



# Postgraduate Prospectus 2016-17



**National Textile University Faisalabad**





شروع اللہ کے نام سے جو بڑا مہربان اور نہایت رحم والا ہے  
In The Name of Allah the Most Beneficent, the Most Merciful

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## Welcome Message from the **Rector**



**Prof. Dr. Tanveer Hussain**

Role of universities is immensely important in creating new knowledge and inventing new technologies for the benefit of humankind as well as in equipping students with suitable knowledge, skills and behavior that not only make them excel in their occupations but also in their general life, ultimately leading to the development of a peaceful and prosperous world. The purpose of education is to help mankind in the pursuit of self-actualization, in addition to the fulfilment of physiological, social and self-esteem needs. Good education includes not only the vocational development but also the cognitive, spiritual, emotional and social development of people.

National Textile University is one of the most rapidly rising universities in Pakistan. Our teaching philosophy at NTU is student-oriented and our focus is to develop professional competence as well as good character in our graduates. The educational objectives of our programs not only include suitable knowledge and skills components but also the inculcation of desirable behavioural attributes in the students, such as: self-motivation, initiative and drive, passion for achieving goals, creativity, flexibility and adaptability, self-confidence, dependability, trustworthiness, fairness, empathy, politeness, integrity and conscientiousness etc.

We offer plenty of curricular and extracurricular opportunities to enable our students to recognize and actualize their intellectual potentials and help them in acquiring key employability skills, such as effective communication, information management, critical thinking and problem solving. I am looking forward to your joining NTU to explore endless opportunities for your personal development and professional growth. I pray for your bright future and success in every walk of life.



Welcome to  
**NTU**

# The University

The dawn of history of National Textile University (NTU) rooted back from 1954 as the Institute of Textile Technology, an excogitate effort of national industrialist prognosticators. The President of Pakistan, Field Marshall Muhammad Ayub Khan, laid the foundation stone of the Institute on 12th October 1959.

A Board of Trustees with the Minister of Industries as Chairman and nominees of the donor companies as members was constituted to manage the affairs of the Institute. In 1965, the Institute was granted affiliation by the University of Engineering & Technology, Lahore. Subsequently, the Institute was renamed as National College of Textile Engineering and it executed its functioning with Board of Governors led by Federal Minister of Industries as Chairman, seven members from Federal Government and three members from All Pakistan Textile Mills Association (APTMA). The college was granted a charter by the Government of Pakistan for establishing the National Textile University (NTU) on November 15, 2002.

Since its inception in 2002, NTU has been the premier Institute of textile education in the

country, meeting the technical and managerial human resource needs of entire textile industry of Pakistan by retaining crucial link between university and business world. NTU has strived to achieve the aim of imparting world class education while encouraging research and intellectual growth in the country. As a result, NTU has played a key role in setting high standards of academics and produce professionals to compete in the world.

NTU imparts extraordinary academic and social skills among students to face challenges of the time and become the next generation of leaders believing in its motto "Innovate and Lead". NTU has close collaboration with the world renowned universities to promote research and innovation. The hallmark of NTU is that within a short period of ten years, it is now among top universities of the country. On the face of fast changing and diverse world, the National Textile University stands firm to offering new programmes in relevant, emerging fields for the people of Pakistan and the wider world.

## The Momentous City of Faisalabad



The National Textile University is situated in the third largest historic city of Faisalabad also known as 'Manchester of Pakistan, the world famous place for its cotton export industry and agriculture production. Indeed, a thriving hub of business and industry, the city with its old beautiful name of Lyallpur, a tribute which was given to Sir James Lyall, Lt. Governor of Punjab, for his services rendered for the lower Chenab Valley during the colonization period. The design of the city was prepared by Captain Papuan Young C.I.E, the colonization officer.

Later, Lyallpur was named "Faisalabad" after the late King Faisal of Saudi Arabia to commemorate deep friendship which exists between the two great Islamic countries of the world. The famous clock tower of Faisalabad has eight streets/bazaars leading from it and was designed in a pattern to form Union Jack, presenting a magnificent example of town planning. The city is located in the province of Punjab to the west of Lahore, the provincial capital, situated 360 kilometers south of the Federal Capital Islamabad.

Faisalabad is surrounded by major agricultural areas such as, Hafizabad and Sheikhpura towards north and northeast, Okara and Sahiwal towards east and southeast, and Jhang and Toba Tek Singh towards west and southwest. City District Faisalabad consists of eight towns, which are: Lyallpur town, Madina town, Jinnah town, Iqbal town, Samundri town, Tadianwala town, Jaranwala town, and Chak Jhumra town.

The city has two public libraries and an art council to promote art and culture and a number of cinemas to provide entertainment. A cultural museum is currently established to promote both the national and international culture. The hockey and cricket stadiums of the city host national and international matches. Moreover, international airport, dry port and industrial zone are linked with the Motorway and other national highways to facilitate this hub of industrial activities.

## Aims and Objectives

The aim is to develop the Textile Industry and Human Resources of Pakistan and make Pakistan an active player in the world economy.

- NTU is committed to information revolution in every aspect of its activities.
- NTU will continue to strengthen its profile as a high standard University.
- NTU aims to collaborate with industry and produce high quality research and provide excellent educational services within the field of its mission.
- NTU is committed to launching and establishing facilities for postgraduate studies in textile and allied fields.

# Facilities

## Transport

The University provides pick and drop services to the students and staff from the campus to different parts of the city according to the approved routes.

## Student Accommodation

The University is a residential institution and has facilities to accommodate majority of students on the campus. There are two hostels for boys and an independent hostel for girls to accommodate about 450 students. Resident students are provided furnished accommodation comprising cubicles and dorms. Telephone lines are provided to every hostel. Each hostel is provided independent mess and common room.

## Health Care

A clinic supervised by a devoted medical officer has been setup on the campus to provide health care facilities to students, employees & their dependent family members.

## IT Center

Established in 2008, IT Center is a centrally air-conditioned building having 06 computer labs, video conferencing room, meeting room and faculty/staff offices. Department has following infrastructure and responsibilities.



- Management of Data-center
- Fiber optic sites connectivity
- Layer 03 Networks and Virtual LANs
- Active Directory Logins and Home Drives
- Controller bases Wireless LAN to Campus and Hostels

- Secure and high speed internet access through Firewalls
- WebApps like Faculty Profiles, Course Evaluation, Distributed Websites and Email Management
- Dreamspark Microsoft Software
- Printing Services for Students
- Video conferencing
- IT Training for university staff

## NTU Library

NTU Library is housed in a two-story building and holds a unique collection of almost 19,700 information resources in textile engineering and allied disciplines. The library has subscribed to twenty international and national textile journals in print format and has bound archives of core textile and Applied Sciences journals, some of them starting from 1918 to date. Electronic access to more than 40,000 peer reviewed titles is also available through HEC Digital Library Program. The library acquires a variety of resources in print, audiovisual and electronic formats to support study and research in the university and has a wide range of services, including borrowing, reference, user advisory, information literacy (IL), OPAC, photocopying, indexing, TOC alert etc.

The library is one of the few in the country that has implemented standardized integrated software for library automation. LibraryWorld, Version 3.02 developed by CASPR Inc., is currently in use at NTU Library. The library provides electronic services through an electronic services lab that has ten computers, two scanners and three printers. The library web pages provide information about its staff, rules & regulations, information services, collection, NTU student's projects, CD Roms, virtual library links, etc. The Virtual Library contains categorized links to websites of textile and general media, product sourcing and trade associations, research centers and institutes, universities and colleges, trade directories, computer and technology for textiles, electronic resources and databases and open access journals and resources. Campus-wide access to a large number of electronic resources is available through HEC Digital Library.

## Services

National Textile University Library is providing excellent knowledge resources, services and facilities to fulfill the

teaching, learning and research needs of its faculty members, students, staff and a large number of users belonging to the textile community in Pakistan.

### Information Literacy/ Continuing Education

The library is providing information literacy services to its patrons by organizing seminars and practical workshops to enhance the learning skills of students, researchers as well as faculty members. In this regard teachers/library community of different institutes has visited NTU library several times.

### Library Hours

Library opens seven days a week according to the following schedule:

Monday – Thursday	8:30 a.m. to 9:00 p.m.
Friday	8:30 a.m. to 4:40 p.m.
Saturday & Sunday	2:00 p.m. to 9:00 p.m.



There will be one-hour Prayer/Lunch break, as notified by the administration.

### Borrowing Privileges

- Students/ Staff Members/ Teaching Assistant and Research Associate can borrow three books for 21 days.
- Faculty Members can borrow fifteen books for a semester or 90 days.
- Borrowing facility is not available to NTU Alumni and

students referred from other institution: however other library services are available accordingly.

- Some material, such as reference books, press clippings, CD-ROMs, current issue of periodicals, or any other publication marked as Reference/Reserved will not be circulated/issued.

### Online Library

In 2011, the library has uploaded its data (books, journals, CDs, thesis and reports) on web. Now the users can search their required title/material everywhere, even through their cell phones at university website [www.ntu.edu.pk](http://www.ntu.edu.pk).

### Digital Library

Since 2008, National Textile University Library has subscribed more than 11,600 peer reviewed leading international journals and 40,000 online books available through National Digital Library Program of Higher Education Commission, Islamabad. Users can browse, search and link to find the exact information looking for, fast.

### Memberships

#### • The Textile Institute, UK

In support of NTU Library mission, the library has acquired Corporate Membership of the Textile Institute since 2013 to facilitate our patrons in their academic activities. Corporate Membership allows organizations to keep up to date with what is happening in the textile industry locally, nationally and globally. This includes for potential partners for strategic alliances.

Through the TI's extensive global network members benefit from contacts with textile professionals worldwide. Corporate Members of the Textile Institute are afforded many diverse benefits as part of their membership making it useful to both industrial & Academic organizations.

#### • World Textile Abstracts Database (Online)

Since last few years the library has subscribed online research database namely "World Textiles" by EBSCO publishing for students, researchers and faculty members to help them in their research activities the access is available within the NTU campus.

World Textiles provides data from 1970 to present. Current coverage of over 340 international journals and provides archival coverages of several 100 additional journal titles, books and reports.



# FACULTY OF ENGINEERING & TECHNOLOGY

## Introduction

Faculty of Engineering & Technology is the largest of the four faculties of National Textile University, offering the University's flagship undergraduate and postgraduate programmes in textiles and advanced materials. The faculty has some of the most advanced and sophisticated laboratories in the country, highly qualified faculty members and well-trained laboratory staff.

## Research facilities

**Our research facilities include:**

### Fiber production labs

- Comprising melt spinning, wet spinning and electrospinning.

### Yarn production labs

- Comprising blow room, card, drawing frame, roving frame, ring frame, compact spinning, open-end spinning and auto-coner.

### Weaving labs

- Comprising single-end warping, sizing, and sample loom. Industrial-scale shuttle looms, rapier looms, projectile looms, air-jet looms and electronic jacquard.

### Knitting labs

- Comprising circular knitting machines, flat knitting machine, gloves knitting machine, socks knitting

machine and braiding machine.

#### **Textile processing labs**

- Comprising IR dyeing machine, HT- dyeing machine, yarn package dyeing machine, jigger machine, jet machine, soft-flow machine, winch machine, pad-steam dyeing machine, pad-thermosol dyeing machine, stenter, calender, flat-bed printing machine, rotary printing machine, plasma treatment, autoclave and coating machine.

#### **Garment production labs**

- CAD system for pattern digitizing and plotting, specialized sewing machines and garment washing machines.

#### **Testing and characterization labs**

- Comprising FT-IR spectrophotometer, UV-VIS-NIR spectrophotometer, atomic absorption spectrometer, UV-Visible spectrophotometer, Gel permeation chromatography, rheometer, differential scanning calorimeter, zeta-sizer, electro-kinetic potential analyzer, tensiometer, compound microscope, stereo microscope, USB microscope, scanning electron microscope, X-Ray diffractometer, sweating guarded hotplate, air permeability tester, universal fabric tensile tester, single fiber tensile strength tester, Uster yarn evenness tester, Tensorapid single yarn strength tester, fabric flammability tester, LOI indexer, pneumatic fabric stiffness tester, fabric thickness tester, fabric touch tester, hydrostatic-head tester, water repellency tester, Kawabata KES-FB2 bending tester, KES-FB3 compression tester, KES-FB4 surface tester, KES-F7 Thermolabo II.

## **Research Areas**

#### **Advanced Materials**

- Advance polymeric and composite materials; nanostructures/nanoscale materials and nano devices; shape memory polymers and other functional materials

#### **Engineered Textile Structures & Composites**

- Linear fiber assemblies, woven fabrics, knitted fabrics, braided fabrics, nonwovens, fiber reinforced composites

#### **Textile surface modification and chemical treatments**

- Coloration, finishing, coating, enzyme, plasma and other novel functional treatments of textiles

#### **Clothing engineering**

- Tactile and thermo-physiological comfort; sizing, fit and fashion; engineering functional apparel

#### **Technical textiles**

- Medical, protective, sports and smart textiles

#### **Textile machinery and instrument design**

- Design and development of textile sensors, machinery, instrumentation and control systems

#### **Textile modeling and simulation**

- Modeling & simulation; expert systems; image analyses; numerical analyses; computer aided design

#### **Energy, environment and sustainability in textiles**

- Development of energy efficient, eco-friendly and sustainable textile products and processes

## Faculty Research Interests

### Mr. Zafar Javed, (Associate Dean)

- Garments Manufacturing and Garments Machinery Design

### Prof. Dr. Tanveer Hussain, PhD (UK)

- Functional Materials including Nanofibers and Nanoparticles; Comfort & Protective Properties of Textiles; Textile Dyeing, Finishing and Coating; Modelling and Predicting Textile Behaviour; Medical Textiles

### Dr. Zulfiqar Ali, PhD (Pakistan)

- Fiber Assemblies, Medical, Protective and Sports Textiles, Machinery Development and Modeling

### Dr. Yasir Nawab, PhD (France)

- Advanced Materials, Engineered Textile Structures & Composites, Technical Textiles, Textile Machinery and Instrument Design, Textile Modeling and Simulation

### Dr. Talha Ali Hamdani, PhD (UK)

- Technical and Smart Textiles

### Dr. Waseem Ibrahim, PhD (UK)

- Textile Dyeing & Printing; Photochromic and Thermochromic colorants; Advance Material, Textile surface modification and chemical treatments, Technical Textiles

### Dr. Rashid Masood, PhD (UK)

- Biomaterials for Healthcare, Flame Retardant Materials; Microencapsulation Technology, Surface Modification of Textiles; Plasma Technologies for Textiles; Medical and Healthcare Textiles

### Dr. Abdur Rehman, PhD (UK)

- Textile Surface Modification and Chemical Treatments

### Dr. Munir Ashraf, PhD (France)

- Nanomaterials, Surface functionalization, Synthesis and Application of Functional Dyes and Finishes

### Dr. Abher Rasheed, PhD (France)

- Clothing Engineering

### Dr. Adul Basit, PhD (France)

- Energy, Environment and Sustainability in Textiles Advanced Materials, Engineered Textile Structures & Composites

### Dr. Sheraz Ahmed, PhD (France)

- Textile Machine design and Instrumentation

# MS Programmes

## Programme Structure

Faculty of Engineering and Technology offers two MS programmes, viz. MS Textile Engineering and MS Advanced Materials Engineering. Each MS is a 2 years degree programme consisting of 24 credit hours of course work and 6 credit hours of research work.

The structure of each MS Programmes is given as follows:

## MS TEXTILE ENGINEERING

### Semester I

Code	Course	Credit Hours
TE-5071	Advanced Materials	3
TE-5072	Technical Textiles	3
TE-5077	Composite Technology	3
RM-5071	Research Methodology	3

### Semester II

Code	Course	Credit Hours
TE-5073	Adv. Textile Process & Quality Control	3
TE-5074	Nonwoven Technology	3
TE-5075	Medical Textiles	3
TE-5076	Protective Textiles	3

### Semester III

Code	Course	Credit Hours
TE-6079	Research Thesis	3

### Semester IV

Code	Course	Credit Hours
TE-6079	Research Thesis	3

## MS ADVANCED MATERIALS ENGINEERING

### Semester I

Code	Course	Credit Hours
TE-5071	Advanced Materials	3
TE-5072	Technical Textiles	3
TE-5077	Composite Technology	3
RM-5071	Research Methodology	3

## Semester II

Code	Course	Credit Hours
AME-5071	Nano Materials	3
AME-5072	Smart Materials	3
AME-5074	Mechanics of Materials	3
AME-5073	Advance Characterization Techniques	(2-1-3)

## Semester III

Code	Course	Credit Hours
AME-6079	Research Thesis	3

## Semester IV

Code	Course	Credit Hours
AME-6079	Research Thesis	3

## Eligibility Criteria

### MS Textile Engineering

BS Textile Engineering or equivalent degree from HEC/PEC recognized institution with a minimum CGPA 2.50/4.00 or 3.50/5.00 in semester system or 60% marks in annual/term system.

### MS Advanced Materials Engineering

BS Textile/Materials/Polymer/Mechanical/Chemical Engineering or any other equivalent degree from HEC/PEC recognized institution with a minimum CGPA 2.50/4.00 or 3.50/5.00 in semester system or 60% marks in annual/term system.

### Admission Criteria

Admission merit list will be prepared according to the following criteria:

MS Textile Engineering		MS Advanced Materials Engineering	
BS Textile Engineering	60% weightage	BS Textile Engineering	60% weightage
GAT (General)	30% weightage	GAT (General)	30% weightage
Interview	10% weightage	Interview	10% weightage

### Course Outlines

#### TE-5071 Advanced Materials

The objective of this course is to give the students an overview of various types of materials used for advanced engineering applications. The students will learn about the properties and applications of various polymeric, ceramic, metallic, bio- and composite materials ranging from nanoscale to macro scale. In addition to various physical and mechanical properties, various functional aspects of the materials will also be covered in the course including: shape memory effect, self healing, phase change, fire retardant behaviour and energy harvesting properties. At the end of the course, the students should be able to select suitable materials

for various engineering applications, particularly for making advanced technical textile products.

#### TE-5072 Technical Textiles

Technical textiles comprise textile materials and products which are manufactured and used primarily for their performance and functional features rather than for their aesthetics. Global technical textiles market is estimated to be of worth US\$150 billion. The objective of this course is to give the students a broad and detailed overview of the market size, manufacturing technologies, properties and end-uses of different categories of technical textiles, including: textiles used in agriculture, horticulture and forestry; textiles for buildings and construction;

technical components of clothing; textiles used in civil engineering; household technical textiles; textiles used in filtration, cleaning and process industries; textiles used for healthcare and hygiene; textiles used in automobiles, railways and aerospace; textiles used for environmental protection; textiles used for packaging; textiles for personal and property protection; and textiles used in sports and leisure.

### **TE-5073 Advanced Textile Process and Quality Control**

The course aims at strengthening students' conceptual understanding in the areas of Six Sigma and Statistical Process Control. The students will be able to learn different tools for process definition and discovery, process measurement, process analysis, process re-design and improvement, and process control.

### **TE-5074 Nonwoven Technology**

Nonwoven materials are used worldwide in a variety of applications, including construction, apparel, hygiene products, wet wipes, medical dressings, automotive end uses, geotextiles, home furnishings, and filtration. Hence, knowledge of how nonwoven fabrics are structured, manufactured and engineered for required end-uses is important and relevant in various industries. Nonwovens are advantageous because of their ease of manufacture, versatility, and low production cost compared to other textile manufacturing methods. The objective of this course is to introduce students to the nonwoven textiles and their manufacturing processes, characterization & testing methods. The course covers various web formation, web bonding and finishing methods. An overview of product developments in key application areas is also integral part of the course.

### **TE-5075 Medical Textiles**

This module aims to furnish students with the advanced specialized knowledge and skills required for the design and development of polymer and fiber-based products for use in the medicine and healthcare. It progresses students' knowledge and skills required for designing new medical products, devices and processes. The module covers materials/tissue engineering, non-implantable materials (wound dressings, hygiene products), healthcare environment materials (surgical gowns), materials to reduce healthcare associated infection, therapeutic drug delivery technologies as well as fundamental aspects of legal and ethical issues involved within the medical

practices.

### **TE-5076 Protective Textiles**

The focus of this course is the development and characterization of textiles for protection from fire and heat, cold, water and wind, ballistics, cuts and stabbing, microbes and odour, particulate matter, static charge, ultra-violet radiation, chemical, biological, nuclear and electrical hazards. The course deals with the selection of suitable raw materials for protective textiles as well as their manufacturing and testing techniques.

### **TE-5077 Composites Technology**

Composites are the materials of 21st century. They have vast applications in sports, defence, automotive, aerospace engineering, medical sciences, building/construction material and many other sectors. This course is designed to provide student thorough knowledge of fundamental issues of fibres reinforced composites. Students will develop the understanding how composites are made from different fibres and how the inherent properties and layout of fibres affect the mechanical behavior of composites. They will also learn the techniques used to characterize the structure and properties of composites materials. They will also gain the practical experience of making fibre reinforced composites and characterize their behavior through mechanical properties.

### **RM-5071 Research Methodology**

The overall aim of this course is to enable the students to identify a research area, identify a research problem, formulate research question, conduct literature survey, formulate research hypothesis, design research experiments, graphically present, analyze and interpret the experimental data, and draw valid conclusions. Additionally, the students will be able to write a research proposal, critically analyze research papers, and write a short literature review with proper citations and referencing. The students will practice relevant statistical tools and techniques using a statistical software package. The students will also become familiar with plagiarism and other ethical issues in research, patents, copyrights and trademarks, thesis and research paper writing styles.

### **AME-5071 Nanomaterials**

This course introduces the fundamental principles needed to understand the behavior of materials at

the nanometer scale and the principles of electrostatic and steric stabilization. It provides an introduction to different types of nanoscale materials i.e. zero dimension, one dimension and two dimension nanostructures. Homogeneous and heterogeneous nucleation and subsequent growth of nanostructures are discussed in detail. It also covers the physical and chemical techniques to synthesize nanostructures/nanomaterials and their characterization techniques like x-ray techniques, scanning probe microscopy, scanning electron microscopy, transmission electron microscopy etc. The effect of size on properties of materials like mechanical, electrical, optical, melting point etc as well as application of nanomaterials in diverse field is included in this course.

### **AME-5072 Smart Materials**

This course has been designed to develop students' knowledge of smart materials and intelligent textiles. The students will gain a critical understanding of mechanisms giving rise to the characteristics and beneficial properties of smart materials as well as the technological applicability and limits of smart materials.

### **AME-5073 Advanced Characterization Techniques**

This course gives an introduction to different physical, chemical and mechanical characterization techniques, including XRD, SEM, TEM, chromatography, infrared spectroscopy, UV/Vis spectroscopy, atomic absorption spectroscopy, tensile testing, impact testing, bending, shear and hardness testing.

### **AME-5074 Mechanics of Materials**

Mechanics of materials is a branch of applied mechanics that deals with the behaviour of solid bodies subjected to various types of loading. This course deals with stress-strain behaviour of different materials, testing techniques, constitutive equations, micromechanics, modelling and simulation techniques for structural analysis.

### **TE-6079 Research Thesis/AME-6079**

The Research Project module will enable the students to bring together the knowledge and skills acquired in the earlier modules to investigate a selected topic reviewing the literature, presenting seminars and preparing material in the form of a publication. The project will demonstrate the student's capabilities to perform independently but supervised research to solve practical problems utilizing the theoretical knowledge and analytical skills attained. The overall purpose of the module is to develop in the students an understanding of the steps involved in planning and conducting a research project and in communicating the findings both orally and in writing. The project work can be undertaken in an industrial concern, where possible, ensuring both the relevance to the employer, access to appropriate facilities, and allowing sufficient time to be spent on the practical work. Alternatively, projects could be based and carried out at the university. In case of collaboration with other national and international research institutes and universities the final semester research projects can be completed at mother and collaborated organization.





## PhD. Textile Engineering

### Aims and Objectives

- To enhance the intellectual development of PhD scholars through creativity, analytical thinking, critical analysis, and innovative problem-solving.
- To carry out research of international standard aimed at advancing the scientific and technological knowledge globally.

### Eligibility Criteria

- MS Textile Engineering or any other equivalent degree from HEC recognized university.
- In MS degree minimum CGPA 3.00/4.00 or 3.50/5.00 in semester system, 60% marks in annual system.
- No 3rd division or 'D' Grade in the entire academic career.
- Maximum one second division in the entire academic career but not in the terminal degree. In case of second division, total marks should not be less than 50%.
- The Ph.D. candidate must have passed GAT (Subject).
- No Objection Certificate from the employer routed through proper channel in case of candidates employed in government or semi-government organization.
- The applicant must not be already registered as a student in any other academic programme in Pakistan or abroad.

### Admission Criteria

- The admission merit list will be prepared according to the following criteria:
  - o M.Sc./MS/Equivalent 50 % weightage
  - o B.Sc./BE/Equivalent 30% weightage
  - o Interview result 10 % weightage
  - o Publication/relevant experience 10% weightage

## Programme Structure

The PhD Textile Engineering Programme is a 4 years degree programme consisting of 18 credit hours of course work and 30 credit hours of research work.

### Semester I

	Subject Title	Credit Hours
TE-7101	Advanced Statistical Methods for Research	3
TE-7102	Recent Development in textile Engineering	2
TE-7103	Modern testing and Characterization Methods	3
TE-7104	Prototype/Review Paper	1
	Total	9

### Semester II

	Subject Title	Credit Hours
TE-7XXX	Elective – I	3
TE-7XXX	Elective – II	3
TE-7XXX	Elective – III	3
	Total	9
	<b>Total Credit Hours of Taught Courses</b>	<b>18</b>

### Semesters III-VIII

	Subject Title	Credit Hours
	Research Thesis	30

### List of elective courses

No.	Research Areas	Electives
1	Advanced Materials	Advanced polymeric materials; Nano composites; Biomaterials for healthcare; Advances in shape memory polymers; Nanofibers and nanoparticles; Flame retardant materials; Functional materials for textiles; Microencapsulation technology.
2	Engineered textile structures & composites	Engineering textiles; Advances in yarn spinning technology; Specialist yarn and fabric structures; 3-D Fibrous assemblies; Advances in weaving and knitting technologies; Nonwovens for technical textiles; Design and manufacture of textile composites; Mechanics of fibrous assemblies; Heat and mass transfer in porous media.
3	Textile surface modification and chemical treatments	Advances in dyeing and finishing of technical textiles; Functional finishes for textiles; Smart textile coatings and laminates; Surface modification of textiles; Plasma technologies for textiles; Digital printing of textiles.
4	Clothing engineering	Science in clothing comfort; Smart clothes and wearable technology; Advances in apparel production; Clothing biosensory engineering; Clothing appearance & fit; Biomechanical engineering of textile and clothing.
5	Technical textiles	Medical and healthcare textiles; Smart fibers, fabrics and clothes; Functional textiles for protection and performance; Textiles in sports; High performance textiles and their applications.
6	Textile machinery and instrument design	Instrumentation and control; Applied mechatronics; Mechatronic design in textile engineering; Design of textile machines; Mechanics and calculations of textile machinery
7	Textile modeling and simulation	Simulation in textile technology; Modeling and predicting textile behavior; Soft computing in textiles; Finite element analysis in textiles; Modeling, simulation and control of dyeing process; Advance CAD systems for textile and clothing; Modeling in Matlab
8	Energy, environment and sustainability in textiles	Sustainable textile production; Recycling in textiles; Environmental impact of textiles; Energy harvesting materials



# FACULTY OF SCIENCE

## Department of Computer Science

### Introduction

The Department of Computer Science consists of two departments namely the Department of Applied Sciences and Department of Computer Science. Department of Computer Science is committed to train and produce graduates who have extensive knowledge of the demanding fields that can be helpful for both national and international industries such as in Software Design and Management, Computational Bioinformatics, Computer Networks, Database Systems, Artificial Intelligence Multimedia/Computer Graphics/ Image Processing and parallel Computing. The Department of Computer Science offers “MS and PhD in Computer Science at postgraduate level.

### MS Computer Science

The Faculty of Science offers 2-years MS in Computer Science (MSCS) comprising 24 credit hours of course work and 6 credit hours of research work.

### Aims and Objectives

The programme objectives of the master’s degree in Computer Science are:

- To prepare students for the increasingly sophisticated application of computers to the needs of industry and society.
- To prepare students for research, teaching and further graduate studies in computer science.
- To prepare students for leadership roles in their industrial career.

- To provide students with graduate level course work in computer science that supplement the curriculum in other disciplines.

## Eligibility Criteria for Admission

Candidates must have 16 years of education i.e., BS in Computer Science/Bachelor of Computer Science/MSc in Computer Science, BSIT 4 year or equivalent from HEC recognized university/ Institute with a minimum CGPA 2.5/4.0 or first division in annual system. The admission will be purely on merit and will be granted to the applicants on the basis of their performance in the following areas:

- Bachelor Marks 60% weightage
- NTU GAT (General) 30% weightage
- Interview Marks 10% weightage
- Practical experience preferable

## Programme Structure

MSCS is a 2-year programme spread over 4 semesters. Each semester has at least 18 weeks including one week for mid semester and one week for end semester examination. MSCS programme has 30 credit hours in total i.e. 24 credit hours courses work and 6 credit hours for research thesis. Each MSCS student must has to complete 12 credits from 4 core courses, 12 credits from elective courses and 6 credits of research work to achieve the MSCS degree. The scheme of studies for MSCS programme is as under.

### Semester I

Code	Subject Title	Credit Hours
CSC-5071	Advanced Algorithm Analysis	3
CSC-XXXX	Elective-I	3
CSC-XXXX	Elective-II	3
CSC-XXXX	Elective-III	3
	Total	12

### Semester II

Code	Subject Title	Credit Hours
CSC-5073	Advanced Computational Theory	3
CSC-XXXX	Elective-IV	3
CSC-XXXX	Elective-V	3
CSC-XXXX	Elective-VI	3
	Total	12

### Semester III

Code	Subject Title	Credit Hours
CSC-6072	MS Thesis	3
	Total	3

### Semester IV

Code	Subject Title	Credit Hours
CSC-6072	MS Thesis	3
	Total Credit Hours of the Programme	30

## Course Contents

### CSC – 5071 Advanced Algorithm Analysis

Advanced algorithm analysis including the introduction of formal techniques and the underlying mathematical theory. NP-completeness. Search Techniques. Randomized Algorithms. Heuristic and Approximation Algorithms. Topics include asymptotic analysis of upper and average complexity bounds using big-O, little-o, and theta notation. Fundamental algorithmic strategies (brute-force, greedy, divide-and-conquer, backtracking, branch-and-bound, pattern matching, and numerical approximations) are covered. Also included are standard graph and tree algorithms. Additional topics include standard complexity classes, time and space tradeoffs in algorithms, using recurrence relations to analyze recursive algorithms, non-computable functions, the halting problem, and the implications of non-computability. Algorithmic animation is used to reinforce theoretical results. Upon completion of the course, students should be able to explain the mathematical concepts used in describing the complexity of an algorithm, and select and apply algorithms appropriate to a particular situation.

### CSC – 5072 Advanced Operating Systems

This course will cover Introduction to Characterization of Modern Operating Systems; file systems, memory management techniques, Process scheduling and resource management. In System Models architectural models, Interprocess Communication, Issues of Security in Distributed Systems (Partial coverage), Distributed File System, Concurrency Control in Distributed Systems Problems of Coordination and Agreement in Distributed Systems Replication, Advantages and requirements, Fault-tolerant services, Mobile and Ubiquitous Computing  
CSC-5070 Advanced Computational Theory  
Automata theory, formal languages, Turing machines, computability theory and reducibility, computational complexity, determinism, non-determinism, time hierarchy, space hierarchy, NP completeness, selected advanced topics.

### CSC-5076 Digital Signal Processing

One- and N-dimensional signals and systems, Sampling theorem, Discrete-time Fourier transform, discrete Fourier transform, fast Fourier transform, z-transforms: stability and minimum phase signals/

systems, Linear filtering of signal: Time domain: Difference equations and convolution, Impulse invariance, bilinear transform, FIR filter design, 2D filter design, Statistical signal processing: Stochastic signals: correlation functions and power density spectra, Optimal filtering: Wiener filters, Adaptive filters: LMS and array processing

### CSC-5077 Parallel and Distributed Computing

Why use parallel and distributed systems? Why not use them? Speedup and Amdahl's Law, Hardware architectures: multiprocessors (shared memory), networks of workstations (distributed memory), clusters (latest variation). Software architectures: threads and shared memory, processes and message passing, distributed shared memory (DSM), distributed shared data (DSD). Possible research and project topics, Parallel Algorithms, Concurrency and synchronization, Data and work partitioning, Common parallelization strategies, Granularity, Load balancing, Examples: parallel search, parallel sorting, etc. Shared-Memory Programming: Threads, Pthreads, Locks and semaphores, Distributed-Memory Programming: Message Passing, MPI, PVM. Other Parallel Programming Systems, Distributed shared memory, Aurora: Scoped behaviour and abstract data types, Enterprise: Process templates. Research Topics.

### CSC-5078 Control Systems and Robotics

Review of classical control analysis methods. Nyquist stability criterion. Classical design using frequency domain methods, phase lead and lag controllers, PID controllers. Relay auto tuning. Introduction to state space methods. State space models, state transformations, solution of the state equations. Controllability and observability. Design using state feedback. LQR design, pole placement, use of observers. Introduction to robotics. Transducers, actuators and robot control

### CSC-5079 Real Time Operating Systems

The principles of real-time and embedded systems inherent in many hardware platforms and applications being developed for engineering and science as well as for ubiquitous systems, including robotics and manufacturing, interactive and multimedia, immersive and omnipresent applications. Real-time and quality

of service system principles, understand real-time operating systems and the resource management and quality of service issues that arise, and construct sample applications on representative platforms. Platforms range from handheld and mobile computers to media and real-time server systems. Platforms may also include specialized systems used in application-specific contexts, such as autonomous robotics, smart sensors, and others.

### **CSC-5080 Advanced Networking**

Review of basic concepts: The OSI Model, packet and circuit switching, network topology, ISDN. The TCP/IP protocol stack: IP, ARP, TCP and UDP, DNS, ICMP, Internet Addressing, Routing, IP Multicast, RSVP, Next Generation IP – Ipv6, Wireless: Radio basics, Satellite Systems, WAP, current trends, Issues with wireless over TCP. Congestion Control: Control vs. Avoidance. Algorithms, Congestion in the Internet. Mobile IP, Voice over IP (VoIP), VPNs, Network Security. Management: Quality of Service (QoS), network vs. distributed systems management Protocols, web-based management

### **CSC-5081 Network Security**

Introduction; Cryptology and simple cryptosystems; Conventional encryption techniques; Stream and block ciphers; DES; More on Block Ciphers; The Advanced Encryption Standard. Confidentiality & Message authentication: Hash functions; Number theory and algorithm complexity; Public key Encryption. RSA and Discrete Logarithms; Elliptic curves; Digital signatures. Key management schemes; Identification schemes; Dial-up security. E-mail security, PGP, S-MIME; Kerberos and directory authentication. Emerging Internet security standards; SET; SSL and IPsec; VPNs; Firewalls; Viruses; Miscellaneous topics

### **CSC-5082 Topics in Computer Networking**

This course offers an advanced introduction and research perspectives in the areas of switch/router architectures, scheduling for best-effort and guaranteed services, QoS mechanisms and architectures, web protocols and applications, network interface design, optical networking, and network economics. The course also includes a research project in computer networking involving literature survey, critical analysis, and finally, an original and novel research contribution. Typical topics can be listed below:  
Overview of packet switching networks and devices. Fundamentals of Internet Protocol (IP) networking.

Route lookup algorithms. Router architecture and performance. Detailed operation of Internet routing protocols such as Open Shortest Path First (OSPF) and Border Gateway Protocol (BGP). Integrated and differentiated network service models. Traffic Engineering (TE) concepts and mechanisms including label assignment, label distribution, and constraint-based routing algorithms. Multi-protocol label switching and its generalization. Quality of service mechanisms for multimedia and real-time communications. TE-based routing and signalling protocols. Fundamentals of per-flow and aggregate scheduling algorithms. Application-level and network-level signalling protocols for data, voice, and video communications. Resource signalling and resource reservation protocols. Worst-case analysis for multimedia networking

### **CSC-5083 Network Administration**

Through completion of this course, students will be able to plan, install, and configure a Web Server, manage, monitor, and optimize a Web Server, and design and implement a Web Site on the Web Server created

### **CSC-5074 Wireless Networks**

This course covers fundamental techniques in design and operation of first, second, and third generation wireless networks: cellular systems, medium access techniques, radio propagation models, error control techniques, handoff, power control, common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc), radio resource and network management. As an example for the third generation air interfaces, WCDMA is discussed in detail since it is expected to have a large impact on future wireless networks. This course is intended for graduate students who have some background on computer networks

### **CSC-5084 Network Performance Evaluation**

This is an advanced course in networks and protocols. Analytical, simulation and experimental methods should be used to evaluate and design networks and protocols. Investigate network management tools and techniques

### **CSC-5085 Theory of Programming Languages**

Introduction and History, Syntax and Semantics,

Control Structures, Types, Logic Programming, Functional Programming and Lambda calculus, Concurrent and Distributed Programming, Dataflow, Object-oriented Programming.

### **CSC-5086 Advanced Compiler Design I**

An in-depth study of compiler backend design for high-performance architectures. Topics include control-flow and data-flow analysis, classical optimization, instruction scheduling, and register allocation. Advanced topics include memory hierarchy management, optimization for instruction-level parallelism, modulo scheduling, predicated and speculative execution. The class focus is processor-specific compilation techniques, thus familiarity with both computer architecture and compilers is recommended

### **CSC-5087 Advanced Compiler Design II**

The course should consist of one or two major projects. Theoretical study should depend on the level of the first course Design I and the student needs.

### **CSC-5088 Intelligent User Interfaces**

The increasing complexity of software and the proliferation of information makes intelligent user interfaces increasingly important. The promise of interfaces that are knowledgeable, sensitive to our needs, agile, and genuinely useful has motivated research across the world to advance the state of the art and practice in user interfaces that exhibit intelligence. The text covers the topic well

### **(CSC-5089)Multimedia Database**

Introduction; Overview of Relational and Object-Relational Data Representations; Text/Document Databases; Multidimensional Data Structures, similarity based search (spatial, image, audio); XML Databases; Temporal Data Models; Logical Frameworks

### **CSC-5090 Computer Vision**

Concepts behind computer-based recognition and extraction of features from raster images. applications of vision systems and their limitations. Overview of early, intermediate and high level vision, Segmentation: region splitting and merging; quadtree structures for segmentation; mean and variance pyramids; computing the first and second derivatives

of images using the isotropic, Sobel and Laplacian operators; grouping edge points into straight lines by means of the Hough transform; limitations of the Hough transform; parameterisation of conic sections. Perceptual grouping: failure of the Hough transform; perceptual criteria; improved Hough transform with perceptual features; grouping line segments into curves. Overview of mammalian vision: experimental results of Hubel and Weisel; analogy to edge point detection and Hough transform; Relaxation labelling of images: detection of image features; Grouping of contours and straight lines into higher order features such as vertices and facets. Depth measurement in images

### **CSC-5091 Rich Internet Applications**

This course covers the concept and technology evolution regarding the internet applications and the use of interface tools. Mainly, the course can focus on any one of the technologies of modern day, for example, macromedia's FLASH. However, the course will use the concepts of data structures, object oriented programming, programming languages and the software design and engineering to develop projects of medium to large magnitude

### **CSC-5092 Requirement Engineering**

Definition of requirements engineering and role in system development, Fundamental concepts and activities of requirements engineering, Information elicitation techniques, Modeling scenarios Fundamentals of goal-oriented requirements engineering, Modeling behavioral goals, Modeling quality goals, Goal modeling heuristics, Object modeling for requirements engineering, Object modeling notations, Object modeling heuristics, Identifying objects from goals, Modeling use cases and state machines, Deriving operational requirements from goals, Requirements Specification, Requirements verification and validation Management of inconsistency and conflict, requirements engineering risks, the role of quality goals in the requirements selection process, Techniques for requirements evaluation, selection and prioritization; Requirements management; Requirements traceability and impact analysis.

### **CSC-5093 Software System Architecture**

Definition and overview of software architecture,

the architecture business cycle, Understanding and achieving quality attributes, Attribute-driven design, Documenting software architecture, Evaluating software architecture, Architecture reuse Life-cycle view of architecture design and analysis methods, The QAW, a method for eliciting critical quality attributes, such as availability, performance, security, interoperability, and modifiability, Architecture Driven Design, Evaluating a software architecture (ATAM, CBAM, ARID), Principles of sound documentation, View types, styles, and views; Advanced concepts such as refinement, context diagrams, variability, software interfaces, and how to document interfaces; Documenting the behavior of software elements and software systems; Choosing relevant views; Building a documentation package

### CSC-5094 Software System Quality

What Is Software Quality: Quality Assurance, Quality Engineering

Software Testing: Testing: Concepts, Issues, and Techniques, Test Activities, Management, and Automation, Coverage and Usage Testing Based on Checklists and Partitions, Input Domain Partitioning and Boundary Testing, Coverage and Usage Testing Based on Finite-State Machines and Markov Chains, Control Flow, Data Dependency, and Interaction Testing, Testing Techniques: Adaptation, Specialization, and Integration.

Quality Assurance Beyond Testing: Defect Prevention and Process Improvement, Software Inspection, Formal Verification, Fault Tolerance and Failure Containment, Comparing Quality Assurance Techniques and Activities.

Quantifiable Quality Improvement: Feedback Loop and Activities for Quantifiable Quality Improvement, Quality Models and Measurements, Defect Classification and Analysis.

- Risk Identification for Quantifiable Quality Improvement, Software Reliability Engineering.
- Sample labs and assignments
- Use of automated testing tools
- Testing of a wide variety of software
- Application of a wide variety of testing techniques
- Inspecting of software in teams; comparison and analysis of results

### CSC-5095 Research Study

The students have to perform meta analyses of 25-30

research papers selected in current research topics in International Journals. Topic and papers will be selected with approval from the instructor. Conference papers are not allowed for review. Students have to read all such papers and prepare the analysis related to model, methods, findings and come up with what has been done related to selected area of research and research gaps if any are explicitly identified with future work.

### CSC-5096 Software Case Tools & Applications

The students will be appraised of; Case tools & techniques, CASE in software development process, Traditional CASE methodologies, Emerging CASE methodologies, OO Design, Specific CASE tools, specialized design tools, Managing CASE methodologies.

As part of course, students will be assigned a real life problem for development through CASE tools

**Note:** Other subjects can be offered to the students depending upon the need of the main research work.





## PhD. Computer Science

The Faculty of Science offers 4-year PhD Programme in Computer Science comprising 18 credit hours of course work and 30 credit hours of research work.

### Aims and Objectives

- To promote high achievement in theoretical and practical problems within the field of computer science and to address the burgeoning education demands for graduates and professionals with advanced Computer Science education.
- To offer students a solid background in core areas and exposure to cutting-edge research in computer science.
- To improve the qualifications, skills and expertise of teachers and researchers in order to provide highly competent professionals to various public and private universities.

### Admission Criteria

- MS/M.Phil. Computer Science or Equivalent degree from HEC recognized University/Institute with minimum CGPA 3.00/4.00 or 3.50/5.00 in semester system, 60% marks in annual system and no third division/D grade in entire academic career.
- The Ph.D. candidate must have passed GAT (Subject).
- No Objection Certificate from the employer routed through proper channel in case of candidates employed in government or semi-government organizations.
- Applicant must not be already registered as a student in any other academic programme in Pakistan or abroad.
- It is mandatory to pass interview in order to compete on merit.

### Admission Procedure

- PhD programme shall be advertised in the beginning of each academic year.
- The applicant shall apply on a prescribed admission form alongwith two letters of recommendation within due

- date given in the advertisement for admission.
- The completed application form, along with required documents, shall be submitted in the Admission Office.
  - The applicants shall be evaluated by Advanced Studies & Research Board (ASRB) according to the following criterion.
    - o M.Sc./MS/Equivalent 50 % weightage
    - o B.Sc./BE/Equivalent 30% weightage
    - o Interview result 10 % weightage
    - o Publication/relevant experience 10% weightage
  - The selected candidates will be given an acceptance letter by the Admission Office.
  - The students shall pay their dues within the stipulated time, failing which their admission shall be liable to be cancelled.

## Programme Structure

The PhD Computer Science Programme is a 4 years degree programme consisting of 18 credit hours of course work and 30 credit hours of research work. The department offers PhD degree with the research emphasis on following research areas:

Information vizualization

Artificial Intelligence

Information Systems

Networking and Communication

(This list is not exhaustive and new courses can be added to this category at any time depending upon availability of the instructor)

S. No.	Code	Course Title	Credit Hours
1	CSC-7001	Modeling of Web Information Systems	3
2	CSC-7002	Data Warehousing	3
3	CSC-7003	Peer-To-Peer Systems	3
4	CSC-7004	Multimedia Retrieval Techniques	3
5	CSC-7005	Metadata for Information Resources	3
6	CSC-7006	Information Privacy and Access Control	3
7	CSC-7007	Ubiquitous Information Interaction	3
8	CSC-7008	Human Information Interaction	3
9	CSC-7009	Information Architecture	3
10	CSC-7010	Collaborative Data Mining	3
11	CSC-7011	Communication Networks	3
12	CSC-7012	Advances in Next Generation Networks	3
13	CSC-7013	P2P-based Information retrieval	3
14	CSC-7014	Advanced Software Architecture	3
15	CSC-7015	Artificial Intelligence	3
16	CSC-7016	Advanced topics in Machine Learning	3
17	CSC-7017	Evolutionary Computation	3
18	CSC-7018	Research Seminar	3

## Courses Contents

### CSC-7001 Modeling of Web Information Systems

Web modeling concepts; Modeling the Web applications for requirements engineering; Content modelling; Navigation modeling (Hypertext, Access structure); Modeling the presentation for the end user; Model driven development and model driven architecture; Evolution of the Web, Web 1.0 (visual Web), Web 2.0 (Social Web), and Semantic Web (the Web of metadata); Hypertext patterns; Persistence of HT patterns; O&M of Web applications.

### CSC-7002 Data Warehousing

Overview of the course and a brief history; Data Warehouse Architecture; Extract Transform Load; Data Cleansing Algorithms; Hot and Cold Data; Data Warehouse support for OLAP and Data Mining; Active Data warehousing; Semantic Data warehousing; Oracle solution Teradata solution; Case Studies.

### CSC-7003 Peer-To-Peer Systems

Overview of P2P Systems and brief history; Taxonomy of P2P Networks/Systems and Analysis of popular P2P Systems; Analysis of unstructured P2P Systems; Analysis of structured P2P Systems; Search Efficiency; P2P-based content delivery; Security and Reliability; Replication in peer-to-peer systems; Anonymity in peer-to-peer systems; Social, Legal and Privacy aspects of P2P Systems.

### CSC-7004 Multimedia Retrieval Techniques

Multimedia content and motivations for multimedia retrieval; Issues of multimedia Retrieval. Multimedia retrieval models; Content-based image retrieval; Content-based video retrieval; Content-based audio retrieval: audio representations, audio feature extraction; Query modalities and similarity measures; Analysis of existing multimedia retrieval systems, retrieval evaluation criteria, relevance feedback; current trends in Multimedia Retrieval.

### CSC-7005 Metadata for Information Resources

Overview of the course and Metadata; History of schemes and metadata communities; Functions and Types of metadata; Metadata Structure and Characteristics: Semantics, syntax, and structure;

Metadata creation process models; Interoperability; Metadata Integration and Architecture: Warwick Framework; Resource Description Framework; Open Archives Initiative; Encoding Standards (Markup Languages): Introduction and history of markup; Metadata use of markup languages; Document Type Definitions (DTD); Structural metadata Data Control Standards: Resource Identifiers; Data Registries; Controlled vocabularies; Name authority control (ISAAR and FRANAR); A-Core; Encoded Archival Description (EAD), Text Encoding Initiative (TEI); Metadata Evaluation: User needs; Quality control issues; Evaluation methods; Educational Metadata: Instructional Management Systems (IMS); Learning Object Metadata (LOM); Gateway to Educational Materials (GEM); Government Information Locator Service (GILS); Visual Resources Metadata: Categories for the Description of Works of Art (CDWA); Visual Resources Association (VRA) Core; Computer Interchange of Museum Information (CIMI)

### CSC-7006 Information Privacy and Access Control

Privacy, Privacy policies; Privacy enforcement; Adaptive privacy management; Access control mechanisms; Different access control models such as Mandatory, Discretionary, Role-Based and Activity-Based; Access control matrix model; Harrison-Russo-Ullman model and undecidability of security; Confidentiality models such as Bell-LaPadula; Integrity models such as Biba and Clark-Wilson; Conflict of interest models such as the Chinese Wall

### CSC-7007 Ubiquitous Information Interaction

Information Interaction; Seminal ideas of ubiquitous computing; Tangibility and Embodiment; Social computing; Privacy; Critical and cultural perspectives; Mobility and Spatiality; Mobile Technology in the Messy Now; Infrastructure; Seams, seamlessness, seamfulness ; Evaluating Interaction of Ubicomp systems

### CSC-7008 Human Information Interaction

Overview of the course and a brief history; Types and structures of information resources; Types and structures of vocabularies; Information retrieval & Interaction in information retrieval  
Search engines, Digital libraries; Search techniques and effectiveness; Advanced searching  
Web search and the invisible web; Information seeking

behavior; User modeling ; Mediation between search intermediaries and users; Evaluation of search sources and results; Result Presentation to users; Keeping up: sources for life-time learning

### **CSC-7009 Information Architecture**

Introduction and Overview of the course. Process of Web development; Information behavior & the web. Content design and organization systems; Copyright issues. Labeling systems; Writing for the Web. Navigation design; Search systems. Page design; Multimedia. Web usability evaluation & testing. Accessibility for users with disabilities. Global audiences; Web standards & policies. Weblogs, Intranets, Websites for mobile devices; Web design software; Web Content Management Systems. Metadata; Search engines

### **CSC-7010 Collaborative Data Mining**

Overview of the course and a brief history; Overview of Distributed Database systems; Importance and usage of collaboration; Web Data Resources; A brief introduction to overlay networks; Remote Collaboration; Collaborative Data Mining Guidelines; Parallel Data Mining; Grid-based Data Mining; Collaborative mining over social networks; Collaborative mining in P2P Networks; Collaborative data mining case studies.

### **CSC-7011 Communication Networks**

Overview of the course & research activities in computer networks; Communication Networks & Services; Overview of network simulations; Layered architecture; Congestion Control and Traffic Management; Wireless, Mobility and Cross layer concepts; Switching & Routing; Quality of Service ( QoS); Multicast; Peer-to-Peer (P2P) and Overlay Networks; Content Distribution in P2P Networks; Multimedia Information & Networking; Network Measurement.

### **CSC-7012 Advances in Next Generation Networks**

Next Generation Internet/Networks: "Convergence to IP"; Network Technologies and Architectures; Quality of Service; Multimedia protocols; Policy routing; Future Internet; Network traffic optimization; Next Generation Internet and broadband deployment; Advances in wireless mobile networks; Advances in sensor networks; Management of Next Generation Networks

### **CSC-7013 P2P-based Information retrieval**

Overview of the Information Retrieval Systems;

Multimedia & its characteristics; P2P Systems & its characteristics; Content searching/locating in P2P systems; Emerging coding standards for information; Architecture of P2P-based information retrieval; Privacy & security issues in P2P-based information retrieval; Current research trends in P2P-based information retrieval.

### **CSC-7014 Advanced Software Architecture**

Re-use in architectures: Software product lines, evaluation and validation of product lines, product line testing, re-use in product lines; Service oriented architectures (SOAs): SOA concepts, risks and challenges, quality attributes and SOAs, evaluating and testing SOAs; Architectural evaluation: Methods for architectural analysis, Comparison of methods; Architectural evolution and reconstruction: Models of software evolution, analysis and metrics for evolution, Techniques and tools for architecture reconstruction; Architectures in dynamic environments: Modeling and analyzing dynamic software architectures; Self healing architectures: The need for self-healing, approaches for self healing

### **CSC-7015 Artificial Intelligence**

This course considers ideas and techniques from Artificial Intelligence. It first introduces a range of search algorithms that are used throughout AI. It then examines applications and techniques of AI, including rule-based systems for embodying human expertise, algorithms for planning and problem solving, natural language processing, methods for machine learning, and neural nets and other computation intelligence techniques.

### **CSC-7016 Advanced topics in Machine Learning**

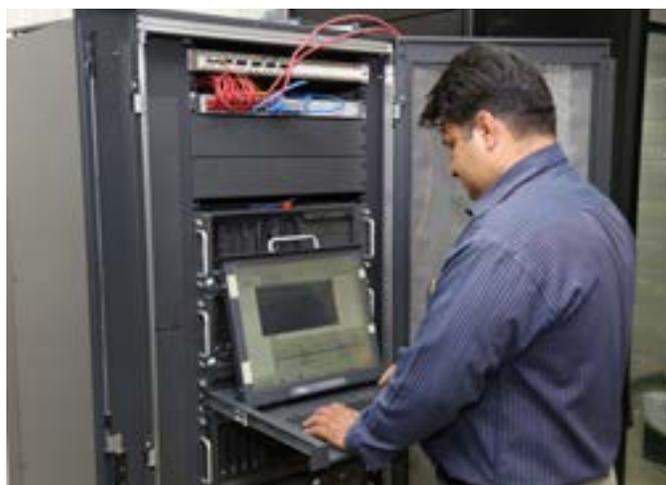
Introduction: Overview of machine learning, Machine learning applications and examples; Reinforcement learning; Elements of reinforcement learning, Model based learning, Temporal difference learning, Generalization; Genetic Algorithms: Genetic operators, fitness function, Hypothesis space search, Genetic programming; Support Vector Machines: Optimal separating hyperplane, soft margin hyperplane, kernel functions, SVMs for regression; Combining learners: Voting, Bagging, Boosting; Assessing and Comparing Classification Algorithms: Cross-validation and resampling, Measuring error, Assessing performance, Comparing multiple classification algorithms.

## CSC-7017 Evolutionary Computation

Evolutionary Computation can be considered as a sub-field of Artificial Intelligence. Evolutionary algorithms are inspired in the principles of natural selection and genetics. This course explores how principles from theories of evolution and natural selection can be used to construct machines that exhibit nontrivial behavior. In particular, the course covers techniques from genetic algorithms, genetic programming, and learning classifier systems for developing software agents capable of solving problems as individuals and as members of a larger community of agents.

## CSC-7018 Research Seminar

This course offers a substantial introduction relevant to doctoral work in student's research area. The course provides directed and supervised investigation of selected topics. Each week Research papers related to the topic will be discussed, and presented in a seminar format. This course progresses as a series of seminars, each presenting a different paper(s). It prepares students to review studies of other researchers in the field, and allows them to become more knowledgeable about methods appropriate to their dissertation research.



# Department of Applied Sciences

## Introduction

The Faculty of Science consists of two departments namely Department of Applied Sciences and Department of Computer Science. The Department of Applied Sciences offers PhD Chemistry and MS Mathematics at postgraduate level.

## MS Mathematics

The Department of Applied Sciences offers 2-years MS Mathematics comprising 24 credit hours of course work and 6 credit hours of research work.

## Aims and Objectives

- to inculcate habits of creative thinking, critical analysis and rigorousness.
- to make the student appreciate the uniqueness of mathematics as tool of the tools, having the power of generalization and the power of application.
- to develop ability in students to formulate a problem using the language of mathematics.
- to equip students with the mathematical techniques and solutions to indigenous problems faced by industries business and financial organizations with a special focus on textile industry.
- to strengthen academia-professional-world bonding by tailoring the courses and the trainings offered according to needs of the end-user.

## Eligibility Criteria for Admission

- A candidate seeking admission to MS Mathematics must possess a M.Sc./BS in Pure Mathematics/Applied Mathematics/Computational Mathematics (minimum 16 year education) degree or its equivalent with a minimum CGPA of 2.5/4 in semester system or 60% in annual system/Term system from an HEC recognized institute/university.
- The MS candidate must pass GAT (General) conducted by NTS as per HEC guidelines with a minimum of 50% cumulative score at the time of admission to MS Mathematics.
- No objection certificate from the employer must be routed through proper channel, in case the candidate is an employee in government or semi-government organization.
- The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

## Admission Process

1. The MS program shall be advertised in the beginning of each academic session.
2. An applicant shall apply on a prescribed form within the due date given in the advertisement for admission.
3. The completed application form, along with required documents, shall be submitted in the admission office.
4. The applications shall be evaluated according to the following criteria for making the merit list.
  - Intermediate: 10% weightage
  - BS Mathematics/B.Sc. + M.Sc.: 40/20+20% weightage
  - GAT (General) 40% weightage
  - Interview: 10% weightage

## Program Structure and Course Contents

MS Mathematics is spread over a minimum of 4 semesters and maximum of 6 semesters. Each semester has at least 18 weeks including one week for mid semester examination and one week for final examination. MS Mathematics

program has 30 credit hours in total including 24 credit hours of course work and 6 credit hours for research thesis. The scheme of studies is given as under:

### Semester I

Code	Subject Title	Cr. Hrs.
MA -5001	Commutative Algebra-I	3
MA-5013	Partial Differential Equations	3
MA -5009	Riemannian Geometry	3
MA-xxxx	Elective-I	3
	Total	12

### Semester II

Code	Subject Title	Cr. Hrs.
MA -5021	Numerical Solutions of Partial Differential Equations	3
MA -5022	Functional Analysis	3
MA-5015	General Relativity	3
MA -xxxx	Elective-II	3
	Total	12

### Semester III and IV

Code	Subject Title	Cr. Hrs.
MA-6026	Research Thesis	6
	Total Credit Hours of the Program	30

### Note:

- MS students will have to pass 24 credit hours courses and 6 credit hours thesis.
- Department can offer any course from the list of approved courses on the availability of resources.
- Summer semester will not be offered.
- Internal assessments include seminars, quizzes and assignments of every student in each subject. At least one seminar per student per subject is compulsory.
- Number of assessment activities is double to the number of credit hours of each subject.

### LIST OF COURSES

S. No.	Code	Course Title	Credit Hours
1	MA -5001	Commutative Algebra-I	3
2	MA -5002	Homological Algebra-I	3
3	MA -5003	Commutative Algebra-II	3
4	MA -5004	Homological Algebra-II	3
5	MA -5005	Banach Algebra	3
6	MA -5006	Advanced Complex Analysis-I	3
7	MA -5007	Advanced Complex Analysis-II	3
8	MA -5008	Topological Vector Spaces	3
9	MA -5009	Riemannian Geometry	3

10	MA -5010	Integral Equations	3
11	MA -5011	Inequalities Involving Convex Functions	3
12	MA -5012	Harmonic Analysis	3
13	MA -5013	Partial Differential Equations	3
14	MA -5014	Numerical Solutions of Ordinary Differential Equation	3
15	MA -5015	General Relativity	3
16	MA -5016	Graph Theory	3
17	MA -5017	Combinatorics	3
18	MA -5018	Research Methodology	3
19	MA -5019	Non-Newtonian Fluid Mechanics	3
20	MA -5020	Advanced Analytical Dynamics-I	3
21	MA -5021	Numerical Solutions of Partial Differential Equations	3
22	MA -5022	Functional Analysis	3
23	MA -5023	Advanced Numerical Analysis	3
24	MA -5024	Special topics in Advanced Mathematics-I	3
25	MA -5025	Special topics in Advanced Mathematics-II	3
26	MA-6026	Research Thesis	6

## Course Contents

### MA -5001 Commutative Algebra-I

Integral domains, unit, irreducible and prime elements in ring, Types of ideals, Quotient rings, Rings of fractions, Ring homomorphism, Euclidean domains. Construction of formal power series ring  $R[[X]]$  and polynomial ring  $R[X]$  in one indeterminate. Polynomial extension of Noetherian domains, Quotient ring of Noetherian rings, Ring of fractions of Noetherian rings. Valuation map and Valuation rings.

### MA -5002 Homological Algebra-I

Revision of basic concepts of Ring theory and Module Theory, Modules, Homomorphism and exact sequences. Product and co-product of Modules. Comparison of free Modules and Vector Spaces Projective and injective Modules. Hom and Duality Modules over Principal ideal Domain Noetherian and Artinian Module and Rings Radical of Rings and Modules Semi-simple Modules.

### MA -5003 Commutative Algebra-II

Gauss Theorem, Quotient of a UFD, Nagata Theorem.

Divisor classes, Divisor class monoid, divisor class group, Divisorial ideals, divisors, Krull rings, Atomic Domains, Domains Satisfying ACCP, Bounded Factorization Domains, Half Factorial Domains, Finite Factorization Domains: Group of divisibility  $G(D)$  of a domain  $D$ ,  $G(D)$  and FFD.

### MA -5004 Homological Algebra-II

Tensor products of modules, Singular Homology flat Modules. Categories and factors cogenerator. Finitely related (finitely presented) Modules. Pure ideals of a ring pure submodules and pure exact sequences. Hereditary and Semihereditary rings. Ext. and extensions, Axioms Tor and Torsion, universal coefficient theorems. Hilbert Syzygy theorem, Serre's theorem, mixed identities.

### MA -5005 Banach Algebra

Banach Algebra: Ideals Homomorphisms, Quotient algebra, Wiener's lemma. Gelfand's Theory of Commutative Banach Algebras. The notions of Gelfand's Topology, Radicals, Gelfand's Transforms. Basic properties of spectra. Gelfand-Mazur Theorem, Symbolic calculus: differentiation, Analytic functions.

Integration of A-Valued functions. Normed rings. Gelfand Naimark theorem.

### MA -5006 Advanced Complex Analysis-I

Analytic continuation, equicontinuity and uniform boundedness, normal and compact families of analytic functions, external problems, harmonic functions and their properties, Green's and von Neumann functions and their applications, harmonic measure conformal mapping and the Riemann mapping theorem, the Kernel function, functions of several complex variables.

### MA -5007 Advanced Complex Analysis-II

Holomorphic functions, Extension of analytic functions, Levi-convexity: The Levi form, Geometric interpretation of its signature, E.E. Levi's theorem, Connections with Kahlerian geometry, Elementary properties of plurisub harmonic functions. Cohomology, complex manifolds. The  $d$ -operators, the Poincare Lemma and the Dolbeaut Lemma, The Cousin problems, introduction to Sheaf theory.

### MA -5008 Topological Vector Spaces

Vector spaces, Topological vector spaces, product spaces, quotient spaces, bounded and totally bounded sets, convex sets and compact sets in topological vector spaces, closed hyperplanes and separation of convex sets, complete topological vector spaces, metrizable topological vector spaces, normed vector spaces, normable topological vector spaces and finite dimensional spaces.

Locally convex spaces: Convex and compact sets in locally convex spaces, bornological spaces, barreled spaces, spaces of continuous functions, spaces of indefinitely differentiable function, the notion of distributions, nuclear spaces, montal spaces, Schwartz spaces, (DF)-spaces and Silva spaces.

### MA-5009 Riemannian Geometry

Definition and examples of manifolds. Differential maps. Submanifolds. Tangents. Coordinate vector fields. Tangent spaces. Dual spaces. Multilinear functions. Algebra of tensors. Vector fields. Tensor fields. Integral curves. Flows. Lie derivatives. Brackets. Differential forms. Introduction to integration theory on manifolds. Riemannian and semi Riemannian metrics. Flat spaces. Affine connection. Parallel translations. Covariant differentiation of tensor fields.

Curvature and Torsion tensors. Connection of a semi-Riemannian tensor. Killing equation and Killing vector fields. Geodesics. Conformal transformations and the Weyl tensor.

### MA -5010 Integral Equations

Existence theorems, intergral equations with Kernels. Applications to partial differential equations. Integral transforms, Wiener-Hopf techniques.

### MA-5011 Inequalities Involving Convex Functions

Jensen's and related inequalities, Some general inequalities involving convex functions, Hadamard's inequalities, Inequalities of Hadamard type I, Inequalities of Hadamard type II, Some inequalities involving concave functions, Miscellaneous inequalities.

### MA -5012 Harmonic Analysis

Topology. Sets and Topologies. Separation axioms and related theorems. The Stone- Weierstrass theorem. Cartesian products and weak topology. Banach spaces. Normed linear spaces. Bounded linear transformations. Linear functionals. The weak topology for  $X^*$ . Hilbert space. Involution on  $\beta(H)$ . Integration. The Daniell integral. Equivalence and measurability. The real LP-spaces. The conjugate space of LP. Integration on locally compact Hausdorff spaces. The complex LP-spaces. Banach Algebras. Definition and examples. Function algebras. Maximal ideals. Spectrum, adverse Banach algebras, elementary theory. The maximal ideal space of a commutative Banach algebra. Some basic general theorems

### MA -5013 Partial Differential Equations

Cauchy's problems for linear second order equations in  $n$ -independent variables. Cauchy Kowalewski Theorem. Characteristics surfaces. Adjoint operations, Bicharacteristics Spherical and Cylindrical Waves. Heat equation. Wave equation. Laplace equation. Maximum-Minimum Principle, Integral Transforms.

### MA -5014 Numerical Solutions of Ordinary Differential Equations

Theory and implementation of numerical methods

for initial and boundary value problems in ordinary differential equations. One-step, linear multi-step, Runge-Kutta, and Extrapolation methods; convergence, stability, error estimates, and practical implementation, Study and analysis of shooting, finite difference and projection methods for boundary value problems for ordinary differential equation.

### MA -5015 General Relativity

Review of special relativity, tensors and field theory. The principles on which general relativity is based. Einstein's field equations obtained from geodesic deviation. Vacuum equation. The Schwarzschild exterior solution. Solutions of the Einstein-Maxwell field equations and the Schwarzschild interior solution. Kerr-Newmann solution (without derivation). Foliations. Relativistic corrections to Newtonian gravity Black holes. Kruskal and Penrose diagrams. The field theoretic derivation of Einstein's equations. Weak field approximations and gravitational waves. Kaluza-Klein theory. Isometrics. Conformal transformations. Problems of "quantum gravity"

### MA -5016 Graph Theory

Fundamentals. Definition. Paths cycles and trees. Hamilton cycles and Euler circuits. Planer graphs. Flows, Connectivity and Matching Network flows. Connectivity and Menger's theorem. External problems paths and Complete Subgraphs. Hamilton path and cycles. Colouring. Vertex colouring Edge colouring. Graph on surfaces.

### MA -5017 Combinatorics

Elementary concepts of several combinatorial structures. Recurrence relations and generating functions. Principle of inclusion and exclusion. Latin squares and SDRs. Steiner systems. A direct construction. A recursive construction. Packing and covering. Linear algebra over finite fields. Gaussian coefficients. The pigeonhole Principle. Some special cases. Ramsey's theorem. Bounds for Ramsey numbers and applications. Automorphism groups and permutation groups. Enumeration under group action.

### MA -5018 Research Methodology

Scientific statements, hypothesis, model, Theory &

Law, Types of research, Problem definition, objectives of the research, research design, data collection, data analysis, Interpretation of results, validation of results, Literature search, Formal research proposal, budgeting and funding, sampling, systematic sampling, Stratified sampling, cluster sampling, Convenience sampling, judgment sampling, quota sampling, snow ball sampling, Identifying variables of interest and their interactions, Operating characteristic curves, power curves, Surveys and field trials, Submission of a paper, role of editor, Peer-review process, importance of citations, impact factor, Plagiarism, protection of your work from misuse, Simulation, need for simulation, types of simulation, Introduction to algorithmic research, algorithmic research problems, types of algorithmic research, problems, types of solution procedure.

### MA -5019 Non-Newtonian Fluid Mechanics

Classification of non-Newtonian fluids, Rheological formulae (time-independent fluids, thixotropic fluids and viscoelastic fluids), variable viscosity fluids, cross viscosity fluids, the deformation rate, viscoelastic equation, materials with short memories, time dependent viscosity, the Rivlin-Ericksen fluid, basic equations of motion in rheological models. The linear viscoelastic liquid, Couette flow, Poiseuille flows, the current semi-infinite field. Axial oscillatory tube flow, angular oscillatory motion, periodic transients, basic equations in boundary layer theory, orders of magnitude, truncated solutions for viscoelastic flow, similarity solutions, turbulent boundary layers, stability analysis.

### MA-5020 Advanced Analytical Dynamics-I

Equations of dynamic and its various forms, equations of Lagrange and Euler, Jacobi's elliptic functions and the qualitative and quantitative solutions of the problem of Euler and Poisson. The problems of Lagrange and Poisson. Dynamical systems. Equations of Hamilton and Appell. Hamilton-Jacobi theorem. Separable systems. Holder's variational principle and its consequences.

### MA-5021 Numerical Solutions of Partial Differential Equations

Boundary and initial conditions, Polynomial approximations in higher dimensions, Finite Element

Method: The Galerkin method in one and more dimensions. Error bound on the Galarki method, the method of collocation, error bounds on the collocation method, comparison of efficiency of the finite difference and finite element method. Finite Difference Method: Finite difference approximations. Applications to solutions of linear and non-linear partial differential equations appearing in physical problems.

### **MA -5022 Functional Analysis**

Separation properties. Hahn-Banach theorem. Banach algebras theorem (Introduction). Linear mappings. Finite dimensional spaces. Metrization. Boundedness and continuity. Seminorms and local convexity. Baire category theorem. The Banach-Steinhaus theorem. The open mapping theorem. The closed graph theorem. Bilinear mappings. The normed dual of normed spaces. Adjoint.

### **MA -5023 Advanced Numerical Analysis**

Introduction. Euler's method. The improved and modified Euler's method. Runge-Kutta method. Milne's method. Hamming's methods. Initial value problem. The special cases when the first derivative is missing. Boundary value problems. The simultaneous algebraic equations method. Iterative methods for linear equations. Gauss-Siedel method. Relaxation methods. Vector and matrix norms. Sequences and series of matrices. Graph Theory. Directed graph of a matrix. Strongly connected and irreducible matrices. Gerschgorin theorem. Symmetric and positive definite matrices. Cyclic-Consistently ordered matrices. Choice of optimum value for relaxation parameter.

### **MA-5024 Special topics in Advanced Mathematics-I**

The course contents should be specified from time to time by the resource person with consultation of the Chairman, Department of Applied Sciences.

### **MA-5025 Special topics in Advanced Mathematics-II**

The course contents should be specified from time to time by the resource person with consultation of the Chairman, Department of Applied Sciences.

# Ph.D. Chemistry

## Aims and Objectives

- To carry out research of international standard aimed to advance the global scientific and technological knowledge.
- To enhance the intellectual development of Ph.D. graduates through creativity, analytical thinking, critical analysis, and innovative problem solving.
- To equip students with the Chemistry techniques to solve indigenous problems of industrial organizations with a special focuss on textile industry.
- To strengthen academia-professional-world bonding by tailoring the courses and the trainings offered according to needs of the end-user.

## Admission criteria

- M.Phil./MS Chemistry or equivalent degree from HEC recognized university/institute with a minimum CGPA 3.00/4.00 or 3.50/5.00 in a semester system or 60% marks in annual system, and no third division/D grade or less than 45% in the entire academic career.
- Maximum one second division in the entire academic career but not in the terminal degree. In case of second division, total marks should not be less than 50%. There must not be any third division throughout the academic career.
- The Ph.D. student must pass GRE/GAT (subject) test as per HEC guidelines.
- No objection certificate from the employer must be routed through proper channel in case the candidate is employed in government or semi-government organization.
- The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

## Admission Procedure

1. The Ph.D. program shall be advertised in the beginning of each academic session.
2. An applicant shall apply on a prescribed form along with two letters of recommendation within due date given in the advertisement for admission.
3. The completed application form, along with required documents, shall be submitted in the admission office.
4. The applications shall be evaluated according to the following criteria for making the merit list.
  - M.Phil./MS Chemistry: 50 % weightage
  - M.Sc./B.S. Chemistry: 30 % weightage
  - Publications/relative experience 10 % weightage
  - Interview result 10 % weightage
5. An HEC Scholarship holder will be given preference for admission.
6. The candidate must have the supervisor's (and co supervisor's) willingness letter.

## Duration of the Program

- The minimum period for completion of Ph.D. program shall be 4 years, one year for 18 credit hours course work and three years for research, the period shall be counted from the commencement of semester for 18 credit hours course work.
- The maximum permissible period for submission of Ph.D. thesis will be 10 semesters. After 10 semesters, the scholar will cease to be the student of the university and shall not be eligible for readmission.

## Semester-wise Workload

- The Ph.D. candidate has to take Ph.D. level course work of minimum 18 credit hours with the consent of his/her supervisor.
- The course contents shall be proposed by the concerned Faculty Board of Studies, recommended by the Advanced Studies and research Board(ARSB) and approved by the Academic Council.

## Semester I

Code	Subject Title	Cr. Hrs.
CH-XXXX	Elective Course – I	3
CH-XXXX	Elective Course – II	3
CH-XXXX	Elective Course – III	3
	Total	9

## Semester II

Code	Subject Title	Cr. Hrs.
CH-XXXX	Elective Course – IV	3
CH-XXXX	Elective Course – V	3
CH-XXXX	Elective Course – VI	3
	Total	9

## Semesters III-VIII

Code	Subject Title	Cr. Hrs.
CH-8090	Research Thesis	30

## Research Paper Requirement

Before final submission of thesis for evaluation, the Ph.D scholar would have to publish at least one research paper from his/her research, as first author, in an Internationally Abstracted Journal, recognized by the HEC, Pakistan. Only published paper are acceptable for award of PhD degree.

## Course Contents of the Program

### LIST OF ELECTIVE COURSES

(This list is not exhaustive and new courses can be added to this category at any time depending upon the available facilities/requirements)

S. No.	Code	Course Title	Credit Hours
1	CH-7001	Advanced Physical Chemistry	3
2	CH-7002	Inorganic Materials Chemistry	3
3	CH-7003	Physical Organic Chemistry	3
4	CH-7004	Nuclear Magnetic Resonance in Organic Chemistry	3
5	CH-7005	Advanced Mass Spectrometry	3
6	CH-7006	Advanced Polymer Chemistry	3
7	CH-7007	Special Organic Materials	3
8	CH-7008	Advanced Photochemistry	3
9	CH-7009	Advanced Surface Chemistry	3
10	CH-7010	Chemistry of Advanced Composite Materials	3
11	CH-7011	Advanced Applied Chemistry	3
12	CH-7012	Applied Environmental Chemistry	3

13	CH-7013	Nanochemistry	3
14	CH-7014	Biophysical Chemistry	3
15	CH-7015	Advanced Chemical Treatment of Textiles	3
16	CH-7016	Advanced Textile Chemistry	3
17	CH-8090	Research Thesis	18

## Details of Elective Courses

### CH-7001 Advanced Physical Chemistry

Chemical Thermodynamics: Thermodynamic properties interrelations: Maxwell's equations; flow of fluids. Phase equilibrium: Non-ideal gas and liquid mixtures; chemical reaction equilibria. Chemical Kinetics: Reactions in solutions: Diffusion-controlled reactions; applications of transition state theory; solvent effects on polar and ionic reactions; salt effects on reactions. Chain reactions: Features of chain mechanisms; branching chain and oscillating reactions. Determination of reaction orders; Product catalyzed reactions; series reaction with reversible step; prior-equilibrium and improved steady-state approximation. Solutions: Interactions in solutions: multicomponent systems; preferential solvation. Solvents: Their characterization; microscopic structure of solvent and solvates. Molecular dynamics and microscopic structure; different techniques of molecular dynamical calculations. Theories and laws related to solutions. Macroscopic properties of solutions.

### CH-7002 Inorganic Materials Chemistry

Introduction to inorganic materials, Application and interpretation of powder X-ray diffraction data of materials, The synthesis of inorganic materials – Solid state reactions, Precursor, solution and sol-gel methods, Solid-gas reactions, Hydrothermal method, CVD, Aerosol process, Low temperature method, Transition metal oxides, Electronic, magnetic and optical properties of inorganic materials, Nonstoichiometric compounds, Zeolites, intercalation in layer materials and solid electrolytes, Some recent developments in inorganic material chemistry.

### CH-7003 Physical Organic Chemistry

History and development: Evolution of a hybrid discipline, energy changes during chemical

reactions, theory and principles related to kinetics and equilibrium processes. Correlation of structure and reactivity: Hammett equation and other linear free energy relationships. Hückel molecular orbital (HMO) method: Correlation of HMO parameters with molecular properties, alternant and nonalternant hydrocarbons and their properties. Correlation of structure and activity: Use of molecular descriptors, Hansch analysis, Craig plots, Topliss scheme in establishing SAR. FMO method: Concept of Frontier orbitals and its application for explaining chemical reactivity.

### CH-7004 Nuclear Magnetic Resonance in Organic Chemistry

Spin couplings: Spin coupling in different spin systems. Double resonance experiments: Spin decoupling in  $^1\text{H}$ - and  $^{13}\text{C}$ -NMR spectroscopy, suppression of solvent signal,  $^1\text{H}$  BB decoupling, gated decoupling,  $^1\text{H}$  off-resonance decoupling. 1D NMR experiments with complex pulse sequence: The J-modulated spin echo, SPI, INEPT and DEPT experiments. 2D NMR Spectroscopy: Introduction, theory and presentation of 2D spectrum. 2D J-resolved NMR spectroscopy: Homo- and hetero-nuclear 2D J-resolved NMR spectroscopy. 2D shift-correlated NMR spectroscopy: H,H-COSY, H,C-COSY, NOESY, ROESY, HMBC, HMQC and TOCSY experiments. Applications: NMR use as a tool for structure elucidation and stereochemical assignments.

### CH-7005 Advanced Mass Spectrometry

Introduction: Aims and scope, theory and basic terminology. Instrumentation: Instrumental design, ionization techniques, types of analyzers and detectors. Applications: Modes of fragmentation of various organic compounds, interpretation of mass spectra of unknown organic compounds.

### CH-7006 Advanced Polymer Chemistry

Mechanism and kinetics: Step growth, free radical

addition polymerization, ionic polymerization, Ziegler-Natta polymerization. Molecular weight determination: Different methods used to determine the absolute and relative molecular weights of polymers. Structure-property relationship. Reactions of synthetic polymers. Polymer degradation and stability: Special emphasis on thermal and photo-degradation. Polymer interactions. Polymer solutions: Expansion factor in solutions; physical parameters affecting the chain dimensions; theta conditions. Theories of polymer solutions; phase separation and fractionation; solubility parameters; criteria for solubility. The polymerization processes and techniques, polymer additives (plasticizers, stabilizers and fillers). Polymers characterization.

### CH-7007 Special Organic Materials

Organic dyes: Chromophore structure, synthesis of azodyes and cyanins, reactive vs. direct textile dyes, Chemiluminescence, photochromocs, color photography. Liquid Crystals: definition, classification: thermotropic/lyotropic, calamitic/discotic, nematic/smectic columnar, synthesis and orientation, liquid crystal displays (LCD's), liquid crystal polymers. Electronic materials: Types of organic semi-conductors, polyacetylenes, and polyparaphenylenes, band structure, synthesis, electroluminescence and light emitting diodes (LED's).

### CH-7008 Advanced Photochemistry

Principles of photochemistry: Primary and secondary chemical processes. Electron transfer in photochemistry: Collisional and coulombic modes, effect of temperature, eximers and exiplexes, the SET photochemistry, quantum yields. Kinetics and energetic of photochemical reactions: Mechanism of photochemical reactions, intersystem crossing, flash photolysis, mass spectrometric methods. Experimental methods in photochemistry: Low, medium and high pressure mercury lamps, resonance lamps, actinometers, phototubes, sources of high intensity flashes of light, laser and synchrotron radiations. Photolytic studies: Aqueous and non-aqueous systems, effects of radiations on solids. Applications in daily life and industry: Picosecond and femtosecond flash photolysis, Supramolecular photochemistry.

### CH-7009 Advanced Surface Chemistry

Solid-liquid interface: Wetting, heat of wetting, thermodynamic description of an interface, Gibbs-

Duhem equation for an interphase, Gibbs adsorption isotherm, adsorption from solutions (dilute, liquid mixtures, non-electrolytes, electrolytes, etc.) at solid-liquid interface, detergency and flotation. Study of liquid interfaces: Kelvin's and Laplace equations. Technical catalysis: Catalyst preparation techniques, catalytic reactors, supported metal catalysts, industrial applications of heterogeneous catalysts. Catalysis for steam-reforming, CO- & CO<sub>2</sub>-methanation, water-gas shift, Fischer-Tropsch synthesis reactions. Catalysts for syntheses of: ammonia, nitric acid, chemical fertilizers etc.

### CH-7010 Chemistry of Advanced Composite Materials

Introduction: Definitions and classification of composite materials, natural composites, property enhancement by reinforcement and orientation, matrix interface, synthetic fibers, processing of composites. Examples: Metallic, ceramic and polymeric matrices, interface reactions. Properties: Mechanical and thermal properties of composite materials, stress relaxation and creep studies, dynamical mechanical properties, toughening mechanisms and mechanical failure in polymeric composites.

### CH-7011 Advanced Applied Chemistry

The importance of chemical industries for the economic development of Pakistan; chemistry of ceramics and its processing; the agrochemical industry; chemistry of structural adhesives; dyes and pigments; chemistry of silicone technology; chemistry of fuel technology; corrosion; quality control (analytical and statistical). Various aspects of the energy and raw material supply, cost calculations to improve yield and to reduce pollution. Industrial techniques and quality control. Equipment for large-scale manufacturing. Conversion of a lab. process to a pilot plant and then plant procedure. Industrial catalysis. Inorganic and organic processes. Products of fermentation process. Preparation of chemical products from small molecules. Pesticides, herbicides and pharmaceuticals. The environmental impact of a process.

### CH-7012 Applied Environmental Chemistry

Atmospheric Chemistry: Atmospheric structure: Natural constituents, anthropogenic emissions and atmospheric pollution. Air quality criteria pollutants: Sources, dispersion models and sinks of atmospheric

pollutants. Measurement and monitoring methods: Gaseous pollutants and particulate matter in the atmosphere, dry and wet depositions. Photochemical smog-formation: Types and effects. Acid rain: Causes, effects and control. Ozone Chemistry: Stratospheric ozone production and depletion, causes and significance of ozone hole, catalytic and non-catalytic processes, effects of UV on the biosphere. Global warming: Green house gases, production, control and future trends of green house gases, consequences of global warming. Control management: Standards and legislation regarding the atmospheric pollution. Aqueous Chemistry: Aquatic environment: hydrological cycle, water quality criteria, physical, chemical and biological characteristics of water, utilization, contamination and protection of water resources, collection and preservation of water samples. Physico-chemical analysis of water: Fresh water bodies, stratification and turn-over. Water pollution: Soap, detergents and agricultural sprays. Water management: Policies and tools. Deposition of sediments: Trace metals in the hydrocycle and sediments, quantification of environmental impact in sediments.

### CH-7013 Nanochemistry

Nanomaterials: Classification; structure and bonding; size dependent properties of mater; arrangements in 3D, 2D and 1D. Specific heats and melting points of nano-crystalline materials. Semiconductor nanocrystals: Spinels; quantum dots. Alloy semiconductors and their synthesis. Metal nanoparticles, double layers. Nanoparticle stability; charge transfer. Optical properties: Light absorption by colloids; dielectric response; size effects, electron transfer; temperature effects. Magnetism: Magnetic susceptibility and permeability: diamagnetism; paramagnetism; Langevin model; quantum effects. Ferromagnetism, Curie-Weiss law. Antiferromagnetism: Ferri-magnetism. Magnetic anisotropy. Magnetic domains. Hysteresis. Super-paramagnetism. Nanomaterials synthesis: Chemical and catalytic aspects of nanocrystals. Nanotechnology: Synthesis techniques. Applications.

### CH-7014 Biophysical Chemistry

Thermodynamic aspects: Simple molecules, macromolecules, colloidal particles in solution. Bioenergetics: Association of biopolymers. Lipids and biological membranes: Membrane transport, membrane potential. Characterization of

macromolecules: Moving-boundary sedimentation, zonal sedimentation, density gradient sedimentation, viscosity measurement, electrophoresis, isoelectric focusing. Structure of proteins and nucleic acids: Folding/unfolding of proteins and nucleic acids. Enzymology: Kinetics of enzyme catalysis, mechanisms of enzyme catalysis. Experimental techniques: Protein NMR, MRI, X-ray crystallography of proteins, electron microscopy of macromolecular assemblies.

### CH-7015 Advanced Chemical Treatment of Textiles

This course includes the detailed study of different chemical treatments of textile materials including pre-treatments, coloration, modification along with comprehensive study of synthetic chemistry of different chemicals used in textile processing. The course also includes the characterization of treated textile materials using advanced analytical techniques.

### CH-7016 Advanced Textile Chemistry

Chromophore structure; synthesis and applications of azo, anthraquinones, phthalocyanines, vat, indigo polymethine and nitro dyes; Reactive vs. direct textile dyes, Chemiluminescence, photochromocs, color photography; high technology applications. Textile surface modifications; Multifunctional finishing; Textile surface characterization; Development of textiles for technical applications.



# FACULTY OF MANAGEMENT SCIENCES

## Introduction

The Faculty of Management Sciences is playing a colossal role in imparting quality education and meeting the requisites of the global management. The department invests in skills and education and help people to start and grow a business. The faculty aims at providing students with adequate learning, knowledge, skills and attitudes that ultimately enable them to have managerial as well as leadership qualities. We infuse the spirit of cooperation and team work among our learners to have a proactive nation. The Faculty comprises Department of Business Administration and Department of Textile Management. The designed curriculum and the faculty are equipped with the national and international teaching learning standards. We have tailored courses to assist managers in the world of business and textiles as well.

The Faculty offers graduate and post graduate programme like BBA Honors, BS-TMM, MBA and MS. We believe in motivation, innovation and analytical reasoning. Therefore, our focus is to have creative and interactive teaching learning experiences. We welcome the learners who are to put their steps into the world of business and textile professionalism, knowledge and wisdom. We ensure any possible assistance in having a successful life.

## MBA 3.5 Years (Including 2-Years BBS Degree)

### Introduction:

The students with 14 years of education will be required to complete 60 to 66 credit hours of business courses and earn a Bachelor of Business Studies (BBS) degree before they could become eligible for admission to MBA programme. In essence BBS is similar to old MBA (16 years) programme and is a subset of BBA 4-year programme. The underlying assumption is to have minimum of 6 credit hours in each functional area. BBS degree holder will be eligible for admission to MBA or MS programme. This programme is to produce business executive with the true picture and awareness of the business world to the students which holds bachelor degree i.e. B.A., B.Com, B.Sc. and equivalent degrees.

### Programme Objectives:

The programme objectives are:

1. To apply business concepts and theories to real-world decision-making.
2. To develop students' communicative, managerial, competitive skills and proactive thinking.

3. To equip students with the skills, understanding and know-how to succeed in the real world and economy.
4. To enable students understand global business and to solve diverse issues in business world.
5. To develop a solid work ethic and professional demeanor, as well as a commitment to ethical conduct and social responsibility.

## Eligibility Criteria for Admission

- 14-year of education (B.Com, B.A, B.Sc., etc.)      100% weightage

## Scheme of Studies BBS (Bachelor of Business Studies)

### Semester I

Code	Course Title	Cr. Hrs.
ACCT-3081	Financial Accounting-I	3
ECON-3082	Principles of Economics	3
MGT-3081	Management Theory & Practices	3
MIS-3072	Computer Application for Managers	3
MA-1004	Business Mathematics	3

### Semester II

Code	Subject Title	Cr. Hrs.
ACCT-3082	Financial Accounting-II	3
MKT-3081	Fundamentals of Marketing	3
BUS-3085	Managerial Communications	3
ECON-2082	Principles of Macro Economics	3
HRM-3084	Human Resource Management	3

### Semester III

Code	Subject Title	Cr. Hrs.
MA-2003	Statistics for Business	3
FIN-2081	Business Finance	3
MGT-3082	Organizational Behaviour	3
MKT-2082	Marketing Management	3
ACCT-3083	Cost Accounting	3

### Semester IV

Code	Subject Title	Cr. Hrs.
FIN-3082	Financial Management	3
MIS-3082	Management Information System	3
BUS-3085	Business Research & Report Writing	3
MGT-4085	Entrepreneurship	3
LAW-3081	Business & Corporate Law	3



## MBA / MS (1.5 Years)

### Eligibility Criteria for Admission

- |   |               |
|---|---------------|
| • BBA (4 Years),BSTMM(4 Years) BBS, M.Com or Equivalent | 70% weightage |
| • NTU Admission Test                                    | 10% weightage |
| • Interview   | 20% weightage |

### Programme Objectives

The programme objectives are:

- To develop in students the skill of analysis, synthesis, and evaluation in the context of business decisions.
- To provide students with the knowledge of theoretical and practical aspects of the operation of the various types of business organizations.
- To develop an awareness in the changing and integrated nature of business problems and the ability to explore and deal with those problems.
- To develop the ability to identify and evaluate the ethical, global, and societal implications of doing business as an organization.
- To develop in pupils the importance of research orientation and focus on academic research having practical applications in real life.

### Programme Duration

It is 1 ½-Year program spread over 3 semesters. Each semester has at least 18 weeks including one week for mid semester and one week for end semester examination.

\* First two years (Four Semesters) for BBS degree and last (1.5 Years) for MBA programme spread over three semesters.

## Programme Structure

The scheme of studies for MBA/MS Business Administration is as under:

### Semester I

Code	Course Title	Cr. Hrs.
MGT-6091	Advance Research Methods	3
MGT-6092	Strategic Finanace	3
MGT-6093	Strategic Marketing	3
MGT-6094	Organization Theory & Design	3
	Total	12

### Semester II

Code	Course Title	Cr. Hrs.
MGT-6095	Project Management	3
MGT-6096	Leadership and Organizational Behavior	3
	Elective	3
	Elective	3
	Total	12

### Semester III

Code	Course Title	Cr. Hrs.
	*Elective	3
	*Elective	3
	Elective	3
	Elective	3
	Total	12
Total Credit Hours of the Programme		36

\*Instead of electives, Research Thesis of 6 credit hours is compulsory for MS students.



## Course Contents

### MGT-6081 Business Economics

This course aims at imparting knowledge of basic economic principles to the business students. It covers micro-and macroeconomic issues that are essential for managers and professionals. The course starts with basic microeconomic concepts such as demand, supply, elasticity's, production and cost. Having established the solid ground of the basics of microeconomics, parts of macroeconomics including national income accounts, aggregate demand, aggregate supply, concepts of inflation and unemployment, major macroeconomic policy operations will be dealt with. After completing the course the students will be able to apply principles of economics to solve economic problems being faced by both public and private sectors of Pakistan.

### MGT-6082 Business Math and Stats

The scope of the course is to see the horizon of Mathematics & Statistics application in business and financial affairs. The course stresses business applications using arithmetic, algebra, and ratio-proportion and graphing. Applications include payroll, cost-volume-profit analysis and merchandising mathematics. The course also includes Statistical Representation of Data, Correlation, Time Series and Exponential Smoothing, Elementary Probability and Probability Distributions. This course stresses logical reasoning and problem solving skills.

### MGT-6083 Financial Accounting

The primary aim of Financial Accounting is to provide students with an introduction to the process and function of financial reporting. Whilst a large proportion of the course is aimed at understanding accounting as a process, taking a preparers' perspective, we will also seek to develop an understanding of the importance of the role of accounting in today's society.

### MGT-6084 Marketing Management

Marketing management course is geared toward providing an understanding of the rationale for marketing decisions from a managerial perspective and the manipulation of marketing mix to achieve business goals. Practically marketing management encompasses activities such as demand creation and Stimulation, positioning, product differentiation, and product and brand management among others. All these activities involve planning, analysis, and decision-making. This course will require the

integration of theory and practice. Students will have to make strategic marketing decisions based on analytical techniques they have learned in this course. They will have to devise a marketing plan that is based on a sound conceptual framework, and with a focus on its practical applicability.

### MGT-6085 Theory and Practice of Management

This is an introductory course about the management of organizations. It provides instructions on principles of management that have general applicability to all types of enterprises; basic management philosophy and decision making; principles involved in planning, organizing, leading, and controlling; and recent concepts in management. The principles learned in this course will allow the student to effectively work with and through others in an organization. The course will also encourage the students to explore and inquire the applicability of western management principles and theories in local settings. Besides, the course will discuss the Islamic perspective of managing businesses and organizations.

### MGT-6086 Financial Management

Financial Management course aims at imparting knowledge about the fundamental concepts and tools of financial management. It emphasizes the importance of financial management skills to individuals and enterprises. You are expected to gain an initial understanding of the finance function in an organization, the role of the finance manager and the financial environment in which the firm operates. The financial environment covers the understanding of financial and capital markets along with the broad orientation of macroeconomic factors affecting the business. The emphasis will remain on developing the skills for planning, appraising and evaluating the investment, financing and operating decisions.

### MGT-6087 Human Resource Management

This course is basically designed to provide students the basic understanding of key HRM functions, which include HR planning, recruitment & selection, compensation, performance evaluation, and training & development. Since human resource provides a competitive advantage that ultimately has a vital role in success and effectiveness of any organization, this course emphasizes on the understanding of the basic concepts of managing human resource and their applications in today's organizations. The course is designed to help the students understand if western

human resource management theories and practices have any relevance to the local settings. The course will also discuss the Islamic perspective of managing human resource. It will shed light on the basic tenets of human resource management given by Qura'n and Sunnah. The students will also be encouraged to compare and contrast the human resource practices suggested in their text books and the practices critical for achieving success from indigenous perspective.

### **MGT-6088 Business Law**

The course basically deals with the introduction of those commercial laws which are directly or indirectly related to Business. It includes a short study of contract law, partnership Act, companies' ordinance and Negotiable instrument. The emphasis in this course is to introduce the students with the basic concepts of conventional business law and its implementation in the contemporary financial institutions. The course is outlined in such a way to show the basic philosophy of conventional Business Law along with some example from case study.

### **MGT-6089 Business Communication**

This course enhances your communication skills. It further builds on the experience and exposure necessary to develop outstanding presentations & communication talents. It examines the theoretical and practical concepts of public speaking. The course will also help you to create a standing and authority through well applied dialectic.

### **MGT-6090 Business Research Methods**

This course is designed to give an overview of the principles and methods of business research: identification of research question, development of theoretical framework and model, securing the respondents, making a test investigation, sampling, collecting data, types and errors of collected data, tabulating and analyzing the information, interpreting the findings and stating the conclusion through a series of class projects. Practical experience is offered to the students on how research techniques and procedures are applied to solve the business problems. This course is also designed to encourage the students to explore the application of theories that have been predominantly developed in Western cultures by using different research method techniques. An understanding of the relevance of Western research for local practice would help students to explore various business related problems and their plausible solutions

from indigenous perspective. The course will also help the students in understanding the importance of the business research as a management decision tool and in dealing with various business-related theoretical and applied problems.

### **MGT-6091 Advance Research Methods**

This course emphasis is on the research design, instrument development, data collection techniques and methods of evaluation in applied settings. Additionally to business research methodology contents, students also become of familiar with the policy implications of business research outcomes. It is intended to introduce students' ways of conceptualizing problems, designing research, collecting data, and interpreting those data. It also examines implications and consequences of choices among alternative approaches. On the successful completion of this course students should be able to acquaint with research processes and assumptions and they can introduce alternative methods and logics of inquiry which will make students more discriminating consumers of others' research and promote the development of their research. They will develop research skills which will be required for planning and executing research projects, including; conducting literature review, articulating research questions, justifying a research approach and methodology, designing a study and selecting specific methods and techniques appropriate for answering the questions and conducting data collection, analyzing data and presenting research results. The key topics includes, research methods in management sciences, research problems and how to explore them and how to conduct literature search, research paradigms and approaches-assumptions of positivist, interpretive and critical approach, quantitative research methods, survey based research, statistical modeling techniques, selecting statistical packages tutorials (SPSS etc), qualitative research methods, ethnographic research, cross-paradigm and multi method research, writing the research proposal and structure, from research question to research design-justifying the methodology and writing strategies.

### **MGT-6092 Strategic Finance**

The aim of this course is to examine the theoretical underpinnings of corporate finance and see how they are applied. The material is a continuation of what was taught in the first year Financial Management course. There will be more emphasis on "how corporate financing is really done'. The emphasis of Financial

Management course was on skill development while this course emphasis is on theoretical and conceptual understanding of financial management function and its application in real life scenario.

### **MGT-6093 Strategic Marketing**

Strategic Marketing Management is an advance level Marketing course. The aim of the course is to develop a strategic thinking approach to marketing. It aims to help students understand how companies compete using marketing strategy and its correlates focusing on achieving a competitive advantage for the firm by creating customer value and leveraging the firm's marketing resources in the most efficient and effective manners. It builds upon the basic concepts of Marketing, which the students have learned in their previous marketing courses and to prepare students to grasp the complex issues of specialized courses like Business policy, etc. In this course students are exposed to a dynamic world of marketing activities using a number of approaches and to enable the students to understand the practical issues that are critical to develop performance orientation. Principles, concepts and analytical tools are taught employing real life examples from both Pakistan's and international corporate world. This will enable the students to develop skills and competency to apply analytical tools and develop appropriate strategic marketing plans and manage its implementations. After taking this course students are better equipped, both mentally and academically; they understand various terms and concepts and understand how and when to apply them. It prepares them to take on the real life challenges and to add value to the organization for which they will work.

### **MGT-6094 Organization Theory & Design**

Business is changing at break-neck speed so managers must be increasingly active in reorganizing their firms to gain a competitive edge. Organizational Theory, Design, and Change continue to provide students with the most up-to-date and contemporary treatment of the way managers attempt to increase organizational effectiveness. Organization theory and design gives us the tools to evaluate and understand how a huge, powerful firm like Lehman Brothers can die and a company like Bank of America can emerge almost overnight as a giant in the industry. It enables us to comprehend how a band like the Rolling Stones, which operates like a highly sophisticated global business organization, can enjoy phenomenal success for nearly half a century, while others with equal or

superior talent don't survive. Organization theory helps us explain what happened in the past, as well as what may happen in the future, so that we can manage organizations more effectively.

### **MGT-6095 Project Management**

Projects have been part of the human scene since civilization started, yet the practice of project management is quite recent. The concepts and tools required to plan, organize, implement, and evaluate a project are equally applicable to such diverse ventures as launching of a space shuttle, developing curriculum in primary education, or organizing a trekking trip to the K-2 base camp. The purpose of this course is to expose students to the real-life issues in project management, and equip them with necessary tools to resolve these issues. Use of quantitative techniques is supplemented by softer skills of leadership and human resource management.

### **MGT-6096 Leadership and Organizational Behavior**

Organizational behavior (OB) is an interdisciplinary field drawing from numerous disciplines including psychology, sociology, anthropology, economics, organization theory, statistics, and many others. Effective management of human resources within organizations requires an understanding of various behavior and processes. Managers need to know why people behave as they do in relation to their jobs, their work groups and their organizations. This knowledge of individuals' perceptions, motivational attitudes and behavior will enable managers to not only understand themselves better, but also to adopt appropriate managerial policies and leadership styles to increase their effectiveness. The focus of instruction will move progressively through the individual, group and organizational levels of behavior and will examine the interrelationships of behavioral phenomena among these levels. Additionally, concepts such as motivation, communication and leadership and their relevance to organizational behavior will be examined in detail. The course is also designed to help the students understand if Western Organizational Behavioral theories and practices have any relevance to the local settings. The course will also discuss the Islamic perspective of understanding and directing human behavior in a specific direction.

## 1. MS Programmes

### 1.1 Course/Research Project Registration

Students shall be required to register for the courses/research projects before the start of each semester as announced by the university. Any change in course registration shall be allowed only in the first two weeks of the semester. A regular student is required to take 9 credit hours per semester. However, a student can take maximum 12 credit hours, if she/he is graduating in that semester.

### 1.2 Withdrawal of Course(s)

- 1.2.1 A Student, with the permission of the incharge graduate studies and research may be allowed to withdraw a course/s within 10 weeks of the commencement of semester.
- 1.2.2 Students shall be awarded grade "W" for the respective course/s if withdrawn within the 10 weeks of the semester with prior permission from the University.
- 1.2.3 Course/s withdrawn within 10 weeks shall be recorded on the transcript with a grade "W".
- 1.2.4 Non attendance will not constitute an official withdrawal.

### 1.3 Attendance Requirement

Students shall be required to maintain a minimum of 75% of class attendance in each course, adhere to the university academic calendar and attend regularly all lectures, seminars, discussions and field work as may be specified for a course in a semester. Failure to meet attendance requirement shall render the students ineligible for appearing in the final examination of the concerned course and "F" grade shall be awarded for the course.

### 1.4 Academic Evaluation

Formative feedback on coursework will be given on regular basis. In order to give appropriate feedback, all assignments submitted by deadlines, will be returned to the students within the specified period. The following shall be scheduled during a semester for the purpose of academic evaluation of students:

Quiz Tests:	Quiz tests shall be conducted at irregular intervals through the semester, with or without intimation.
Assignments:	Assignments relative to the course shall be given during the semester.
Mid Semester Exam:	A 2-hour written test shall be conducted during the semester after 8 week of studies.
End Semester Exam:	A 2-3-hour written test shall be conducted at the end of 16 weeks of studies.
Projects:	Project is a research work aimed at assessing the ability of a student to translate the theoretical knowledge acquired during the academic programme into practical use to create new knowledge/product/process for the benefit of the mankind and economical development of the country.

The weightage of the examinations quizzes and assignments shall be as under:

- Quizzes/Assignments 30 %
- Mid-Semester Examination 30 %
- End-Semester Examination 40 %

End semester examination is mandatory, irrespective of the total marks obtained in quizzes, assignments and mid semester examination.

The performance of students in a course of study is graded as follows:

Grade	Grade Point	Percentage	Description
A	4.00	85 & above	Excellent
B+	3.50	80-84.9	Very Good
B	3.00	75-79.9	Good
C+	2.50	70-74.9	Above Average
C	2.00	65-69.9	Average
D+	1.50	60-64.9	Below Average
D	1.00	50-59.9	Pass
F	00.00	Below 50	Fail
I			Incomplete
W			Course Withdrawn

Computation of semester grade point average (GPA) and cumulative grade point average (CGPA)

$$\text{GPA} = \frac{\text{Sum over Courses in Semester (Course Credit Hours x Grade Point Earned)}}{\text{Total Semester Credit Hours}}$$

Semester Grade Point Average (GPA) and Cumulative Grade Point Averages (CGPA) will be calculated using the following relationships:

$$\text{CGPA} = \frac{\text{Sum over all taken Courses in all Semesters (Course Credit Hours x Grade Point Earned)}}{\text{Total Credit Hours Taken in all Semester}}$$

## 1.5 Unfair Means in Examination

Any student found cheating or using unfair means in the examination (mid/final exams, quizzes, assignments, practicals and research projects) will be dealt severely which may lead to expulsion from the university. The university regulations relating to the use of Unfair-Means and Academic Dishonesty in the Examinations-2016 will be applicable to such cases.

## 1.6 Repetition of Courses

Students may repeat the courses in which they obtained an F, D, D+ or C grade. In such case, all grades achieved by the student shall appear on the transcript. The cumulative grade point average for a semester shall be calculated by substituting old grades with the grades obtained after repetition of courses. The students are not allowed to repeat courses for improvement of grades except probationer students with D, D+ and C grades.

## 1.7 Incomplete Research Project

An "I" grade is given to a student in a research project, if the student does not complete project requirements within the prescribed time-limits, and the supervisory committee is satisfied that it was because of the circumstances beyond the control of the student. Incomplete grade "I" shall not be considered in GPA/CGPA calculations. However, it is the responsibility of the student to complete the remaining work of the research project in the given time period, failing which the "I" grade shall be converted to "F" grade.

## 1.8 Make-up Examination

If a student fails to appear in the Mid Semester or End Semester Examination due to unavoidable circumstances that is the death of blood relations (Parents, Grandparents, brother or sister), Personal severe accident, or illness

(hospitalization) (onus of proof entirely on the student) but otherwise complies with other course requirements such as attendance, completion of assessment activities, then on the recommendations of the course(s) teacher(s) and In charge of the programme. The make-up examination may be arranged after the approval of make-up examination committee duly constituted by the competent authority of the university. Any such examination, if allowed, shall be held within three weeks of the examination of which the student is defaulter.

## 1.9 Semester Drop Rules

If a student drops a semester with the prior permission and approval of the university in the first week of the semester the tuition fee shall be refunded. Students dropping semester after the first week shall not be allowed to get any refund. If a student drops a semester without formal approval of the university, his/her admission shall stand cancelled.

## 1.10 Promotion Rules

The minimum requirement for promotion to the second semester of the programme shall be SGPA of 1.00 in the first semester. If a student obtains SGPA less than 1.00 in the first semester, he/she shall be ceased to be on the roll of the university and shall not be eligible for the admission in the same programme of the University in future.

## 1.11 Probation Rules

For graduation, the minimum qualifying CGPA is 2.50. Whenever a student's CGPA is below 2.50 in any semester, the student will be on 1st probation. If the student does not improve/maintain to CGPA 2.50 in any subsequent semester, he/she will be on final probation. If the student does not come out of the final probation by achieving the minimum CGPA of 2.50 in the next regular semester, the student shall be expelled and cannot be re-admitted in the programme.

## 1.12 Degree Requirements

The students of M.Sc. Textile Engineering, M.Sc. Advanced Materials Engineering, MS in Computer Science and MBA/MS Business Administration must have a minimum CGPA of 2.50/4.00 to achieve the degree of their respective programmes.

# 2. PhD Programmes

## 2.1 Course Work

### 2.1.1 Semester Schedule

- Registration and orientation 1 day
- Classes 8 weeks
- Mid-Semester Examination 9th week
- Classes 8 weeks
- Final Examination 18th week
- Semester Break 2 weeks

### 2.1.2 Medium of Instructions

- The medium of instructions as well as of examinations shall be English.
- The student should have good English reading, writing and speaking skills.

### 2.1.3 Course Work Load

- The PhD candidate has to take PhD level course work of 18 credits.
- The candidate shall choose the elective courses with the consent of his/her PhD Supervisors.
- The course contents shall be proposed by the concerned Faculty Board of Studies, recommended by the Advanced Studies & Research Board and approved by the Academic Council.
- All courses given in PhD programme will be designated by 700.
- One credit hour stands for at least one hour class contact per week per semester. For practical/lab work, 3 contact hours shall be considered equivalent to one credit hour.

### 2.1.4 Attendance Requirement

- In order to be eligible to sit in the end semester exam, a student must have attended minimum 75% of the lectures.

### 2.1.5 Residency Requirement

- Ph.D. programme comprises full-time course work and research work.
- Study leave is mandatory for in-service candidates enrolled in Ph.D.

### 2.1.6 Examination, Grading and Evaluation of Course Work

- There shall be two examinations for each course (mid-semester and end-semester) along with quizzes/ assignments/seminars, etc.
- The break-up of the marks in each course will be as follows:
  - o Mid-semester examination 30%
  - o Assignments/quizzes/seminars etc. 30%
  - o End-semester examination 40%.
- The results of each course shall be submitted within one week of the examination.
- The results shall be notified by the Controller of Examination (COE) within one week of the examination.
- The student must obtain a minimum grade point 2.50/4.00 in each subject throughout the course work and maintain a minimum CGPA of 2.50/4.00.
- If a student obtained less than 2.50/4.00 grade point, he/she may be allowed to repeat the course(s) for one time only.
- If a student still fails to obtain a grade point of 2.50, he/she will be removed from the roll of the university.

### 2.1.7 Grading System

Grade	Grade Point	Percentage	Description
A	4.00	85 & above	Excellent
B+	3.50	80-84.99	Very Good
B	3.00	75-79.99	Good
C+	2.50	70-74.99	Above Average
C	2.00	65-69.99	Average
D+	1.50	60-64.99	Below Average
D	1.00	50-59.99	Pass
F	0.00	Below 50	Fail
I	-	-	Incomplete
W	-	-	Course withdrawn

Any fraction of marks in a course shall be up to 2 digits.

## 2.1.8 Comprehensive Examination

- On successful completion of the coursework, there will be a comprehensive examination within next semester of the completion of the course work.
- It shall consist of Written and Oral Examinations (70% : 30%).
- Student shall chose three courses from the courses he/she has taken during course work, minimum one course shall be chosen from the core course and minimum one from the elective courses.
- The examination committee will consist of Dean FET/FOS, Controller of Examination and two teachers whose subjects have been chosen by the student.
- The written examination shall be of two hours containing three equal parts from the chosen subjects.
- Oral examination will be conducted by the examination committee within one month of qualifying Written Exam.
- To pass the comprehensive examination minimum 70% marks are required.
- In case the student fails in the first attempt, one more chance will be given to pass the comprehensive examination within the next two months. If a student does not qualify the comprehensive examination in the second attempt, he/she will be dropped out from the PhD programme.
- The course work and comprehensive exam must be completed within initial two years of the programme.

## 2.2 Research Work

### 2.2.1 Synopsis

- After successfully passing the comprehensive examination, a student shall prepare a synopsis/research proposal for PhD research work within maximum of the next 3 months according to the guidelines for synopsis write up prepared by the university.
- Before beginning the practical research work, the student must successfully defend his/her synopsis through presentation before the ASRB.
- In case of changes in the scope of the research during research work, approval shall be sought on the prescribed form from the ASRB.

### 2.2.2 Research

- The research work will be of 30 Credits.
- Minimum one research paper should have been published in HEC approved journal before submission of thesis/dissertation for defence.

### 2.2.3 Progress Report

It shall be mandatory for the researcher to submit detailed biannual progress report by the end of each semester through his/her supervisors to the Controller of Examination for onward transmission to ASRB for evaluation.

### 2.2.4 Thesis Writing

- The PhD thesis must be written in British English as per the recommended format.
- The thesis must afford evidence of originality and have a distinct contribution to knowledge, shown by the discovery of new facts/knowledge.
- It must not include research work for which degree has been conferred on anybody in this or any other university.

## 2.2.5 Appointment of Examiners

- The ASRB will recommend to the Rector/VC a panel of external examiners, 3 local and 3 foreign from technologically advanced countries, for evaluation of PhD thesis.
- The Rector/VC shall appoint 1 national and 2 foreign external examiners out of the recommended panel for thesis evaluation.

## 2.2.6 Thesis Evaluation

- The Controller of Examination (COE) shall get the thesis evaluated within maximum of 6 months after the date of submission to his office. Before forwarding the thesis to the examiner, COE will arrange to subject the thesis to plagiarism test.
- If any of the examiners suggests minor modifications/revision, this should be incorporated by the students within 3 months and certified by the supervisors.
- No viva voce will be held unless all the examiners recommend the thesis for defence.
- If any of the examiners finds that the thesis is wholly inadequate or requires major modifications, the candidate will be asked for additional research work for maximum one year.
- The same examiner, who suggests modification of the thesis, shall evaluate the revised version of the thesis.

## 2.2.7 Final Thesis Defence

- The Final Defence may be open to the public.
- The scholar shall be required to undergo a viva-voce examination to be conducted by a panel comprising three examiners (two external and one internal) appointed by the Rector/VC from a list recommended by the ASRB.
- If a scholar fails to satisfy the examiners in the viva-voce, they shall direct the scholar to defend the thesis for the second time within a period of 6 months.
- If the scholar passes the viva-voce, the executive committee/syndicate, on the recommendations of the ASRB, will approve the reports of the examiners for the thesis and oral examination and award of the degree of DOCTOR OF PHILOSOPHY on the relevant subject to the candidate.

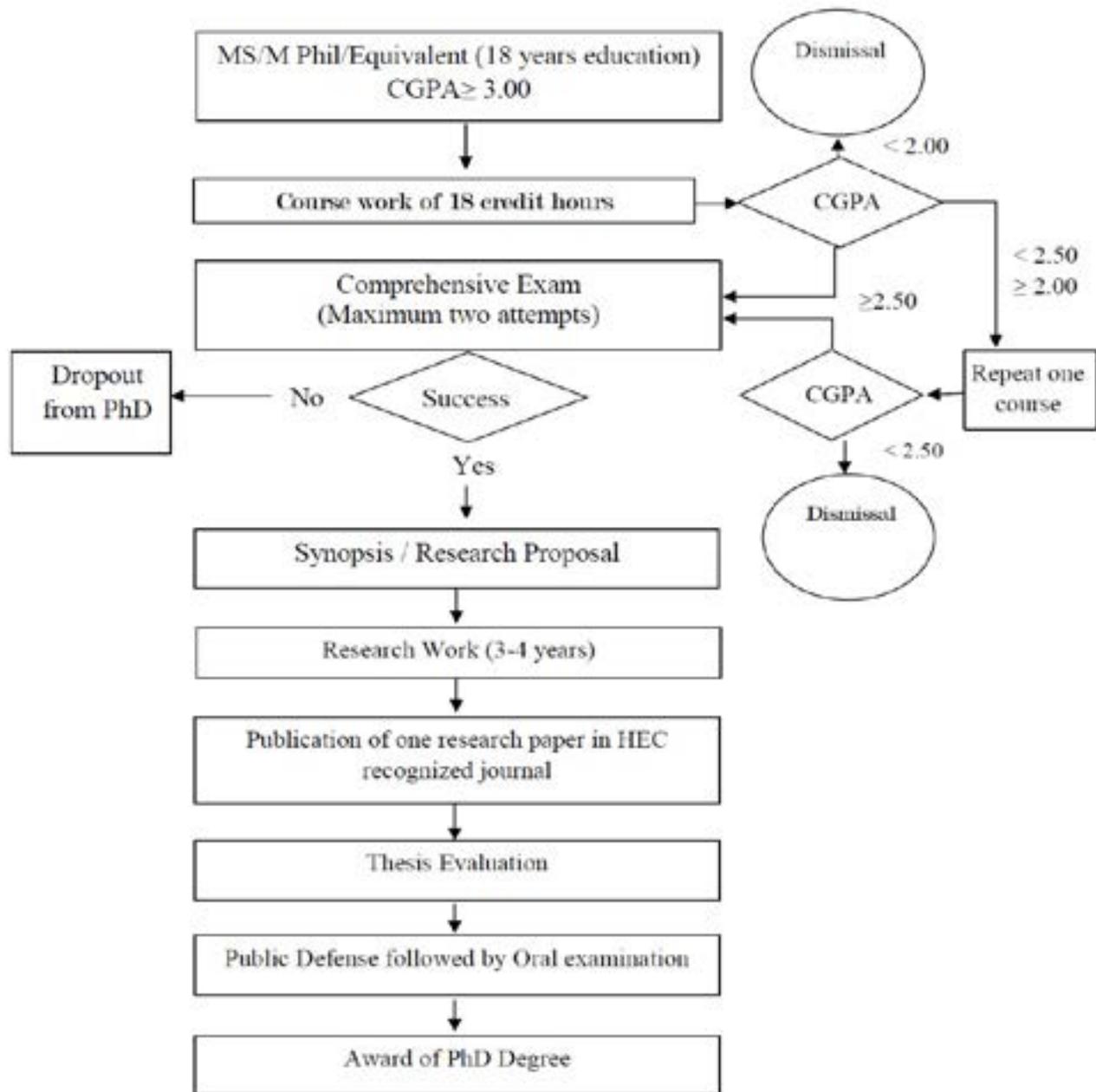
## 2.3 Ph.D. Duration

- The minimum period for completion of PhD programme shall be 4 years, one year for 18 credit hours course work and three years for research. The period shall be counted from the commencement of semester for 18 credit hours course work.
- The maximum permissible period for submission PhD thesis will be 5 years. After 5 years, the scholar shall cease to be the student of the university and shall not be eligible for readmission.

## 2.4 Cancellation of PhD Registration

- PhD registration shall be cancelled by the Controller of Examination on the recommendation of the ASRB followed by the approval of the Rector/Vice-Chancellor, if the scholar:
  - o Earns two consecutive adverse feedbacks from the ASRB on his progress report.
  - o Does not complete the course work with the required CGPA.
  - o Does not qualify the comprehensive examinations even in the second attempt.
  - o Does not meet 75% attendance criteria.
  - o Is guilty of misconduct.
- The aggrieved scholar may file an appeal against the cancellation of PhD registration to the Academic Council within a period of 30 days. Academic Council will give him/her an opportunity to be heard in person. However, the decision of the Academic Council will be final and will not be questioned in any court of law.

## 2.5 Flow Chart for Award of PhD Degree



# Fee Structure

## MS Textile, MS Advanced Materials Engineering, MS Computer Science & MS Math

FEE TYPE	Semester-wise Amount in PKR			
	1st	2nd	3rd	4th
Tuition Fee	27000	27000	18000	18000
Admission Fee	20000	-	-	-
Degree Fee	-	-	-	5000
Certificate Verification Fee	2000	-	-	-
Processing Fee	-	5000	-	-
University Security	5000	-	-	-
Red Crescent Donation	100	-	-	-
University Card Fee	300	-	-	-
Library Fee	1000	1000	1000	1000
Examination Fee	3000	3000	3000	3000
Medical Fee	2000	2000	2000	2000
Student Activity Fund	2000	2000	2000	2000
Endowment Fund	1000	1000	1000	1000
Transport Fee*	5000	5000	5000	5000
<b>TOTAL</b>	<b>68400</b>	<b>46000</b>	<b>32000</b>	<b>37000</b>

## PhD Textile Engineering, PhD Computer Science & PhD Chemistry

FEE TYPE	Semester-wise Amount in PKR							
	1st	2nd	3rd	4th	5th	6th	7th	8th
Tuition Fee	27000	27000	18000	18000	18000	18000	18000	18000
Admission Fee	20000	-	-	-	-	-	-	-
Degree Fee	-	-	-	-	-	-	-	5000
Certificate Verification Fee	2000	-	-	-	-	-	-	-
Processing Fee	-	5000	-	-	-	-	-	-
University Security	5000	-	-	-	-	-	-	-
Red Crescent Donation	100	-	-	-	-	-	-	-
University Card Fee	300	-	-	-	-	-	-	-
Library Fee	1000	1000	1000	1000	1000	1000	1000	1000
Examination Fee	3000	3000	3000	3000	3000	3000	3000	3000
Medical Fee	2000	2000	2000	2000	2000	2000	2000	2000
Student Activity Fund	-	-	-	-	-	-	-	-
Endowment Fund	-	-	-	-	-	-	-	-
Transport Fee*	5000	5000	5000	5000	5000	5000	5000	5000
<b>TOTAL</b>	<b>65400</b>	<b>43000</b>	<b>29000</b>	<b>29000</b>	<b>29000</b>	<b>29000</b>	<b>29000</b>	<b>34000</b>

\* There is no Transport Fee for Hostel Resident but they will pay hostel charges

## MBA (3.5 Years) including BBS (2-Years)

FEE TYPE	Semester-wise Amount in PKR						
	1st	2nd	3rd	4th	5th	6th	7th
Tuition Fee	27500	27500	27500	27500	27500	27500	27500
Admission Fee	20000	-	-	-	-	-	-
Degree Fee	-	-	-	-	-	-	5000
Certificate Verification Fee	2000	-	-	-	-	-	-
Processing Fee	-	5000	-	-	-	-	-
University Security	5000	-	-	-	-	-	-
Red Crescent Donation	100	-	-	-	-	-	-
University Card Fee	300	-	-	-	-	-	-
Library Fee	1000	1000	1000	1000	1000	1000	1000
Examination Fee	3000	3000	3000	3000	3000	3000	3000
Medical Fee	2000	2000	2000	2000	2000	2000	2000
Student Activity Fund	2000	2000	2000	2000	2000	2000	2000
Endowment Fund	1000	1000	1000	1000	1000	1000	1000
Transport Fee*	5000	5000	5000	5000	5000	5000	5000
<b>TOTAL</b>	<b>68900</b>	<b>46500</b>	<b>41500</b>	<b>41500</b>	<b>41500</b>	<b>41500</b>	<b>46500</b>

## MBA / MS (1.5 Years)

FEE TYPE	Semester-wise Amount in PKR		
	1st	2nd	3rd
Tuition Fee	36000	36000	36000
Admission Fee	20000	-	-
Degree Fee	-	-	5000
Certificate Verification Fee	2000	-	-
Processing Fee	-	5000	-
University Security	5000	-	-
Red Crescent Donation	100	-	-
University Card Fee	300	-	-
Library Fee	1000	1000	1000
Examination Fee	3000	3000	3000
Medical Fee	2000	2000	2000
Student Activity Fund	2000	2000	2000
Endowment Fund	1000	1000	1000
Transport Fee*	5000	5000	5000
<b>TOTAL</b>	<b>77400</b>	<b>55000</b>	<b>55000</b>

\* There is no Transport Fee for Hostel Resident but they will pay hostel charges

## Refund Policy

Students who desire to leave their studies from the university will be refunded the dues as per existing refund policy of HEC, Islamabad according to the following rules:

1. If any student applies for the refund of university dues paid by him/her up to 7th day of commencement of classes, he/she will be refunded full (100 %) deposited dues except the admission fee of Rs. 20,000/- (Subject to clearance from all the departments).
2. If any student applies for the refund of deposited university dues from 8th to 15th day of commencement of classes, then he/she will be refunded security deposited and half (50%) fee (Subject to clearance from all the departments).
3. If any student applies for the refund of paid university dues from 16th day of the commencement of classes, only his/ her amount of security will be refunded (Subject to clearance from all the departments).
  - I % age of fee shall be applicable on all components of fee, except for security and admission charges.
  - II Time line shall be calculated continuously, covering both weekdays and weekend.

# University Management

## Rector

**Prof. Dr. Tanveer Hussain**

Tel: 041-9230099

Tel: 041-9230081-85, Ext: 102

rector@ntu.edu.pk

## Dean Academics

**Prof. Dr. Muhammad Tahir Hussain**

Tel: 041-9230081-90, Ext: 138

mtahirhussain@ntu.edu.pk

## Dean Faculty of Engineering & Technology

**Zafar Javed**

Tel: 041-9230081-90, Ext: 212

## Dean Faculty of Science

**Dr. Zahid Rizwan**

Tel: 041-9230081-90, Ext: 159

## Registrar

**Prof. Dr. Muhammad Ashfaq**

Tel: 041-9230097

Tel: 041-9230081-90, Ext: 158

## Controller of Examinations

**Muhammad Zabihullah Khan**

Tel: 041-9230093

Tel: 041-9230081-90, Ext: 127

admission@ntu.edu.pk, coe@ntu.edu.pk

## Director Finance

**Zulfikar Ahmad**

Tel: 041-9230092

Tel: 041-9230081-90, Ext: 121

## Director Quality Assurance

**Muhammad Nisar Bhatti**

Tel: 041-9230094

Tel: 041-9230081-90 Ext: 125

## Student Advisor

**Muhammad Farooq Jamal**

Tel: 041-9230078, 041-9230081-90, Ext: 128

## Librarian

**Mushtaq Ahmad**

Tel: 041-9230081-90 Ext: 150

## Chairman Department of Yarn Manufacturing

**Uzair Hussain**

Tel: 041-9230081-90, Ext: 181

## Chairman Department of Weaving & Knitting

**Muhammad Ayub Asghar**

Tel: 041-9230076

Tel: 041-9230081-90, Ext: 211

## Coordinator Department of Textile Processing

**Muhammad Saif Maqsood**

Tel: 041-9230081-90, Ext: 208

## Chairman Department of Garment Manufacturing

**Saad Ullah Channa**

Tel: 041-9230081-90, Ext: 212

## Chairman Department of Polymer Engineering

**Hammad Mohsin**

Tel: 041-9230081-90, Ext: 210

## Coordinator Department of Material & Testing

**Khurram Shahzad Akhtar**

Tel: 041-9230081-90, Ext: 108

## Chairman Department of Computer Science

**Waqar Ahmad**

Tel: 041-9230081-90, Ext: 140

## Chairman Department of Applied Sciences

**Dr. Zulfiqar Ali Raza**

Tel: 041-9230081-90, Ext: 130

## Chairman Department of Design

**Umer Hameed**

Tel: 041-9230081-90, Ext: 230

## Chairman Department of Business Administration

**Liaquat Ali**

Tel: 041-9230081-90, Ext: 162

## Main Telephone Exchange

Tel: (+92-41) 9230081-90

Fax: (+92-41) 9230098

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For admissions please contact  
The Admission Office  
**National Textile University**  
Sheikhupura Road, Faisalabad -37610

Tel: 041-9230081-90 Ext. 250, 251  
Fax: 041-9230098  
[www.ntu.edu.pk](http://www.ntu.edu.pk)