be assigned. • Student must earn a minimum CGPA of 2.65.
Application of Degree Award	After completion of all degree requirements	Initiated by the student by submitting an application of Degree Award Form (Blue form) with following documents: i) Forwarding letter from Head of the Department ii) M.Sc. Engg. Result Verification Form from academic section (White form) iii) Certificate of approval of project report by board of examiners iv) Acknowledgement of project report submission to the central library v) CASR resolutions vi) Copy of BSc. Engg. Certificate
Termination of the Program	–	Student shall not be allowed to continue in the program if he/she obtains three or more F grades in the same or different subjects and/or at the end of the second or any subsequent semester CGPA falls below 2.5.

Table 3.3: List of actions and required documents for Ph.D. degree in Civil Engineering

Actions	Timelines (When Required by Dept./University)	Who Initiates & Required Forms
Submission of admission related documents	Before the beginning of the first semester of enrollment	Student is responsible for submitting all official documents (e.g., transcripts/marksheets, certificates, testimonials from DSW or proctor, NOCs) to the Department
Appointment of Advisor	Beginning of the first semester of enrollment	Department will assign an advisor for each student and student should meet with the advisor on regular basis.
Course Registration	Beginning of each semester according to the schedule declared by the university	• Initiated by the student through the BIIS Portal (http://biis.buet.ac.bd/) for approval by Advisor, Head of the Department, and Registrar. • Full time student must register minimum 12 credit hours and may register maximum 15 credit hours • Part-time student may register maximum of 9 credit hours. • For enrolling a course offered by other department (non-CE), student must consult with advisor/supervisor, Head of the Department of Civil Engineering and Head of the Department of concerned department. • Student may enroll for a non-credit course/audit course.

Course Add/Drop	After the registration period over, according to the schedule declared by the university	Initiated by the student through the BIIS Portal (http://biis.buet.ac.bd/) for approval of Advisor, Head of the Department, and Registrar. Student must consult with concerned course teacher(s).
Course withdrawn	Within 2 working weeks of the commencement of the semester	Initiated by the student with prescribed form with the approval of Advisor, Head of the Department, and the respective course teacher(s).
Application for I (Incomplete) Grade	Within one week of the examination	• Initiated by the student with prescribed form for approval of Head of the Department • Grade-I is 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.
Term Withdrawn	Within one week of the examination	Initiated by the student with prescribed form for approval of Head of the Department
Appointment of Thesis Supervisor	During first semester	Initiated by the student with prescribed form with the consent of requested supervisor for approval of BPGS
Change of Thesis Supervisor	–	Initiated by the student in prescribed form with the consent of existing supervisor and requested supervisor for approval of BPGS
Change of Status (e.g., Part-time to Full-time)	Beginning of a semester	Initiated by the student with prescribed form with the consent of advisor/supervisor for approval of BPGS
Doctoral Committee	Within 6 months of admission	Initiated by the Head of the Department in consultation with the supervisor for approval of CASR

Thesis Proposal	After approval of doctoral committee	Initiated by the student in prescribed template with the recommendation of Doctoral Committee for approval of CASR.
Comprehensive Examination	After the completion of required course work	Student shall be required to appear at a written and/or oral comprehensive examination on a date fixed by the Doctoral Committee on the request of the supervisor. If a student fails to qualify in a comprehensive examination, he/she shall be given one more chance to appear in the examination as scheduled by the Doctoral Committee.
Thesis Examination Board	After approval of thesis proposal by CASR	Initiated by the supervisor with the recommendation of Head of the Department for approval of CASR
Time Extension	Before ending of the maximum program duration, which is 6 academic years from the date of the first admission in the respective program. Minimum Program Duration is 6 semesters.	Initiated by the student with prescribed form with the recommendation of BPGS for approval of CASR
Thesis Defense (Oral Examination)	After approval of thesis proposal and board of examination by CASR	Student shall be required to appear at an oral examination on a date fixed by the Head of the Department. Student shall submit a draft copy of thesis to all examiners at least two weeks prior to the oral examination date

Thesis Submission	After oral examination, on or before a date to be fixed by the Head of the Department with consultation of concerned supervisor	Student must submit a required number of printed thesis (at least 6 copies) in the approved format Student must submit an electronic version of thesis to the central library for archival
Degree Requirements	–	Student must earn a minimum of 54 credit hours including a thesis for which maximum of 45 credit hours is assigned. Student must earn a minimum CGPA of 2.75
Application of Degree Award	After completion of all degree requirements	Initiated by the student by submitting an application of Degree Award Form (Blue form) with following documents: i) Forwarding letter form Head of the Department ii) Ph.D Result Verification Form from academic section (White form) iii) Certificate of approval of thesis by board of examiners iv) Acknowledgement of thesis submission to the central library v) CASR resolutions vi) Copy of B.Sc. and M.Sc. Engg. certificates.
Termination of the Program	–	Student shall not be allowed to continue in the program if he/she obtains three or more F grades in the same or different subjects
Program Duration	–	Minimum 4 semesters and maximum 6 academic years from the date of the first admission in the program.

3.5 Student Accommodations/Residential Facilities

The University has eight halls of residence including one for the female students. One residential hall (Shahid Smrity Hall) is designated solely for postgraduate students. This facility is available for full time postgraduate students only. These halls provide residential accommodation for the majority of students of the University. All eight residential halls are on campus and are within walking distance from the main academic buildings. All residential halls have furnished rooms, dining facilities and recreational arrangements. The University has commuter bus service for students having residence within the city area.

3.6 Student Welfare/Medical Facilities

The University has a well-equipped Medical Centre staffed by six qualified doctors including one female physician. The students get free treatment and medicine from the Medical Centre.

A student who has been absent for short periods, up to a maximum of three weeks due to illness should approach, the course teacher(s) or the course-coordinator(s) for make-up quizzes or assignments immediately on returning to the classes. Such request should be supported by medical certificate from a university Medical Officer. The medical certificate issued by a registered medical practitioner (with the Registration Number shown explicitly on the certificates) will also be acceptable only in those cases where the student has valid reasons for his absence from the university.

3.7 Sports/Recreational Facilities

Regular sport activities are part of student life at BUET. Inter-hall football, basketball, and cricket competitions are organized regularly. There are playgrounds, tennis courts, basketball courts, a squash court, and a well-equipped gymnasium. All the halls of residence have adequate facilities for indoor games.

The students participate in various cultural programs throughout the year. Special cultural weeks are arranged in each of the halls of residence. The University has an air-conditioned auditorium complex with 1200 seating capacity. Various educational and recreational films are shown in this auditorium with film projectors.

Chapter 4

Ordinance for Master's Degree Programme

The following are the rules and regulations for administering the Master's degree programme. The following articles have been reproduced from Ordinance, Statutes, Rules and Regulation (February 1991; as amended up to 2001), published by Bangladesh University of Engineering and Technology.

4.1 Degrees Offered

The Masters degrees to be offered under this Ordinance are as follows:

Master of Science in

Advanced Engineering Management	abbreviated as	M.Sc. Engg. (AEM)
Chemical Engineering	abbreviated as	M.Sc. Engg.(Chem)
Civil Engineering (Environmental)	abbreviated as	M.Sc. Engg. (Civil & Environmental)
Civil Engineering (Geotechnical)	abbreviated as	M.Sc. Engg.(Civil & Geotechnical)
Civil Engineering (Structural)	abbreviated as	M.Sc. Engg. (Civil & Structural)
Civil Engineering (Transportation)	abbreviated as	M.Sc. Engg. (Civil & Transportation)
Computer Science and Engineering	abbreviated as	M.Sc. Engg. (CSE)
Electrical & Electronic Engineering	abbreviated as	M.Sc. Engg. (EE)
Environmental Engineering	abbreviated as	M.Sc. Engg. (Environmental)

Industrial & Production Engineering	abbreviated as	M.Sc. Engg. (IP)
Information and Communication Technology	abbreviated as	M.Sc. Engg. (ICT)
Materials & Metallurgical Engineering	abbreviated as	M.Sc. Engg. (MM)
Mechanical Engineering	abbreviated as	M.Sc. Engg. (Mech)
Mineral Resources Engineering	abbreviated as	M.Sc. Engg. (Mineral Resources)
Naval Architecture and Marine Engineering	abbreviated as	M.Sc. Engg. (NAM)
Petroleum Engineering	abbreviated as	M.Sc. Engg. (Petroleum)
Water Resources Engineering	abbreviated as	M.Sc. Engg. (WR)

Master of Engineering in

Advanced Engineering Management	abbreviated as	M. Engg. (AEM)
Chemical Engineering	abbreviated as	M. Engg.(Chem)
Civil Engineering (Environmental)	abbreviated as	M. Engg. (Civil & Environmental)
Civil Engineering (Geotechnical)	abbreviated as	M. Engg. (Civil & Geotechnical)
Civil Engineering (Structural)	abbreviated as	M. Engg. (Civil & Structural)
Civil Engineering (Transportation)	abbreviated as	M. Engg. (Civil & Transportation)
Computer Science and Engineering	abbreviated as	M. Engg. (CSE)
Electrical & Electronic Engineering	abbreviated as	M. Engg. (EE)

Environmental Engineering	abbreviated as	M. Engg. (Environmental)
Industrial & Production Engineering	abbreviated as	M. Engg.(IP)
Information and Communication Technology	abbreviated as	M. Engg.(ICT)
Materials & Metallurgical Engineering	abbreviated as	M. Engg.(MM)
Mechanical Engineering	abbreviated as	M. Engg. (Mech)
Mineral Resources Engineering	abbreviated as	M. Engg. (Mineral Resources)
Naval Architecture and Marine Engineering	abbreviated as	M. Engg. (NAM)
Petroleum Engineering	abbreviated as	M. Engg. (Petroleum)
Water Resources Engineering	abbreviated as	M. Engg. (WR)

Master of Architecture	abbreviated as	M. Arch

Master of Urban & Regional Planning by Course and thesis	abbreviated as	MURP
Master of Urban & Regional Planning by Courses and project	abbreviated as	MURP

Master of Science in Water Resources Development	abbreviated as	M.Sc. (WRD)

Any other master's degree approved by the Academic Council may also be offered under this ordinance.

4.2 Admission Requirements

For admission to the courses leading to a Master's degree (M.Sc. Engg. /M. Engg. /M. Arch. / MURP / M. Sc.) an applicant

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

(b) must have at least 50% marks or a minimum GPA of 2.50 out of 4.0 or its equivalent in B. Sc. Engg. / M. A or M. Sc. or MSS / B. Arch. / BURP in the relevant branch.

(c) Specific requirements for different departments and institutes are spelt out in the following sections.

For admission to the courses leading to the degree of M.Sc. Engg. /M. Engg. in any branch, an applicant must have obtained a B.Sc. Engg. Degree in the relevant branch or an equivalent degree from any recognized institution. An applicant with a B. Sc. Engg. degree in other branches of engineering may also be eligible for admission to the courses leading to the degree of M.Sc. Engg. (Environmental) / M. Engg. (Environmental), M.Sc. Engg. (AEM)/M. Engg. (AEM) and M. Sc. Engg. (MM) / M. Engg. (MM). In such cases, the selected candidate may be required to undertake non-credit prerequisite courses at the undergraduate and / or postgraduate level as may be determined by the BPGS of Civil Engineering Department, Industrial and Production Engineering Department and Materials and Metallurgical Engineering Department respectively.

For admission to the courses leading to the degree of M.Arch. an applicant must have obtained a B. Arch degree or its equivalent degree from any recognized institution.

For admission to the courses leading to the degree of MURP an applicant must have either a Bachelor's degree in Urban & Regional Planning / Architecture / Engineering / Agricultural Economics or a four-year degree in Mathematics / Statistics / Physics / Public Administration / Sociology /

Social Work / Geography / Economics or its equivalent from any recognized institution.

OR

Master's degree with Honours in Mathematics / Statistics/ Physics / Public Administration / Sociology / Social Welfare / Social Work / Geography / Economics or its equivalent from any recognized institution. An applicant not having an Honours degree should have a first class in the Master's degree.

For admission to the courses leading to the degree of M.Sc. Engg. (ICT) / M. Engg.(ICT) an applicant must have either a Bachelor's degree in Computer Science and Engineering or Electrical and Electronic Engineering or Computer Engineering or Computer Science or Information Technology having a minimum GPA of 2.5 out of 4.0 or its equivalent from any recognized university,

OR

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

A student on recommendation of the relevant RAC and as approved by the CASR may be transferred to the Masters Programme and may be allowed to transfer a maximum of 12 credits of courses provided,

a) he/she has completed the academic requirement for the PG. Diploma (ICT) from this university, but results not published.
b) the courses are common to both P. G. Diploma and Master's Programme and
c) he/she has earned a minimum GPA of 3.0 out of 4.0 in individual courses.
d) If he/she fails to qualify for the master's degree, he/she may be awarded the P. G. Diploma.

For admission to the courses leading to the degree of M.Sc. (WRD) an applicant must have either a Bachelor's degree in Civil Engineering/ Water Resources Engineering / Agricultural Engineering / Environmental Science or its equivalent having a minimum GPA of 2.5 out of 4.0 or PG. Dip.

(WRD) having a minimum GPA of 2.65 out of 4.0 or its equivalent from any recognized institution.

4.3 Admission and Registration Procedures

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

Before being finally selected for admission a candidate may be required to appear at an oral and / or written test by a Selection Committee as constituted by the BPGS / RAC. He/She will be required to take pre-requisite courses as may be prescribed by the Selection Committee. Every selected candidate, unless he/she has already been registered, shall get himself/herself registered with the University.

After admission each student shall be assigned, by the relevant BPGS/RAC, an Adviser from among the teachers of the Department / Institute not below the rank of an Assistant Professor. In advance of each enrollment and course registration for any semester, the Adviser or Supervisor (as appointed by Art. 8.1 & 9.1 of this ordinance) shall check and approve his/her student's schedule for subjects, pre-requisites as recommended by the Selection Committee and the total hours. The student is expected to consult his/her Adviser/Supervisor on all academic matters but it is the responsibility of the individual student to see that his/her schedule conforms to the academic regulations.

Every registered student shall get himself/herself enrolled on payment of prescribed fees and other dues as per the University rules before the commencement of each semester. In an academic year there will be normally two semesters. All course registration must be completed within two weeks from the start of a semester.

On the recommendation of the appropriate BPGS / RAC and CASR the rules for admission into the University for postgraduate studies shall be framed from time to time by the Academic Council. CASR on its own may, if it deems fit, recommend such rules for admission for approval of the Academic Council.

No late registration will be allowed after two weeks of designated dates of registration. Late registration after this date may only be accepted for thesis/project if the student submits a written appeal to the Registrar through the concerned Head and can document extenuating circumstances such as medical problems (physically incapacitated and not able to be presented) from the Chief Medical Officer (CMO) of the University or some other academic commitments which precluded registration prior to the last date of registration.

Students will be charged a late registration fee of Tk. 1000.00 (One thousand) only. This extra fee will not be waived whatever be the reason for late registration.

If a student unable to complete the final examination of a semester due to serious illness or serious accident or official commitment he/she may apply to the Registrar in a prescribed form through Head/Director of the degree awarding Department/Institute for total withdrawal from the semester within a week after the end of the semester final examination.

The application must be supported by a medical certificate from the CMO, BUET or relevant Official documents. The Academic Council will take the final decision about such application on the recommendation of the relevant BPGS/RAC.

4.4 Academic Requirements and Regulations

The minimum duration of the M.Sc. Engg./M. Engg./ M. Arch. and M.Sc. program shall be three semesters.

The minimum duration of MURP shall be three semesters but four semesters for MURP students not having BURP or equivalent degree.

A candidate for the Master's degree must complete all the requirements for the degree within five academic years (Session) from the date of the first admission in the respective program.
Academic progress shall be measured in terms of credit hours earned by a student. One credit hour subject shall normally require 14 hours of lecture

for one semester; while one credit hour for thesis/project/ laboratory should normally require 42 hours of work for one semester. The number of credit hours for each subject shall be as specified in the syllabus of the respective department /institute.

The credit hour requirement for the master's program shall be as follows:

For the degree of M.Sc. Engg., a student must earn a minimum of 36 credit hours including a thesis, for which 18 credit hours shall be assigned.

For 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.

For the degree of M. Arch., a student must earn a minimum of 36 credit hours including a thesis, for which 18 credit hours shall be assigned.

For the degree of MURP (by course and thesis), a student must earn a minimum of 36 credit hours (48 credit hours for students not having BURP or equivalent degree) including a thesis, for which 18 credit hours shall be assigned.

For the degree of MURP (by course and project), a student must earn a minimum of 36 credit hours (48 credit hours for students not having BURP or equivalent degree) including a project, for which 6 credit hours shall be assigned.

In MURP programme (either by course and thesis or by course and project) a student not having a 4-year Bachelor's degree in URP (or equivalent) must undertake an extra 12 credit hours of courses and other non-credit courses as determined by the BPGS of the department.

For the degree of M.Sc. (WRD), a student must earn a minimum of 36 credit hours including a thesis, for which 18 credit hours shall be assigned.

There shall be two categories of students, namely, full-time students and part-time students.

A student may enroll as a part-time student. Students, serving in different organizations, may also be admitted as part time students with the written consent of the employer. A part time student may be assigned a maximum of 9 credit hours of course including thesis/project work in any semester.

Full time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per semester. A full-time student shall not be allowed to be in the employment of any organization (even as a part time employee). However, they may be employed as teaching/ research assistant at the University. If a full-time student becomes an employee (full time or part time) of any other organization in the middle of a semester, he/she may, with the approval of the Head of the Department / Director of the Institute and his/her Employer, be allowed to continue as a full time student for that semester.

A student may be allowed to switch from part-time to full-time or vice versa on the recommendation of the respective BPGS/RAC before the commencement of a semester.

The courses of study in different departments / institutes shall be as recommended by the respective BPGS / RAC and the Faculty / CASR and approved by the Academic Council. The BPGS / RAC may review the curriculum from time to time and recommend any changes as may be considered necessary. The courses to be offered in any semester shall also be as determined by the relevant BPGS / RAC.

A student on the recommendation of the relevant BPGS / RAC and as approved by the CASR may be allowed to transfer a maximum of 9.0 credits of the courses completed by the student at a recognized institution provided that the courses were not taken earlier than five calendar years from the date of his/her first enrolment in the respective programme at BUET and that the student obtained a minimum grade point of 3.0 out of 4.0 or its equivalent in such courses and that the courses are equivalent to the approved courses of BUET.

4.5 Grading system

Final grades for courses shall be recorded as follows:

Grade	Merit description	Grade points
A (Plus)	Excellent	4.0
A	Very good	3.5
B (Plus)	Good	3.0
B	Average	2.5
C	Pass	2.0
F	Failure	0.0
I	Incomplete (for theory courses)	-
S	Satisfactory	-
U	Unsatisfactory	-
W	Withdrawn	-
X	In Progress (for thesis/project)	-
I	Discontinued (for thesis/project)	-

Courses in which the student gets F grades shall not be counted towards credit hour requirements and for the calculation of Grade Point Average (GPA).

The C grades, up to a maximum of two courses, may be ignored for calculation of GPA at the written request of the student to the Head of the Department / Director of the Institute on the recommendation of the supervisor / Advisor, provided that the student has fulfilled the total course credit hour requirement in the remaining subjects with a minimum GPA of 2.75.

When a course is repeated for improvement, better grade shall be counted for calculation of GPA.
Performance in all the subjects including all the F grades shall be reflected in the transcript.

Grade I is 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 Department / Director of the Institute within one week after the examination to get an I grade in that course. It must be completed within the next two semesters, otherwise, the I grade becomes an F grade. He/She may, however, be allowed to register without further payment of tuition fees for that course.

Satisfactory or Unsatisfactory- used only as final grades for thesis/project and non-credit courses. An X grade shall be recorded for thesis/project continuation. If, however, thesis / project is discontinued an I grade shall be recorded.

Students may enroll for non-credit course(s) termed as audit course(s) on recommendation of his/her thesis / project Supervisor and Head of the Department / Director of the Institute.

A student shall withdraw officially from a course within two working weeks of the commencement of the semester or else his grade in that course shall be recorded as F unless he/she is eligible to get a grade of I. A student may be permitted to withdraw and change his/her course within the specified period with the approval of his/her Adviser, Head of the Department / Director of the Institute and the respective teacher(s) concerned. In that case his / her grade in the courses registered shall be recorded as 'W' in his Academic Record but shall not be reflected in the transcript.

Numerical markings 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:

90% and above		:	A (Plus)
80% to below	90%	:	A
70% to below	80%	:	B (Plus)
60% to below	70%	:	B
50% to below	60%	:	C
Below 50%		:	F

4.6 Conduct of Examination

In addition to tests, assignments and/ or examinations during the semester as may be given by the teacher(s) concerned, there shall be a written examination and / or other tests for each of the subjects offered in a semester at the end of that semester, the dates of which shall be announced by the Controller of Examinations, BUET as advised by Dean of the respective Faculty / The Director of the respective Institute 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 / or examinations.

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 semester. In addition, each student is entitled to one official transcript of the University record at the completion of his academic programme from the office of the Controller of Examinations on production of statement of clearance from all departments/ institutes/offices.

The BPGS / RAC of a department / institute shall recommend the names of the paper setters and examiners for the semester examinations at least two weeks before the date of commencement of the examination to the Vice-Chancellor for approval.

4.7 Qualifying Requirements

The qualifying requirement for graduation is that a student must earn a minimum grade point of 2.65 based on the weighted average in his course work.

Two courses may be repeated for improvement with the prior approval of the Head of the Department / Director of the Institute on the recommendation of the Supervisor / Advisor. Such approval shall be reported to the BPGS/RAC.

A student obtaining F grade in a course may be allowed to repeat the course with the prior approval of Head of the Department / Director of the Institute

on the recommendation of the Supervisor / Advisor. Such approval shall be reported to the BPGS/RAC.

A student shall not be allowed to continue the programme if he/she obtains a total of three or more F grades in one or more than one subjects taken together, during the course of his / her studies.

If at the end of the second or any subsequent semester, the cumulative GPA falls below 2.5 he/she shall not be allowed to continue in the programme.

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

4.8 Thesis

Research work for a thesis shall be carried out under the supervision of a full-time member of the staff belonging to the relevant department/institute. However, in special cases, a full-time member of the staff belonging to a department/institute/centre outside the student's relevant department/ institute of the University may be appointed as Supervisor, if the research content of the thesis is within the field of specialization of the member of the staff. A Co-supervisor from within or outside the department/institute may be appointed, if necessary. The thesis proposal of a student shall be submitted for approval of the CASR on the recommendation of the relevant BPGS / RAC after completion of at least 12 credit hours of course work.

If any change is necessary of the approved thesis (title, content, cost, supervisor, co-supervisor etc.) it shall be approved by the CASR on recommendation of the relevant BPGS/RAC.

The research work must be carried out in this University or at a place(s) recommended by the BPGS/RAC. The work schedule and financial involvement should be mentioned in the research proposal for carrying out research work outside the university.

Every student shall submit to the Head of the Department/Director of the Institute, through his/her Supervisor, required number of written copies of

his/her thesis in the approved format on or before a date to be fixed by the Supervisor concerned in consultation with the Head of the Department/Director of the Institute.

The student shall certify (as per prescribed format) that the research work was done by him/her and that this work has not been submitted elsewhere for the award of any other diploma or degree.

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

Every student submitting a thesis in partial fulfillment of the requirements of a degree, shall be required to appear at an oral examination, on a date or dates fixed by the Supervisor concerned in consultation with the Head of the Department/Director of the Institute and 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/her research work.

4.9 Thesis Examination Board

An Examination Board for every student for thesis and oral examination shall be approved by the CASR on recommendation of the thesis Supervisor in consultation with the Head of the Department/Director of the Institute. 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 Board shall consist of at least four members including the Head of the Department/Director of the Institute and the Supervisor.

The Examination Board shall be constituted as follows:

(i) Supervisor - Chairman
(ii) Co-supervisor(if any) - Member
(iii) Head of the Department/Director of the Institute(Ex-officio) - Member
(iv) One or two members from within the Department/Institute - Member

(v) One external member from outside the student's Department/Institute - (External)

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

In case a student fails to satisfy the Examination Board in thesis and/or oral examination, the student shall be given one more chance to resubmit the thesis and/or appear in oral examination as recommended by the Board.

4.10 Project

Project work shall be carried out under the supervision of a full-time member of the staff belonging to the relevant Department/Institute. However, in special cases, a full- time member of the staff belonging to a Department/Institute outside the student's relevant Department/Institute of the University may be appointed as Supervisor, if the research content of the project work is within the field of specialization of the member of the staff. The title of the project, cost and the Supervisor shall be recommended by the BPGS/RAC for approval of the Vice-Chancellor. This approval will be reported to the CASR.

If any change is necessary for the approved project (title, content, cost, Supervisor, etc.) it shall be approved by the Vice-Chancellor on the recommendation of the relevant BPGS/RAC. This approval will be reported to the CASR.

The project work must be carried out in this University or at a place approved by the Vice-Chancellor on recommendation of the Supervisor in consultation with the Head of the Department /Director of the Institute. The work schedule and financial involvement should be mentioned in the project proposal for carrying out project work outside the university.

Every student shall submit to the Head of the Department/Director of the Institute, through his/her Supervisor, required number of written copies of

his/her project report in the approved format on or before a date to be fixed by the Supervisor concerned in consultation with the Head of the Department/Director of the Institute.

The student shall certify (as per prescribed format) that the research work was done by him/her and that this work has not been submitted elsewhere for the award of any other diploma or degree.

Every student submitting a project report in partial fulfillment of the requirement of a degree shall be required to appear at an oral examination, on a date or dates fixed by the Supervisor concerned in consultation with the Head of the Department/Director of the Institute and must satisfy the examiners that he/she has gained satisfactory knowledge related to the project work.

4.11 Project Examination Board

An Examination Board for every student for the project and oral examination shall consist of at least three members including the Supervisor. The Supervisor shall act as the Chairman. The BPGS/RAC shall recommend the names of the examiners for approval of the Vice-Chancellor. This approval will be reported to the CASR. The Examination Board shall be constituted as follows:

(i) Supervisor (Chairman)
(ii) One member from within the Department/Institute (Member)
(iii) One member from within or outside the Department/Institute (Member)

If any examiner is unable to accept the appointment or has to relinquish his/her appointment before the examination the Vice-Chancellor shall appoint another examiner in his/her place on the recommendation of the relevant BPGS/RAC. This appointment will be reported to the CASR.

In case a student fails to satisfy the Examination Board in project report and/or oral examination, the student shall be given one more chance to resubmit the project report and/or appear in oral examination as recommended by the Board.

4.12 Striking off and removal of names from the rolls

The name of the student shall be struck off and/or removed from the rolls of the University on the following grounds:

(i) Non-payment of dues within prescribed period. Post graduate students residing in the halls of residence shall be subject to the same conditions as allowed in the Ordinance Relating to the Board of Residence and Discipline.
(ii) Failing to proceed with the programme by the exercise of the Art. 4.1 or 7.2 or 7.3of this Ordinance.
(iii) Failing to make satisfactory progress in his/her programme as reported by the supervisor through the BPGS/RAC and approved by CASR.
(iv) Forced to discontinue his/her studies by the Board of Residence and Discipline. Withdrawn officially from the master's degree Programme.

4.13 Academic fees

Items of Academic fees shall be as per prescribed format, and the fees shall be reviewed and recommended from time to time by the Academic Council.

4.14 Refund of fees

A student withdrawing officially from all courses and/or thesis/project as per Art. 10(v) is entitled to get a refund of 50% of the course registration fees provided he/she withdraws in writing through the respective Head of the Department/Director of the Institute before the expiry of two working weeks from the commencement of the classes. Thesis/project registration fees in any case are not refundable.

Chapter 5

Ordinance for the Degree of Doctor of Philosophy

The following are the rules and regulations for administering the Doctoral degree programme. The following articles have been reproduced from Ordinance, Statutes, Rules and Regulation (February 1991; as amended up to 2001), published by Bangladesh University of Engineering and Technology.

5.1 Degrees Offered

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

Department of Architecture
Department of Chemical Engineering
Department of Chemistry
Department of Civil Engineering
Department of Computer Science and Engineering
Department of Electrical and Electronic Engineering
Department of Industrial and Production Engineering
Department of Materials and Metallurgical Engineering
Department of Mathematics
Department of Mechanical Engineering
Department of Naval Architecture and Marine Engineering
Department of Petroleum and Mineral Resources Engineering
Department of Physics
Department of Urban and Regional Planning
Department of Water Resources Engineering

Institute of Water and Flood Management and such other department/Institute as may be approved by the Syndicate of the University.

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

5.2 Admission Requirements

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

a) Must have a minimum GPA of 3.50 out of 5.00 or a first division or equivalent in any one of S.S.C. and H.S.C. or in equivalent examinations and must not have a GPA less than 2.00 out of 5.00 or a third division or equivalent in any of the aforementioned examinations.
b) Must have at least 50% marks or a minimum GPA of 2.50 out of 4.0 or its equivalent in B. Sc. Engg. / Four-year B. A or B. Sc. degree / M. A or M. Sc. or MSS degree / B. Arch. / BURP in the relevant branch.
c) Must have a minimum GPA of 2.75 out of 4.0 or its equivalent in M. Sc. Engg. / M. Engg. / M. Phil / MURP / M. Arch. / M. Sc. (WRD) degree in the relevant branch.
d) Specific requirements for different Departments and Institutes are spelt out in the following sections.

For engineering, the minimum qualification for admission shall normally be an M.Sc. Engg./M. Engg. degree in the appropriate branch of engineering or its equivalent from any recognized Institution.

For Materials and Metallurgical Engineering, applicants having an M. Phil. in Materials Science or its equivalent from a recognized institution may also be eligible for admission.

For Urban and Regional Planning, the minimum qualification for admission shall normally be an MURP degree or its equivalent from any recognized Institution.

For Architecture, the minimum qualification for admission shall normally be an M. Arch. degree or its equivalent from any recognized Institution.

For Physics, the minimum qualification for admission shall normally be an M. Phil. degree in Physics/ Applied Physics or its equivalent from any recognized Institution.

OR

M.Sc. Engg. degree in Mechanical/ Electrical & Electronic / Materials & Metallurgical Engineering or its equivalent

For Chemistry, the minimum qualification for admission shall normally be an M. Phil. degree in Chemistry / Applied Chemistry or its equivalent from any recognized Institution.

OR

M.Sc. Engg. degree in Chemical / Materials & Metallurgical / Electrical & Electronic / Mechanical Engineering.

For Mathematics, the minimum qualification for admission shall normally be an M. Phil. degree in Mathematics or Applied Mathematics or its equivalent from any recognized Institution.

OR

M.Sc. Engg. degree provided he completes some prerequisite courses in Mathematics as determined by a Selection Committee.

For Water Resources Development, the minimum qualification for admission shall normally be an M.Sc. Engg./M. Engg. degree in Civil Engineering/Water Resources Engineering / Environmental Engineering / Agricultural Engineering or M. Sc. degree in Water Resource Development or its equivalent from any recognized Institution.

A student already working for an M.Sc. Engg./ M.Phil/ MURP / M. Arch./ M.Sc.(WRD) degree at this University and showing excellent progress and promise in thesis work may be provisionally transferred to the Ph.D. degree programme after completion of M.Sc. Engg./ M.Phil./ MURP/ M.Arch./ M.Sc.(WRD) course work with a minimum GPA of 3.0 out of 4.0 on approval of the Committee for Advanced Studies and Research (CASR) on the recommendation of the relevant Board of Post Graduate Studies (BPGS)/Research and Academic Committee (RAC).

5. 3 Admission Procedure

A candidate may apply to the Registrar for provisional admission to the Ph.D programme in any semester.

There shall be a Selection Committee in each department/institute as constituted by the relevant BPGS/RAC on recommendation of the Head/Director of the Department/Institute.

A candidate selected by the Selection Committee shall be provisionally admitted and may be required to pass the prerequisite non-credit courses as prescribed by the Selection Committee.

On the recommendation of the appropriate BPGS/RAC and CASR the rules for admission into the University for postgraduate studies shall be framed from time to time by the Academic Council. CASR on its own may, if it deems fit, recommend such rules for admission for approval of the Academic Council.

5.4 Registration

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

Every registered candidate (student) shall get himself/herself enrolled on payment of prescribed fees and the dues as per the University rules before the commencement of each semester. Course registration must be completed within two weeks from the start of the semester.

No late registration will be allowed after two weeks of designated dates of registration. Late registration after this date may only be accepted for thesis if the student submits a written appeal to the Registrar through the concerned Head and can document extenuating circumstances such as medical problems (physically incapacitated and not able to be presented) from the Chief Medical Officer (CMO) of the University or some other academic commitments which precluded registration prior to be last date of registration.

Student will be charged a late registration fee of Tk.1000.00 (One thousand) only. This extra fee will not be waived whatever be the reason for late registration.

If a student is unable to complete the final examination of a semester due to serious illness or serious accident or official commitment, he/she may apply

to the Registrar in a prescribed form through Head/Director of the degree awarding Department/Institute for total withdrawal from the semester within a week after the end of the semester final examination.

The application must be supported by a medical certificate from the CMO, BUET or relevant Official documents. The Academic Council will take the final decision about such application on the recommendation of the relevant BPGS/RAC.

5.5 Appointment of a Supervisor

On provisional admission, the Selection Committee as constituted in Art.3.2 shall submit a name of a Supervisor who shall be a full-time member of the staff belonging to the relevant department/institute and a Co-supervisor from within or outside the department/institute, if necessary. These selections have to be approved by the CASR. The supervisor shall prescribe a plan of study to be undertaken by the student and supervise the progress of the candidate's work.

5. 6 Final Registration

A provisionally admitted student shall be deemed to be eligible for final registration as a Ph.D. student with effect from the date of his/her provisional admission after he/she passes the comprehensive examination (Art.12.3 of this Ordinance).

5. 7 Academic Requirements and Regulations

The minimum duration of the Ph.D. course shall be four 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.

Academic progress shall be measured in terms of Credit hours earned by a student. One Credit hour subject shall normally require 14 hours of lecture for one semester while one Credit hour for thesis work should normally require 42 hours of research work for one semester. The number of Credit hours for each subject shall be as specified in the syllabus of the respective department/ institute.

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

There shall be two categories of students, namely, full-time students and part-time students.

A student may enroll as a part-time student. Students, serving in different organizations, may also be admitted as part time students with the written consent of the employer. A part time student may be assigned a maximum of 9 credit hours of course including thesis work in any semester.

Full-time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per semester. A full-time student shall not be allowed to be in the employment of any organization (even as a part-time employee). However, they may be employed as Teaching/Research Assistant at the University. If a full-time student becomes an employee (full time or part time) of any other organization in the middle of a semester, he/she may, with the approval of the Head/Director of the Department/Institute and his/her Employer, be allowed to continue as a full time student for that semester.

A student may be allowed to switch from part-time to full-time or vice versa on the recommendation of the respective Doctoral Committee before the commencement of a semester.

The subjects of study in the different Departments/Institutes shall be as recommended by the respective BPGS/RAC and the Faculty/CASR and approved by Academic Council. The BPGS /RAC may review the curriculum from time to time and recommend any changes as may be considered necessary.

The subjects that may be offered in any semester shall be as decided by the relevant department/institute.

A student on the recommendation of the relevant BPGS / RAC and as approved by the CASR may be allowed to transfer a maximum of 3.0 credits of the courses completed by the student at a recognized institution provided that the courses were not taken earlier than five calendar years from the date of his/her first enrolment in the respective programme at

BUET and that the student obtained a minimum GPA of 3.0 out of 4.0 or its equivalent in such courses and that the courses are equivalent to the approved courses of BUET.

5. 8 Grading System

Final grades for courses shall be recorded as follows:

Grade	Merit description	Grade points
A (Plus)	Excellent	4.0
A	Very good	3.5
B (Plus)	Good	3.0
B	Average	2.5
C	Pass	2.0
F	Failure	0.0
I	Incomplete (for theory courses)	-
S	Satisfactory	-
U	Unsatisfactory	-
W	Withdrawn	-
X	In Progress (for thesis/project)	-
I	Discontinued (for thesis/project)	-

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

The C grades, up to a maximum of two courses, may be ignored for calculation of GPA at the written request of the student to the Head of the Department / Director of the Institute on the recommendation of supervisor provided that the student has fulfilled the total course credit hour requirement in the remaining subjects with a minimum GPA of 2.75.

When a course is repeated for improvement, better grade shall be counted for calculation of GPA.

Performance in all the subjects including all the F grades shall be reflected in the transcript.

Grade I is 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 control. He/she must apply to the Head of the Department / Director of the Institute within one week after the examination to get an I grade in that course. It must be completed within the next two semesters; otherwise, the I grade becomes an F grade. He/she may, however, be allowed to register without further payment of tuition fees for that course.

Satisfactory or Unsatisfactory used only as final grades for thesis and non-credit courses. An X grade shall be recorded for thesis continuation. If, however, thesis is discontinued an I grade shall be recorded.

Students may enroll for non-credit course(s) termed as audit course(s) on recommendation of his/her thesis Supervisor and Head of the Department/ Director of the Institute.

A student shall withdraw officially from a course within two working weeks of the commencement of the 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/her 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. (In that case his/her grade in the courses registered shall be recorded as ‘W’ in his Academic Record but shall not be reflected in the transcript.)

Numerical markings 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:

90%	and above		:	A (Plus)
80%	to below	90%	:	A
70%	to below	80%	:	B (Plus)
60%	to below	70%	:	B
50%	to below	60%	:	C
	Below	50%	:	F

5. 9 Doctoral Committee

A Doctoral Committee for every student shall be proposed by the Supervisor in consultation with the Head of the department / Director of the Institute. The committee shall be approved by the CASR on recommendation of the BPGS / RAC. The Committee shall be formed within six months from the date of the student's provisional admission. The Committee shall consist of at least five members but shall not exceed seven including the Head of the Department / Director of the Institute and the Supervisor. 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 Doctoral Committee. The Doctoral Committee should meet from time to time at the request of the Supervisor to review the progress of the student. In special circumstances CASR may approve any addition and/or alteration in the Doctoral Committee on the recommendation of the Supervisor through the Head of the Department / Director of the Institute.

5.9.1 Research Proposal

The student, after passing the comprehensive examination, shall submit a research proposal to the Doctoral Committee which shall examine the proposal and recommend it for the approval of the CASR through the Head of the Department / Director of the Institute. In special circumstances the Doctoral Committee may recommend through the Head of the Department / Director of the Institute to CASR for approval of any subsequent changes in the research proposal.

Research work for a thesis shall be carried out in this University or at a place(s) approved by the Doctoral Committee. The work schedule and financial involvement should be mentioned in the research proposal for carrying out research work outside the university.

5.9.2 Conduct of Examination

In addition to tests, assignments and/or examinations during the semester as may be given by the teacher(s) concerned, there shall be a written examination and/or other tests for each of the subjects offered in a semester at the end of that semester, the dates of which shall be announced by the Controller of Examinations, BUET as advised by the Dean/Director of the respective Faculties/Institute 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/or examinations.

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 semester. In addition, each student is entitled to one official transcript of the University record at the completion of his/her academic programme from the office of the Controller of Examinations on production of statement of clearance from all departments/institutes /offices.

The BPGS/RAC of a department/institute shall recommend the names of the paper setters and examiners for the semester examination at least two weeks before the date of commencement of the examination to the Vice-Chancellor for approval.

5. 10 Qualifying Requirements

Course Work

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

Two courses may be repeated for improvement with the prior approval of the Head of the Department / Director of the Institute on the recommendation of Supervisor. Such approval shall be reported to the BPGS/RAC.

A student obtaining F grade in a course may be allowed to repeat the course with the prior approval of Head of the Department / Director of the Institute on the recommendation of Supervisor. Such approval shall be reported to the BPGS/RAC.

A student shall not be allowed to continue the programme if he/she obtains a total of three or more F grades in one or more than one subjects taken together, during the course of his / her studies.

Comprehensive Examination

The date(s) and time of the comprehensive examination shall be fixed by the Doctoral Committee on the request of the Supervisor. Comprehensive examination shall be held after the completion of the course work by the student.

The comprehensive examination shall comprise of a written examination and/or an oral examination to test the knowledge of the student in his/her field of study and research. The Doctoral Committee shall conduct the comprehensive examination. If a student fails in a comprehensive examination, he/she shall be given one more chance to appear at the examination as scheduled by the Doctoral Committee.

In addition to successful completion of course works and comprehensive examination every student shall submit a thesis on his/her research work fulfilling the requirements.

5. 11 Thesis

At the end of the student's research work the student shall submit a thesis which must be an original contribution to engineering/sciences and worthy of publication. At least six typed written copies of the thesis in the final form as per prescribed format must be submitted to the Head of the Department.

The student shall certify (as per prescribed format) 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).

On completion of the research work and submission of the thesis an oral examination shall be arranged on a date or dates fixed by the Supervisor in consultation with the Head of the Department / Director of the Institute in which the student shall defend his/her thesis. The student must satisfy the examiners that he/she is capable of intelligently applying the results of his/her research to the solution of problems, of undertaking independent research and afford evidence of satisfactory knowledge related to the theory and technique used in his / her research work.

5. 12 Examination Board

An Examination Board for every student for thesis and oral examination shall consist of the Doctoral Committee and one or more external examiner(s) to be appointed by the CASR on the recommendation of the thesis supervisor in consultation with the Head of the Department / Director of the Institute. The Board shall consist of at least six members including the Head of the Department / Director of the Institute and the supervisor. The supervisor shall act as the Chairman of the Examination Board. At least one external examiner shall be appointed from outside the University. If the external examiner is appointed from outside the country a copy of the thesis should be sent to him / her for his / her evaluation and his / her written opinion be placed before the Examination Board.

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

In case a student fails to satisfy the Examination Board in thesis and /or oral examination, the student shall be given one more chance to resubmit the thesis and/or appear in oral examination as recommended by the Board.

A student who has been transferred to the Ph.D. programme from the M.Sc. Engg./M.Phil/ MURP/ M.Arch./ M.Sc.(WRD) programme may be awarded an M.Sc. Engg./M.Phil/ MURP/ M.Arch./ M.Sc.(WRD) degree on recommendation of the Supervisor, if the student fails to qualify for the award of the Ph.D. degree.

5. 13 Striking off and removal of names from the rolls

The name of the student shall be struck off and / or removed from the rolls of the University on the following grounds:

(i) Non-payment of dues within prescribed period. Post graduate students residing in the halls of residence shall be subject to the same conditions as allowed in the Ordinance Relating to the Board of Residence and Discipline.

(ii) Failing to proceed with the programme by the exercise of Art.7.1 or 12.2 or 12.3 of this Ordinance.
(iii) Failing to make satisfactory progress in his/her programme as reported by the supervisor through the BPGS / RAC and approved by CASR.
(iv) Forced to discontinue his/her studies by the Board of Residence and Discipline.
(v) Withdrawn officially from the Ph.D. programme.

5. 14 Academic Fees

Items of Academic fees shall be as per prescribed format, and the fees shall be reviewed and recommended from time to time by the Academic Council.

5. 15 Refund of Fees

A student withdrawing officially from all courses and/or thesis as per Art. 15(v) is entitled to get a refund of 50% of the course registration fees provided, he/she withdraws in writing through the respective Head of the Department/Director of the Institute before the expiry of two working weeks from the commencement of the classes. Thesis registration fees in any case are not refundable.

Chapter 6

Detail Outline of Postgraduate Courses

CE 6011 Boundary Element Method
3 Credits
Introduction; One-dimensional problems: potential flow, beam bending; Two-dimensional problems of potential flow; Two-dimensional problems of elastostatics; Axisymmetric analysis; Three-dimensional formulations; Parametric representations of functions and geometry; Time- dependent analysis: elastodynamics, transient groundwater flow; Non-linear analysis: problems of elastoplasticity; Combination of Boundary Element Method with other numerical methods.

CE 6101 Theory of Elasticity
3 Credits
Stress-strain relationship; Plane-stress and plane-strain; Stress functions; Two dimensional problems in rectangular and polar coordinates; Torsion; Energy principles; Stress and strain in three dimensions; General theorems; Three dimensional problems; Theories of failure; Computer solutions of elasticity problem.

CE 6103 Theory of Plates
3 Credits
Rectangular plates with various edge conditions; Circular plates; Energy methods; Approximate methods; Orthotropic plates; Numerical methods in the solution of plate problems; Non-linear analyses of plates.

CE 6105 Plastic Design of Structures
3 Credits
Review of fundamental concepts; Plastic hinges, collapse of beams and frames; Effects of axial load and shear forces; Investigation of plastic collapse mechanisms and calculation of collapse loads; Upper and lower bounds; Plastic analyses and design of beams, frames and grillages; Plastic collapse of reinforced concrete and masonry structures; Elastic-plastic

analysis; Repeated loading; Shakedown theorems; Minimum weight design; Numerical analysis; Design of multistory frames.

CE 6106 Elastic Stability of Structures
3 Credits
Stability of struts and beam-columns; Initial imperfections; Inelastic bucking; Stability functions; Stiffness matrix; Fixed and moments; Energy method; Elastic instability of plane frames; Critical load; Buckling modes; Failure load analysis. Torsional buckling under various conditions of end loads; Buckling by combined torsion and flexure; Lateral buckling of beams; Local buckling phenomenon; Buckling of thin plates and membrane shells; Buckling of built-up sections.

CE 6108 Analysis and Design of Shells
3 Credits
Review of membrane theory of shells; Bending theory of cylindrical shells and shells of revolution; Synclastic and anticlastic shells; Design of shell roof of various shapes; Finite difference and finite element methods; Model analysis.

CE 6109 Finite Element Methods
3 Credits
Introduction to finite element concepts, basic techniques, shape functions; Finite element formulation of various elastic problems-plane stress, plane strain, axisymmetric and three dimensional cases; Isoparametric elements, the elastic membrane, thick shell and plate elements, body of revolution with pressure and sinusoidal loading; Local loads from shape function routines; Bending of plates axisymmetric shells, shells-the semiloof beam and shell; Developing and implementing elements; Convergence the patch test; Solution techniques-front and band solutions, element assembly and equation solving, roundoff errors; Variational principles in finite element analysis.

CE 6110 Computer Methods in Civil Engineering
3 Credits
Advanced programming techniques related to civil engineering problems; Program optimization; Computational pitfalls; Management of files and data bases; File structures; Direct access backing storage; Computational

aspects of matrix algebra relaxation methods, various reduction and elimination schemes; Eigenvalue problems, storage of and computation with large and space matrices; Numerical differentiation and integration; Interpolation and curve fitting; Linear and non-linear programming algorithms; Software packages; Computer graphics; Interactive analysis and design; Programming for civil engineering problems on microcomputers.

CE 6111 Advanced Design of Concrete Structures
3 Credits
Review of principles: beams, slabs and columns; Design of columns, long columns, two way slab systems, grids, waffle slabs, ribbed slab, deep beams, curved beams shear walls, building frames; Design for torsion; Bulk storage structures, creep and temperature effects; Details of reinforced concrete members; Advanced problems in foundations of structures; Codes and specifications and their influence in design; An individual or group project to design a complete structural system; Prestressed concrete structures.

CE 6114 Analysis and Design of Tall Building
3 Credits
Structural forms of tall buildings-floor system, vertical load resisting systems, lateral load resisting systems. Choice of systems optimum design. Coupled shear walls-continuous medium, wide-column analogy, and finite element solutions. Interaction of walls and frames-approximate methods, analysis. Tubular structures-approximate methods, computer analysis. Masonry high- rise buildings. The future of high-rise building.

CE 6115 Bridge Engineering
3 Credits
Planning concepts, various types of bridges and their suitability for different span ranges. Bridge loadings, Orthotropic plate decks, Grillage, space frame, finite element and finite strip methods of bridge deck analysis. Long span bridges cable stayed bridge, suspension bridge. Substructures; Design and construction.

CE 6116 Finite Element Methods II
3 Credits
General sources of nonlinearity in structures. Solution of nonlinear equations, incremental, Iterative. Newton-Raphson and Modified Newton

Raphson solution procedures. Geometric Nonlinearity- Large displacement and structural instability, Lagrangian approach-both total and updated, Eulerian approach, Material Nonlinearity- Material modelling. Yield criteria, plasticity, creep, elasto-plasticity, viscoplasticity, elastoviscoplasticity, modelling of reinforced concrete. Combined geometric and material nonlinearity. Modelling of dynamic problems and solution procedure. Finite element analysis of non-structural problems fluid flow, heat conduction, electro- magnetic field analysis etc.

CE 6117 Structural Dynamics and Seismic Design of Structures
3 Credits
Fundamentals of structural dynamics. SDOF, Free vibration response, response to harmonic, periodic, impulsive and general dynamic loading. MDOF, undamped free vibrations. Analysis of dynamic response. Beam: vibrations, random vibrations. Probability theory. Deterministic and nondeterministic analysis of earthquake response. Earthquake resistant design of buildings, bridges and dams.

CE 6118 Structural Brickwork
3 Credits
Properties of bricks and mortar: Strength compression element; Analysis and brickwork; Strength of brick masonry compression element; Analysis and design of unreinforced brickwork structures; Reinforced and prestressed brickwork structures; Composite action of brick masonry walls.

CE 6119 Advanced Theory and Design of Steel Structure
3 Credits
Tension members - Design criteria; Compression members - Buckling of Column; Residual Stress; Column Strength curves; AISC design formulas for working stress design; Buckling of plates; Design of column as affected by local buckling. Design of laterally supported beam; Shear on beams; Biaxial bending; Stresses due to torsions; Analogy between torsion and plane bending; Design for combined procedures for laterally unsupported beams. Beam column; AISC working stress design criteria for combined bending and axial load; Connections.

CE 6120 Design of Steel-Concrete Composite Structures
3 Credits
Components and benefits of composite construction, Material properties, Partial shear connection and partial interaction, Sizing of members; Elastic and rigid plastic analysis of composite beams; Types, properties and local detailing rules for shear connectors; Ultimate strength design and serviceability limit states for simply supported composite slabs, Transverse reinforcement and detailing rules for composite slabs; Different types of composite columns, Cross-sectional strength and interaction curve for stocky columns, Buckling load and moment capacity for slender columns, Design guidelines for composite columns; Properties and classification of beam-column joints.

CE 6121 Advanced Structural Steel Design
3 Credits
Compression members - inelastic buckling, residual stress, latticed columns; Torsion – analysis and design of I-shaped and closed thin-walled sections for torsion; Plate buckling – buckling theory of plates, local buckling of plate elements; Plate girders – proportioning girder section, tension field action and design of stiffeners; Connections – slip critical connections, simple and rigid framing of steel members, column bases subjected to axial load and moment; Flexural members – analysis for lateral torsional buckling, design of lateral bracing, bi-axial bending; Beam-Columns – moment magnification and design of non-sway and sway frames; Seismic design – design of steel moment frames, concentric and eccentric braced frames, steel plate shear walls; Cold formed steel structures.

CE 6122 Seismic Analysis of Building Structures
3 Credits
Earthquake ground motion characteristics; Concept of elastic response spectrum; Seismic response of structures using equivalent static approach, response spectrum and time history analysis; Inelastic behaviour and ductility; Performance based analysis; Seismic provisions of the Bangladesh National Building Code (BNBC); Code provisions for dynamic analysis; Evaluation of seismic loads of concrete and steel buildings using the equivalent static approach and response spectrum analysis; Seismic analysis of building structures using computer modelling.

CE 6201 Advanced Concrete Technology

3 Credits

Properties of plain concrete, physico-chemical aspects of behaviour; Constituent materials; Cements, aggregates and admixtures; Influence of material properties on stress distribution in structural members. Durability, permeability and porosity; physical and chemical deterioration. Mixdesign, manufacture, transportation and placing. Formworks. Field control and acceptance. Testing destructive and nondestructive. Concrete for special purposes.

CE 6203 Theory and Design of Structural Concrete

3 Credits

Introduction to the limit state design concept. Ultimate limit state design of sections in bending, shear, torsion and combination of axial load and bending.Comparison of design recommendations of different codes (viz. American, British, Canadian etc.). Evaluation of the impact of traditional concepts describing structural concrete behaviour on its analysis and design. Introduction to compressive field theory, strut-and-tiemodel and compressive-force path concept. Design in compliance with these concepts. Prospects and problems of applying finite element method in the analysis and design of structural concrete.

CE 6301 Theory of Water Treatment

3 Credits

Water and its impurities. Criteria of water quality; Physical, chemical andbiological treatment processes. Desalinization and demineralization processes. Controls of aquatic growth. Control of taste and odour.

CE 6304 Theory of Sewage Treatment

3 Credits

Composition, properties and analysis of sewage. Biology and bio-chemistry of sewage treatment. Principles of physical, chemical and biological treatment processes. Tertiary treatment of effluents. Sludge digestion. Sludge dewatering and disposal.

CE 6305 Biology of Sewage and Polluted Waters

3 Credits

Important micro-organisms related to water and waste water engineering; Cell physiology; Introductory Biochemistry; Bacterial growth and

disinfection kinetics; Enumeration of bacterial population; Indicator organisms and water borne pathogens: Sampling and bacteriological examination of water and waste water.

CE 6309 Environmental Sanitation

3 Credits

Application of engineering principles to the control of communicable diseases; Vector control; Insecticides and bacteriocides; Collection and disposal of municipal refuse; Housing; Milk and food sanitation; Industrial and personal hygiene; Air pollution; Plumbing; Ventilation, air-conditioning; Hospital sanitation; Camp sanitation.

CE 6310 Industrial Water and Waste Treatment

3 Credits

Requirements of water and various industries; Quality and treatment of industrial water; Characteristics and volume of industrial waste; Problems associated with industrial wastes; Physical, chemical and biological methods of treatment; Industrial waste problems of major industries and their methods of treatment and disposal.

CE 6311 Municipal and Rural Sanitation

3 Credits

Transmission and control of communicable diseases; Importance of safe water supply and safe disposal of waste on sanitation; Principles of excreta disposal with and without water carriage; Individual water supply facilities and their sanitary protection; Solid waste management; Municipal and rural sanitation facilities in Bangladesh; Public health organizations.

CE 6312 Water Pollution and its Control

3 Credits

Sources of pollution; Effects on water; Basic theory of control devices; Pollution surveys and control programs; Water pollution problems in Bangladesh.

CE 6315 Water Supply Engineering and Design

3 Credits

Development of design criteria for municipal and rural water sources; Intakes, pipelines, distribution systems, storage facilities and water treatment systems; Ground water resources and well design.

CE 6316 Sewerage and Drainage Engineering Design

3 Credits

Design of collection system, pump house; Functional hydraulic and structural design and complete sewage treatment plant and drainage systems.

CE 6319 Environmental Management

3 Credits

Environment and sustainable development; Global and regional approach to environmental management; Environmental implications of sectoral development: Infrastructure, water resources, industry, agriculture, transport and communication, energy, health and population, mineral resources, tourism, land use and urbanization; Environmental management at project level; Environmental resource management and conservation strategies; Environmental policy and legislation; Environmental Quality Standards (EQS); Economics of Environmental Management.

CE 6321 Environmental Impact Assessment (EIA)

3 Credits

Historical development; Definition, aims and objectives of Environmental Impact Assessment (EIA); Environmental issues related to development projects; Project screening, Initial Environmental Examination (IEE); Impact identification, prediction analysis and evaluation; EIA methodologies: Adhoc, Checklists, Matrices, Network, Simulation Modelling Workshops (SMW), Environmental Evaluation System (EES), Overlays, Geographical Information System Guidelines; Environmental Impact Statement (EIS); Impact mitigation plan; Environmental monitoring and post-development audits; Organization of EIA: Scope, Work plan, resource requirements and costs of EIA, TOR for EIA; EIA in developing countries; Case studies.

CE 6323 Surface Water Quality Modeling

3 Credits

Principal components of dissolved oxygen (DO) analysis, sources and sinks of DO kinetics, DO analysis for waterbodies, engineering control of DO; Basic mechanisms of eutrophication, significance of N/P ratio, sources and sinks of N and P, phytoplankton and nutrient interactions, phytoplankton-DO relationships, simplified river-stream eutrophication analysis for phytoplankton and rooted aquatic plants; Objectives of modeling,

applications; Mass loading rage estimations: point source, tributary and intermittent sources; Low flow estimates, travel time and velocity estimates; Steady state stream equations; Estuarine hydrology; Distribution of water quality in rivers and estuaries, dispersion coefficients, hydraulic transport processes, mathematical formulations, water quality parameters, solution techniques, multi-dimensional models; Physical and hydrologic characteristics of lakes, lakeside response to inputs, finite segment steady state lake models, model calibration and verification, sensitivity analysis parameter estimation; Case studies.

CE 6325 Environmental Fluid Dynamics

3 Credits

Governing laws of motion for a viscous fluid: Review of laminar and turbulent flows; Fickian diffusion; Turbulent diffusion, Mass transport equation; Shear flow dispersion; Mixing in rivers and estuaries; Jets and buoyant jets; Reservoir dynamics; Pollutant movement in porous media; Computation of environmental flows.

CE 6327 Aquatic Chemistry for Environmental Engineers

3 Credits

Review of some fundamentals of Chemistry; Approaches to equilibrium problem solving: numerical solution, graphical solution, the 'tableau method'; Natural weak acids and bases, alkalinity and pH in natural waters, buffer capacity; Dissolved carbonate equilibria (closed system), dissolution of CO2 (open system); Solubility of solids, coexistence of phases in equilibrium; Metal ions and ligands in natural waters, aqueous complexes, ion association among major aquatic constituents, inorganic and organic complexation of trace elements; Redox equilibria and electron activity, pe-pH diagrams, redox conditions in natural waters; Aquatic particles and coordinative properties of surfaces, adsorption of metals and ligands on aquatic particles, surface complexation models; Fate of organic compounds in natural environment: volatilization, sorption/partitioning, transformation reactions, structure-activity and property- activity relationships.

CE 6329Fate and Transport of Chemicals in the Environment

3 Credits

Processes governing the fate of chemicals in the environment - physical transport, chemical reactions and speciation; Formulation and structure of

transport models, analytical and simple numerical solution techniques; Specific applications of mathematical models in surface water, soil, air and groundwater; Examples with conventional pollutants in rivers, toxic organic chemicals and heavy metals in surface and groundwater ; Risk analysis models to assess human health impact of contaminants; Current issues on anthropogenic contributions in the disturbance of global biogeochemical cycles, accumulation of trace gases in the atmosphere and its effect on global warming. Case studies.

CE 6333 Air Pollution

3 Credits

Sources and classification of air pollutants; Effects of air pollution; Air pollution regulations, air quality standards, emission standards, pollution indices; Sources of pollutants in combustion process; Air pollution and meteorology: properties of atmosphere, atmospheric lapse rates and atmospheric stability, atmospheric diffusion theories, Gaussian plume models; Air pollution statistics: probability distribution of air pollutant concentrations and estimation of parameters in distribution, order statistics of air quality data, exceedances of critical levels; Air quality management and control measures: atmospheric removal processes, engineered systems for air pollution control; Global atmospheric change: global warming, stratospheric ozone layer depletion; Indoor air quality; Air pollution measurements.

CE 6339 Fecal Sludge Management

3 Credits

Global and national status of fecal sludge management (FSM); On-site sanitation facilities – concepts and designs; Fecal sludge quantification, characterization and treatment objectives; Collection and transport; Treatment: treatment mechanisms, overview of treatment technologies, settling-thickening tanks, drying beds, co-treatment in municipal wastewater treatment plant, end use of treatment products; Operation, maintenance and monitoring of treatment plant; Institutional framework for FSM; Planning of integrated FSM system, sustainability of FSM services.

CE 6401 Soil Mechanics I

3 Credits

Identifying characteristics of soils, clay minerals, clay-water relation, fabric, Compression. One- and three-dimensional consolidation, swelling, collapse

and rheological properties. Soil shear strength, concept of cohesion and internal friction. Failure theories. Bearing capacity equations and factors. Subsoil exploration programme, interpretation of topographic, geological and agricultural soil maps. Laboratory testing of soils and their interpretation for engineering purposes.

CE 6402 Soil Mechanics II

3 Credits

Soil porosity and moisture effects relative to effective stress principles, capillarity, permeability and frost action. Hydraulic fracturing. Principles governing flow of water through soils. Soil seepage analysis for isotropic and anisotropic conditions. Numerical techniques for vertical and radial drainage. Description, design procedure and usage of current site improvement techniques, preloading, earth reinforcement, dynamic consolidation, vibrocompaction, blasting densification, lime treatment, drains and geotechnical fabrics.

CE 6403 Foundation Analysis Methods

3 Credits

Elastic foundations, loads on infinite slabs, subgrade coefficient, settlement on non- homogeneous half space, linearly elastic pile and soil, laterally loaded pile, soil foundation interaction for footing and mat designs. Analysis of simple pile and pile group foundations. Exact and numerical solutions to above problems.

CE 6404 Earth pressure and Retaining Structures

3 Credits

Fundamentals of lateral earth pressure and classical methods of analysis. Analysis of braced excavations, retaining walls and design of sheet piling system. Principles of cofferdam design. Bearing capacity theories related to shallow and deep foundations.

CE 6405 Earth dams and Stability of Slopes

3 Credits

Seepage in composite sections. Methods of stability analysis, stability of slopes. Compaction, Measurement of performance, construction and control of embankment.

CE 6406 Rock Mechanics

3 Credits

Classification and engineering properties of intact rocks, brittle fracture theory. Characterization and properties of rock discontinuities criteria of rock failure. Engineering problems associated with construction in rocks; Stabilization, anchoring and rock botting; Rock slope stability and reinforcement; Design of underground opening and structures; Geotechnical aspects of open pit and underground mining; soft and hard rock; Material handling, waste disposal.

CE 6407 Soil Dynamics

3 Credits

Sources and types of dynamic loading. Vibration of elementary systems. Wave propagation in soils. Dynamic solid properties and methods of their determination, liquefaction, shear modulus and damping effects. Vibrations of foundations on elastic media, machine foundations, earthquake response, blast effects including nuclear weapon effects.

CE 6408 Advanced Engineering Geology

3 Credits

Advanced physical geology concerning transported and residual soils. Erosion and deposition. Geomorphology. Study of the formation of delta. Engineering geology of soft clays. Engineering properties of rocks. Geologic structures. Historical geology. Geology of Bengal Basin. Earthquake zones of Bangladesh. Geological considerations for engineering designs.

CE 6409 Reinforced Earth

3 Credits

Materials used in reinforced earth; constitutive laws; Design parameters and testing techniques; Conceptual performance of reinforced soil; Analysis, design and construction of reinforced earth retaining structures; Reinforced sloped; Design and construction of reinforced paved and unpaved road; Analysis, design and construction of granular in-situ stabilized columns; Soil nailing, root or micro piles. Random (non-oriented) fibre reinforced soil.

CE 6410 Constitutive Modeling in Soil Mechanics

3 Credits

Elasto-plastic modeling of soils; Model development process; Models for different types of soils; Monotonic, cyclic and repetitive loading models; Modern approach of constitutive modeling in soil mechanics; Thermodynamic approach of modeling; Application of soil models with small and large strain theories; Application of soil models in Finite Element Method, Distinct Element Method and Finite Difference Method.

CE 6411 Earthquake Engineering

3 Credits

Historical background; Plate tectonics; Various types of earthquakes and faulting; Wave types and their characteristics; Characteristics of seismometers and micro tremor instruments; Characteristics of magnitude and intensity scales; Earthquake time histories; Fourier and response spectra; Historical seismicity and earthquake catalogues: data acquisition, sources, magnitude rescaling, application to hazard analysis; Site characterization: amplification and responses; Experimental simulation and shaking tables; Introduction to lifeline engineering: electricity, water, natural gas, telecommunication and transportation systems; Post earthquake damage survey; Mitigation strategies; Case studies of major earthquakes.

CE 6501 Transportation Engineering

3 Credits

Historical development, systems of transportation, technical and operation characteristics of highways, railways, waterways, airways and pipelines; transportation planning and development.

CE 6502 Geometric Design of Highways

3 Credits

Highway classification; Design controls and criteria; Traffic, vehicle characteristics, speed capacity; Elements of design; Sight distance, horizontal and vertical alignment; Cross-section elements; Road intersections, grade separation and interchanges; Highway drainage.

CE 6503 Highway Materials

3 Credits

Origin, production, specifications properties and uses of bituminous materials; binder mixtures; design and analysis of bituminous paving mixes; field operations, surface treatments, stabilization methods; aggregates, base, subbase and subgrade; cement concrete in pavement constructions.

CE 6504 Advanced Surveying

3 Credits

Triangulation; Classification and schemes, instruments, linear and angular measurements, field works errors and corrections, computations; Geometric levelling; Field astronomy; Motions of earth, and other stars, time, coordinate systems, errors and corrections; Hydrographic surveying; determination of depth under water, measurement of discharge and stream current; Terrestrial and aerial photogrammetry; Instruments, field works, plotting of maps, analysis and interpretation of photographs, stereo photogrammetry, remote sensing and its application in civil engineering.

CE 6505 Structural Design of Pavements

3 Credits

Pavement types, wheel loads, stresses in flexible pavements, stresses in rigid pavements, pavement performance, evaluation of subgrade and base support, design theories and practices, construction methods and maintenance, pavement rehabilitation.

CE 6507 Traffic Engineering

3 Credits

Characteristics of vehicles and driver, traffic stream characteristics, traffic control and operation, traffic surveys, accidents and road safety, parking, roadway lighting, traffic management and administration.

CE 6508 Railway Engineering

3 Credits

General requirements, permanent way, alignments, gradient and curves, points and crossings, signaling and interlocking, tunneling, construction and maintenance.

CE 6509 Waterways

3 Credits

Historical development of navigation, navigational channels, survey of waterways, classification of waterways, traffic, vessels, ports and harbors, navigational aids, maintenance of waterways.

CE 6510 Planning and Design of Airports

3 Credits

Growth and demand of air transport, airport site selection and configuration, geometric design of runways and taxiways, terminal areas, capacity analysis, lighting and marking, air traffic control systems, structural design, construction and maintenance of airport pavements, airport drainage.

CE 6511 Transportation Planning

3 Credits

Techniques and processes used in solving transportation problems, relationship between trip generation and land use, collection and characteristics of base year data, formulation of mathematical models to simulate existing travel patterns, forecasting procedures and evaluation of transportation systems.

CE 6512 Transportation Engineering Economics

3 Credits

Introduction to basic economic theories; principles and methodologies appropriate to transportation engineering; identification and measurement of transportation costs and benefits; Road user charges and principles of road pricing; Evaluation of transportation proposals in terms of their economic, social and environmental consequences; Techniques of cost benefit analysis; Selected case studies - application of economic principles to one or more current issues in transportation policy and planning.

CE 6513 Traffic Simulation

3 Credits

Introduction to simulation techniques; Review of Monte Carlo simulation, macroscopic and microscopic simulation, deterministic and stochastic simulation; Simulation in traffic engineering, review of traffic simulation models, lane-based and non-lane-based mixed traffic simulation; Simulation system components, introduction to statistical distributions, sampling from distributions, random number generation techniques, vehicle

representation and processing techniques, simulation warm up and update procedures; Development of traffic simulation model, logical aspects of modeling traffic flow components, elements of systems analysis and synthesis; Model verification, refinements and parameter estimation, calibration and validation; Application of simulation models.

CE 6514 GIS and Remote Sensing in Transportation

3 Credits

Concepts of Geographic Information Systems (GIS): definition, data structure, data processing and management, spatial analysis; GIS software; Basic principles of remote sensing (RS) and global positioning systems (GPS): definition, data acquisition, spectral characteristics of land cover, multi-spectral analysis, image interpretation, geometric corrections, classification techniques; Integration of RS and GPS with GIS; GIS applications in the field of transportation planning and traffic engineering: digitized mapping of land use and transport network, transport infrastructure development and management, analysis and prediction of impacts, strategy planning, monitoring and evaluation of transport systems and environment, route selection, traffic management and accident analysis, public transport information systems; Integration of GIS packages with transport modeling software.

CE6515 Transportation Modelling

3 Credits

Introduction to transportation system analysis and modelling; Mathematical fundamentals; Principles and methodologies of transportation system analysis and modelling; Techniques of model formulation and calibration; Simplifications of Modelling framework and applications; Practical implementations of integrated land use and transportation models; Evaluation of planning proposals using models; Introduction to activity based modelling; Application of GIS in the models for transportation system analysis.

CE 6516 Road Safety Engineering

3 Credits

Introduction to Road Safety Engineering: emerging issues, challenges and opportunities; Safety management systems; Factors in road traffic accidents; Analysis of accident situation in Bangladesh, impact of mixed mode traffic, international comparison; Accident classifications, location,

types and clusters; Accident data – needs, collection, analyses, presentation, limitations; Diagnosis of road accident problems; Hazardous Road Locations; (HRL-Accident Blackspots) Development of road safety countermeasures; Road safety engineering strategies; (Accident Prevention and Accident Reduction) Low-cost road safety and traffic engineering measures; Traffic calming; Accident costing and evaluation; Studies of the effects of accident remedial measures; Vulnerable and Non-motorized road users; New approaches to road safety – introduction to software, road safety audit, safety awareness and community-based road safety; Road safety programme appraisal, monitoring and evaluation.