In The Name of Allah the Most Beneficent, the Most Merciful
# Graduate Admission (Fall-2019)

## Contents

- Welcome Message from the Rector 3
- The University 5
- The Momentous City of Faisalabad 6
- Aims and Objectives 7
- Facilities 8
- **FACULTY OF ENGINEERING & TECHNOLOGY** 10
  - MS Textile Engineering 13
  - MS Advanced Materials Engineering 14
  - MS Textile Technology 18
  - MS Textile Chemistry 31
  - MS Advance Clothing & Fashion 36
  - MS Polymer Science & Engineering 39
  - PhD Textile Engineering 46
  - PhD in Advanced Materials 49
- **FACULTY OF SCIENCE** 52
  - MS Computer Science 53
  - PhD Computer Science 60
  - MS Mathematics 66
  - MS Physics 77
  - PhD Chemistry 90
- **FACULTY OF MANAGEMENT SCIENCES** 96
  - MS Business Administration (Thesis Based Program) 97
  - MBA (Project Based Program) 98
  - Academic Rules for MS Programs 100
  - Academic Rules for PhD Programs 102
  - Fee Structure 107
  - University Management 110
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 programs in relevant, emerging fields for the people of Pakistan and the wider world.
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 Sheikhupura 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.
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
• Web Apps like Faculty Profiles, Course Evaluation, Distributed Websites and Email Management
• Dream spark 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 Twenty-Four Thousands information resources in textile engineering and allied disciplines. The library subscribed Thirty-Four national and international 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.

NTU library is one of the few in the country that has implemented standardized integrated software for library automation (Library World, Online Version) developed by CASPR Inc., USA. The library provides electronic services through an electronic services lab that has ten computers. The library web pages provide information about its staff, rules & regulations, information services, collection, NTU student’s projects, CD Rom’s, 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 also 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 3 books for 21 days.
- Faculty Members can borrow 15 books for a semester or 90 days.
- Borrowing facility is not available to NTU Alumni and students referred from other institutions; however other library services are available accordingly.
- Some material, such as reference books, press clippings, CD-ROMs, current issues of periodicals, or any other publication marked as Reference/Reserved will not be circulated/issued.

Online Public Access Catalogue (OPAC)

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

Digital Library

Since the year of 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.

Post Graduate Student Section

Post Graduate Student Section has been functionalized for post graduate students with WIFI connection, for separate study, combine study in separate room with air-conditioned environment.
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 programs 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

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

Testing and Characterization Labs

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
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)

Dr. Zafar Javed, PhD (Finland)
- Garments Manufacturing and Garments Machinery Design

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 & E Textiles, Quality

Dr. Adul Basit, PhD (France)
- Polymer Fibers, Smart Materials, Advanced Materials and Polymer Composites

Dr. Sheraz Ahmed, PhD (France)
- Textile Fibres, Natural Fibre reinforced composites, Technical Textiles, Textile Machine design and Instrumentation

Dr. Zubair Khaliq, PhD (South Korea)
- Polymer Physics, Polymer Rheology, Advanced Polymer Materials, Technical Textiles and Fiber Assemblies

Dr. Kahif Iqbal, PhD (UK)

Dr. Muhammad Ali Afzal, PhD (France)

Dr. Muhammad Bilal Qadir, PhD (South Korea)
Dr. Muhammad Babar Ramzan, PhD (South Korea)

Dr. Hafiz Shahzad Maqsood, PhD (Czech Republic)
- To explore some greener processes for the oxidation of natural cellulose fibres from the waste of spinning industry. Our target utility of these oxidized fibres is composites or medical industry.

Dr. Abdul Jabbar, PhD (Czech Republic)

Dr. Amjid Javed, PhD (South Korea)
- Materials engineering, surface engineering of textiles, nanomaterials, biomaterials, plasma technology, polymer and and carbon thin films.

Dr. Hafsa Jamshaid, PhD (Czech Republic)

Dr. Ahsan Nazir, PhD (France)
- Electrospun Materials (Medical Applications, Energy Applications, Filteration, Protective Applications, Antimicrobial, Photo catalysis, Sensors)
- Clothing Comfort (Thermo physiological comfort, Sensorial comfort, Sensery evaluation).

Dr. Zulfiqar Ahmad Rehan, Ph.D (Saudi Arabia)
- Nanomaterials, Polymeric Membranes, Water Purification, Nan-Composite

**MS Programs (FET)**
Faculty of Engineering and Technology offers six MS programs, viz. MS Textile Engineering and MS Advanced Materials Engineering, MS Textile Technology, MS Textile Chemistry, MS Advanced Clothing & Fashion and MS Polymer Science & Engineering. Each MS is a 2 years degree program consisting of 24 credit hours of course work and 6 credit hours of research work. The structure of each MS Programs is given as follows:

1. **MS TEXTILE ENGINEERING**

   **Semester-Wise Layout of Courses**

   **Semester-I**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TE-5071</td>
<td>Advanced Materials</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TE-5072</td>
<td>Technical Textiles</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TE-5077</td>
<td>Composite Technology</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>RM-5071</td>
<td>Research Methodology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

   **Semester-II**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TE-5073</td>
<td>Advance Textile Process &amp; Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TE-5074</td>
<td>Nonwoven Technology</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TE-5075</td>
<td>Medical Textiles</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>TE-5076</td>
<td>Protective Textiles</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>
2. **MS ADVANCED MATERIALS ENGINEERING**

**Semester-I**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TE-5071</td>
<td>Advanced Materials</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TE-5072</td>
<td>Technical Textiles</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TE-5077</td>
<td>Composite Technology</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>RM-5071</td>
<td>Research Methodology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Semester-II**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AME-5071</td>
<td>Nano Materials</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>AME-5072</td>
<td>Smart Materials</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>AME-5074</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>AME-5073</td>
<td>Advance Characterization Techniques</td>
<td>(2-1-3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Semester III & IV**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TE-6079</td>
<td>Research Thesis</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credit Hours</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

**Eligibility Criteria**

**MS Textile Engineering**

1. BS Textile Engineering or equivalent degree from HEC/PEC recognized institution with a minimum CGPA 2.00/4.00 or 3.00/5.00 in semester system or 60% marks in annual/term system.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

**MS Advanced Materials Engineering**

1. BS Textile/Materials/Polymer/Mechanical/Chemical Engineering or any other equivalent degree from HEC/PEC recognized institution with a minimum CGPA 2.00/4.00 or 3.00/5.00 in semester system or 60% marks in annual/term system.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.
Merit Criteria

Admission merit will be prepared according to the following criteria:

<table>
<thead>
<tr>
<th></th>
<th>MS Textile Engineering</th>
<th>MS Advanced Materials Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS Textile Engineering</td>
<td>60% weightage</td>
<td>BS or Equivalent 60% weightage</td>
</tr>
<tr>
<td>NTU-GAT (General)</td>
<td>30% weightage</td>
<td>NTU-GAT (General) 30% weightage</td>
</tr>
<tr>
<td>Interview</td>
<td>10% weightage</td>
<td>Interview 10% weightage</td>
</tr>
</tbody>
</table>

Course Specifications

**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 behavior and energy harvesting properties.

**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 thenonwoven 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 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.
3. **MS TEXTILE TECHNOLOGY**

**Program Objectives**

The MS Textile Technology program aims to provide advanced knowledge of textile technology, machine design and quality management. It will also help in developing the skills of investigation of a research problem related to industrial operations. The MS Textile Technology program will offer each student a solid product and process focused education in manufacturing for the large textile industry. Graduate of this program can build a successful professional career in a wide range of job functions as well as a diverse set of industries.

**Program Outcomes**

MS Textile Technology program aims at achieving the following learning outcomes:

- Ability to apply knowledge of advance textile technologies to enhance the quality and production capacities of industrial units.
- Ability to design and develop solutions for products, components or processes that meet specified needs of target market.
- Ability to communicate and interface effectively with all stakeholders; sales & marketing and manufacturing etc. and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Ability to demonstrate technological knowledge to boost the growth of textile sector and help the society as an individual and team leader for the betterment of processes, quality and production in global
business.

- Ability to function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- Ability to sort out problems, take feasible decisions and bring solutions with improvement in quality and production using statistical tools.
- Ability to design robust process, identify and provide sustainable answers for the issues in the process, and can design new products.

**Eligibility Criteria**

1. A candidate seeking admission to MS Textile Technology must possess a BS Textile Engineering Technology or BS Textile Science or M.Sc Fiber Technology or equivalent degree from HEC recognized institution with a minimum CGPA 2.00/4.00 or 3.00/5.00 in semester system or 60% marks in annual/term system.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

**Merit Criteria**

Admission merit will be prepared according to the following criteria:

- BS or Equivalent: 60% weightage
- GAT (General): 30% weightage
- Interview: 10% weightage

**Total Credit Hours**

For award of MS Textile Technology, candidates must need to complete total credit hours of 30 out of which 24 credit hours of course work and 6 credit hours for research work/thesis.

**Study Duration**

The minimum duration of study will be 4 semesters and maximum of 8 semesters as per HEC guidelines.

**MS Thesis Evaluation**

The MS thesis will be evaluated by one Ph.D. expert of the relevant field from external university/institute in addition to departmental evaluation committee.

**Plagiarism Test**

The plagiarism test must be conducted on the dissertation before its submission to the external expert as per HEC criteria.

**Scope of the Degree**

The graduates of this program would be able to get job and progress opportunities in diverse areas, some of them include:

1. Technical professionals for textile industry having in depth knowledge of advanced textile operations and can be able to provide research based solutions regarding operational problems
2. Teaching and research in domain of technology at university/post graduate college level.
3. Research and Development in public and private sector organizations.
4. Production, planning and quality management in public and private sector organizations.
5. Higher studies and research in the field of textiles and relevant interdisciplinary fields.

**Semester-Wise Layout of Courses**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>Category</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Advanced Fiber, Filament &amp; Yarn Manufacturing Technologies</td>
<td>4 Compulsory courses</td>
<td>2-1-3</td>
</tr>
<tr>
<td></td>
<td>Advance Fabric Manufacturing Technologies</td>
<td></td>
<td>2-1-3</td>
</tr>
<tr>
<td></td>
<td>Advanced Textile Processing Technologies</td>
<td></td>
<td>2-1-3</td>
</tr>
<tr>
<td></td>
<td>Advanced Clothing Technologies</td>
<td></td>
<td>2-1-3</td>
</tr>
<tr>
<td>2</td>
<td>Research Methodology</td>
<td>4 Compulsory courses</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td>Technical Textiles</td>
<td></td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td>Production, Planning and Control in Textiles</td>
<td></td>
<td>2-1-3</td>
</tr>
<tr>
<td></td>
<td>Advanced Characterization Techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Research Thesis</td>
<td>Compulsory</td>
<td>0-3-3</td>
</tr>
<tr>
<td>4</td>
<td>Research Thesis</td>
<td>Compulsory</td>
<td>0-3-3</td>
</tr>
</tbody>
</table>

**Note:**
- MS students will have to pass the 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.
- Other details of semester activities are as follows.

<table>
<thead>
<tr>
<th>Assignments</th>
<th>One assignment per credit is generally conducted by teachers for each subject.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>One quiz per credit of course are conducted by each teacher.</td>
</tr>
<tr>
<td>Presentations</td>
<td>Teacher can ask students to present a specific topic generally once in a subject.</td>
</tr>
<tr>
<td>Projects</td>
<td>Teacher can allot small project individually or in groups as per the scope of subject.</td>
</tr>
<tr>
<td>Exams</td>
<td>Two exams, at mid and end of semesters, are conduct for each subject.</td>
</tr>
</tbody>
</table>

**List of Offered Courses**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Category</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TT-5061</td>
<td>Advanced Fiber, Filament &amp; Yarn Manufacturing Technologies</td>
<td>Compulsory</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>2</td>
<td>TT-5062</td>
<td>Advanced Fabric Manufacturing Technologies</td>
<td>Compulsory</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>3</td>
<td>TT-5063</td>
<td>Advanced Textile Processing Technologies</td>
<td>Compulsory</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>4</td>
<td>TT-5064</td>
<td>Advanced Clothing Technologies</td>
<td>Compulsory</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>5</td>
<td>RM-5071</td>
<td>Research Methodology</td>
<td>Compulsory</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>6</td>
<td>TE-5072</td>
<td>Technical Textiles</td>
<td>Compulsory</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>7</td>
<td>AME-5073</td>
<td>Advanced Characterization Techniques</td>
<td>Compulsory</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>8</td>
<td>TT-5065</td>
<td>Production, Planning and Control in Textiles</td>
<td>Compulsory</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>9</td>
<td>TT-6061</td>
<td>Research Thesis</td>
<td>Compulsory</td>
<td>6(0-18)</td>
</tr>
</tbody>
</table>
Course Specifications

TT–5061: Advanced Fiber, Filament & Yarn Manufacturing Technologies

The aim of this course is to enhance the skill in the field of advanced textile technology. The course will be focus on the recent developments in the field of fiber technology and yarn manufacturing. The course will cover the advance fiber manufacturing range from nano-fibers to high performance technical fibers, conventional fibers as well as exotic fibers, conventional and recent yarn manufacturing techniques. The students will also learn about the specialty yarns.

<table>
<thead>
<tr>
<th>Module / Week-1</th>
<th>Conventional Fiber Technologies And Their Potential Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module / Week-2</td>
<td>Conventional Yarn Manufacturing Technologies And Their Technical Aspects</td>
</tr>
<tr>
<td>Module / Week-3</td>
<td>Advancements And Modifications In Conventional Fiber And Yarn Manufacturing Processes</td>
</tr>
<tr>
<td>Module / Week-4</td>
<td>Advanced Fiber And Yarn Technologies And Their Technical Advantages</td>
</tr>
<tr>
<td>Module / Week-5</td>
<td>Advance Fiber And Yarn Manufacturing Technologies</td>
</tr>
<tr>
<td>Module / Week-6</td>
<td>High Performance Fibers Introduction</td>
</tr>
<tr>
<td>Module / Week-7</td>
<td>Structure, Types And Applications Of Technical Fibers</td>
</tr>
<tr>
<td>Module / Week-8</td>
<td>Carbon Fiber Development, Its Types And Applications</td>
</tr>
<tr>
<td>Module / Week-9</td>
<td>Polyamide Fiber Fabrication</td>
</tr>
<tr>
<td>Module / Week-10</td>
<td>High Performance Polyethylene Fiber Development</td>
</tr>
<tr>
<td>Module / Week-11</td>
<td>Other High-Modulus And High-Tenacity Fiber Development</td>
</tr>
<tr>
<td>Module / Week-12</td>
<td>Nano Fiber Technology And Its Applications</td>
</tr>
<tr>
<td>Module / Week-13</td>
<td>Development Of Nano Fibers With Different Manufacturing Technologies</td>
</tr>
<tr>
<td>Module / Week-14</td>
<td>Electrospinning Technology And Its Future</td>
</tr>
<tr>
<td>Module / Week-15</td>
<td>Introduction To Exotic Fibers, Their Types And Applications</td>
</tr>
<tr>
<td>Module / Week-16</td>
<td>Selection And Implication Of Best Material And Structure Analysis</td>
</tr>
</tbody>
</table>

Recommended Books:
1. Advances in Filament Yarn Spinning of Textiles and Polymers, Dong Zhang, 2014

TT-5062: Advanced Fabric Manufacturing Technologies

The aim of this course is to educate the students about latest advancements in fabric manufacturing technologies introduced in the world. The course contents include conventional fabric manufacturing techniques like weaving & knitting with focus on conventional fabrics as well as specialty weaving and knitting, newest fabric manufacturing techniques like nonwoven and braiding, nonwoven manufacturing technology and multi-dimensional technical fabric technologies.

<p>| Course Schedule |
|-----------------|-------------------------------------------------|-------------------------------------------------|
| Week | Module | Intended Learning Outcomes |
| Module / Week-1 | Circular Weaving | Explain The Basics And Production Process Of Circular Weaving. |
| Module / Week-2 | Multiphase Weaving | Describe The Objectives And Discuss Technical Aspects Of Multiphase Weaving Loom. |
| Module / Week-3 | Inkle Weaving | Demonstrate The Working Of Card/Tablet Weaving, Pick Up Weaving, Kumihimo Weaving, Narrow Weaving And Seat Belts Weaving |</p>
<table>
<thead>
<tr>
<th>Module / Week-4</th>
<th>Spacer Fabrics</th>
<th>Explain The Basic Concept And Process Flow Of Spacer Fabrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module / Week-5</td>
<td>Non-Crimped Fabrics (NCF’S)</td>
<td>Explain The Objectives And Basic Concepts Of Non-Crimped Fabrics.</td>
</tr>
<tr>
<td>Module / Week-6</td>
<td>Leno Fabric Weaving</td>
<td>Describe The Basic Concept And Structure Of Leno Fabric Weaving.</td>
</tr>
<tr>
<td>Module / Week-7</td>
<td>Sear Sucker Fabrics</td>
<td>Describe The Techniques Used For Sear Sucker Fabric Weaving.</td>
</tr>
<tr>
<td>Module / Week-8</td>
<td>Terry Towels Weaving</td>
<td>Identify Different Parts Of A Terry Towel Loom And Explain Pile Forming Motion.</td>
</tr>
<tr>
<td>Module / Week-9</td>
<td>Tapestries</td>
<td>Discuss The Basic Concept And Technicalities Involved In Weaving Of Tapestry Fabrics.</td>
</tr>
<tr>
<td>Module / Week-10</td>
<td>Double Cloth Weaving</td>
<td>Explain Double Cloth Fabrics And Weave Design Used To Produce It.</td>
</tr>
<tr>
<td>Module / Week-11</td>
<td>Metal Mesh Weaving</td>
<td>Summarize The Basic Concept And Weaving Of Metal Mesh.</td>
</tr>
<tr>
<td>Module / Week-12</td>
<td>3-D Weaving</td>
<td>Explain The Basic Concept Of 3-D Weaving.</td>
</tr>
<tr>
<td>Module / Week-13</td>
<td>Warp Knitting</td>
<td>Explain The Warp Knitting Techniques Tricot And Rachel.</td>
</tr>
<tr>
<td>Module / Week-14</td>
<td>Fully Fashioned Garment Knitting</td>
<td>Describe The Elements Needs For The Production Of Fully Fashioned Knitted Garment.</td>
</tr>
<tr>
<td>Module / Week-15</td>
<td>Specialty Knitting</td>
<td>Explain The Socks And Gloves Knitting Machines And Process.</td>
</tr>
<tr>
<td>Module / Week-16</td>
<td>Advances In Nonwoven Fabrics</td>
<td>Discuss Latest Advancements In Web Formation And Web Bonding.</td>
</tr>
</tbody>
</table>

**Recommended Books:**

7. Research journals

**TT– 5063: Advanced Textile Processing Technologies**

This course provide knowledge about the advancements and latest technologies introduced in fabric processing and their application areas. The conventional fabric processing techniques will also be included along with state of the art technologies. The topics include preparatory processes, advancements in dyes and dying processes, dyeing operations, processes to develop fabrics with improved aesthetic and functional properties, testing of textile performance using chemical and instrumental methods.
<table>
<thead>
<tr>
<th>Module / Week</th>
<th>Intended Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module / Week-1</td>
<td>Introduction To Agents Driving Advancements In Textile Wet Processing; Sustainability And Functionality. What Are Sustainable Textiles? What Are Functional Textiles?</td>
</tr>
<tr>
<td>Module / Week-2</td>
<td>Advancements In Pretreatment Of Textiles; Enzyme Biotechnologies For Pretreatment Of Textiles; Desizing, Scouring And Bleaching. Comparison Of Conventional And Advanced Technologies. Application Of Plasma Technology In</td>
</tr>
</tbody>
</table>
| Module / Week-3 | Mercerization Of Textiles; Caustic And Ammonia. Comparison Of Both Techniques. 
Advance In Machines. |
| Module / Week-4 | Advancements In Textile Dyeing. Approaches To Enhance Dye Fixation On Textiles And Reduce Effluent. Advancements In Highly Fixing Dyes; Differences Among Mono, Bi And Poly Functional Dyes. |
| Module / Week-5 | Advanced Techniques For Dyes; IR Dyeing Technology, Supercritical Carbon Dioxide Dyeing Technology, Advancements In Machinery To Reduce Textile Effluent And Enhance Fixation. |
| Module / Week-7 | Finishing Of Textiles To Impart Aesthetics; Soft Finishes, Calendaring, Emerizing, Sheering, Bio Polishing, Fragrance Finishes, Mosquito Repellent Finishes, Antistatic Finishes. |
| Module / Week-8 | Finishing Of Textiles To Impart Functionalities; Water And Oil Repellent Finishes, Antibacterial Finishes, Fire Retardant Finishes, Moisture Management Finishes, Thermo Regulating Finishes |

**Recommended Books:**


**TT–5064: Advanced Clothing Technologies**

This course will be about the latest advancements in garment manufacturing. The ergonomic study will also be considered to be a part of this course. This course elaborates the key features and techniques used for garment manufacturing for financial growth and development of industry along with customer based product assembly line optimization studies. The course content also include material sourcing, preproduction operations, production planning, latest technologies and equipment for production, garment style and fit evaluation, advanced marker modes and spreading modes and evaluation of patterns, seams, stitch types on product quality.
<table>
<thead>
<tr>
<th>Week</th>
<th>Module</th>
<th>Intended Learning Outcomes</th>
</tr>
</thead>
</table>
| 1    | Overview Of Apparel Industry And Types Of Articles | At The End Of This Week, The Students Will Be Able To:  
✓ Understand The Structure Of The Apparel Manufacturing Industry In Pakistan As Well As Around The World  
✓ Explain The Supply Chain Of The Apparel Industry.  
✓ Differentiate Between Various Clothing Articles. |
| 2    | Product Development | At The End Of This Week, The Student Should Be Able To:  
✓ Explain Product Development Concept Including Pre-Adoption Phase, Line Adoption Phase And Post Adoption Phase  
✓ Explain Design Development In Apparel Including Concept Board, Groups, Items, Design Elements And Design Principles. |
| 3    | Advances In Apparel Product Development | At The End Of This Week, The Students Will Be Able To:  
✓ Process Model For Clothing Product Development  
✓ Models Of New Product Development  
✓ Product Development Tools And Application Areas  
✓ Product Lifetime Management (PLM)  
✓ Demand-Led New Product Development |
| 4    | Merchandizing | At The End Of This Week, The Student Should Be Able To:  
✓ Introduction To The Process Of Merchandizing  
✓ Summarize The Various Steps Involved In Developing A Sample Garment.  
✓ Explain The Various Types Of Samples Being Prepared In The Apparel Manufacturing (From Customer Approvals To Bulk Orders Confirmation) |
| 5    | Garment Preparatory Processes | At The End Of This Week, The Student Should Be Able To:  
✓ Introduction To Garment Preparatory Processes  
✓ Explain The Presentation Of Fabric Like Open Width, Doubled, Tubular, Rolled, Wound, Plaited, Etc.  
✓ Lay Planning, Digitizing, Grading And Marker Making |
| 6    | Advances In Garment Preparatory Processes | At The End Of This Week Student Should Be Able To:  
✓ Key Issues Affecting Apparel Sizing And Fit  
✓ Importance And Development Of Size Charts  
✓ Applications Of Technological Advancements  
✓ Types Of Body Scanning Technology  
✓ Advantages And Disadvantages Of Body Scanning Technology  
✓ Computerized Pattern Making In Garment Prosecution |
| 7    | Production Processes (Spreading) | At The End Of This Week, The Students Should Be Able To:  
✓ Explain The Spreading, Spread Or Lay  
✓ Explain Different Types Of Lay/Spread Like Single Ply, Multi-Ply, And Stepped Lay.  
✓ Explain Spread/Lay Height Limitations  
✓ Explain Various Methods Of Spreading Being Used In The Industry Like Manual Method, Spreading Carriage Method, And Automatic Spreading Machine Method.  
✓ Explain Spreading Modes Like Face To Face, Face One Way, Etc |
<table>
<thead>
<tr>
<th>Week</th>
<th>Production Processes (Cutting)</th>
<th>At The End Of This Week, The Students Should Be Able To:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td></td>
<td>✓ Explain Spreading Quality, Setup For Spreading, Spreading Equipment's, Spreading Time And Cost.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Spreading Automates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain Cutting Accuracy, Cutting Quality And Cutting Equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain Cutting Machine Types And Cutting Methods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain The Various Steps Involved In Preparation For Sewing Including Marking, Shading, Bundling, Numbering, Etc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Advancements In Cutting Equipment</td>
</tr>
</tbody>
</table>

**Mid-Semester Examination**

<table>
<thead>
<tr>
<th>Week</th>
<th>Production Processes (Sewing)</th>
<th>At The End Of This Week, The Students Should Be Able To:</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td></td>
<td>✓ Explain Different Types Of Seams (Superimposed Seams, Lapped Seams, Bound Seams, Flat Seam)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain Different Types Of Stitches (Class 100, Class 300 Etc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain The Types And Applications Of Sewing Thread Like Spun Threads, Monofilament Threads, Multifilament Threads, Monochord Thread, Texturized Thread, And Core-Spun Threads On Apparel Articles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain The Sewing Thread Selection Criteria Including Features Like Sewability, Size, Strength, Twist, Seam Performance, Color Availability And Fastness, Put-Up Type And Size, Service And Quality, Thread Cost.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Understand The Use Of Alternatives To Thread Like Adhesive And Welding Technologies.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Production Processes (Sewing)</th>
<th>At The End Of The Week, The Students Should Be Able To:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>✓ Sewing Machine Fundamentals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain The Sewing Machine Lubrication System.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Explain The Stitch Forming Mechanism Of The Sewing Machine (The Parts And Devices Like Thread Control Devices, Needles, Bobbins, Cases &amp; Hooks, Looped, Spreader, Throat Plate, Tongue And Chaining Devices.</td>
</tr>
</tbody>
</table>

**Recommended Books:**

1. Apparel Manufacturing: Sewn Product Analysis, 4/E, Glock, 2005

**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, graphical presentation, 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.
Recommended Books:

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.

Course Schedule

<table>
<thead>
<tr>
<th>Module / Week</th>
<th>Intended Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module / Week-1</td>
<td>Introduction, market size and scope</td>
</tr>
<tr>
<td>Module / Week-2</td>
<td>Technical organic fibers including high strength, high modulus, high chemical and combustion resistance fiber, high performance inorganic fibers</td>
</tr>
<tr>
<td>Module / Week-3</td>
<td>Technical yarn types and structures</td>
</tr>
<tr>
<td>Module / Week-4</td>
<td>Technical woven fabric structures</td>
</tr>
<tr>
<td>Module / Week-5</td>
<td>Technical knitted fabric structures</td>
</tr>
<tr>
<td>Module / Week-6</td>
<td>Technical nonwoven fabric structures</td>
</tr>
<tr>
<td>Module / Week-7</td>
<td>Finishing of technical textiles</td>
</tr>
<tr>
<td>Module / Week-8</td>
<td>Coating of technical textiles</td>
</tr>
<tr>
<td>Module / Week-9</td>
<td>Dyeing of technical textiles</td>
</tr>
<tr>
<td>Module / Week-10</td>
<td>Heat and flame protection</td>
</tr>
<tr>
<td>Module / Week-11</td>
<td>Textile reinforced composite materials</td>
</tr>
<tr>
<td>Module / Week-12</td>
<td>Waterproof breathable fabrics</td>
</tr>
<tr>
<td>Module / Week-13</td>
<td>Textiles in filtration</td>
</tr>
<tr>
<td>Module / Week-14</td>
<td>Textiles in civil engineering and geo-textiles</td>
</tr>
<tr>
<td>Module / Week-15</td>
<td>Medical textiles</td>
</tr>
<tr>
<td>Module / Week-16</td>
<td>Protective textiles</td>
</tr>
</tbody>
</table>

Recommended Books:

AME-5073: Advanced Characterization Techniques

The objective of this course is to introduce the concept of textile material characterization methods, interpretation of results and the importance of the compliances. The course aims at strengthening students' conceptual as well as practical knowledge in the field of testing and characterization of textile materials. This will also help the students in handling the different problems faced in the industry efficiently. They can perform preventive quality enhancing measure rather than the corrective ones. The focus will be on tools and techniques that are related to quality enhancement and proper utilization of
The students will gain in-depth knowledge of conventional and advance characterization techniques. They will learn the methods to evaluate their physical and chemical properties to ensure quality of intermediate and end products in textile processes. The students will also learn about different compliances regarding the textile industry. The requisite for these compliances and how to effectively achieve these requisites. The topics will include scanning electron microscope, transmission electron microscope, atomic force microscope, X-ray diffraction, rheometer, thermal analysis, atomic spectroscopy, chromatography, NMR, FTIR and UV-Vis spectroscopy.

<table>
<thead>
<tr>
<th>Module / Week</th>
<th>Intended Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1</td>
<td>Scanning electron microscope</td>
</tr>
<tr>
<td>Module 2</td>
<td>Atomic force microscope</td>
</tr>
<tr>
<td>Module 3</td>
<td>X-Ray Diffraction</td>
</tr>
<tr>
<td>Module 4</td>
<td>Rheometer and viscometer</td>
</tr>
<tr>
<td>Module 5</td>
<td>Thermal analysis: DTA</td>
</tr>
<tr>
<td>Module 6</td>
<td>Thermal analysis: DSC</td>
</tr>
<tr>
<td>Module 7</td>
<td>Atomic spectroscopy</td>
</tr>
<tr>
<td>Module 8</td>
<td>Chromatography: Gas chromatography</td>
</tr>
<tr>
<td>Module 9</td>
<td>Chromatography: HPLC</td>
</tr>
<tr>
<td>Module 10</td>
<td>Chromatography: HPLC-II</td>
</tr>
<tr>
<td>Module 11</td>
<td>FTIR</td>
</tr>
<tr>
<td>Module 12</td>
<td>UV-Vis spectroscopy</td>
</tr>
<tr>
<td>Module 13</td>
<td>NMR-I</td>
</tr>
<tr>
<td>Module 14</td>
<td>NMR-II</td>
</tr>
<tr>
<td>Module 15</td>
<td>NMR-III</td>
</tr>
<tr>
<td>Module 16</td>
<td>Mass spectroscopy</td>
</tr>
</tbody>
</table>

**Recommended Books:**

1. Materials Characterization Techniques, Sam Zhang, Lin Li, Ashok Kumar, CRC Press, 2008
2. Advance Textile Testing Techniques, S. Ahmad, A. Rasheed, A. Afzal, F. Ahmad, 2017

**TT–5065: Production, Planning and Control in Textiles**

The course enables the students to design of inventory & other relevant systems, different textile production planning models & capacity requirement planning. The course includes Analysis and design of inventory, Deterministic and stochastic inventory models, production, and scheduling control systems, Material Requirement Planning (MRP), Master Production Scheduling (MPS), and Aggregate Planning. It will also provide key knowledge about Warehouse, Importance of warehouse, Types of warehouse, Layout planning of warehouse, warehouse security, safety and maintenance, Warehouse operations, introduction to warehouse management system, functions of warehouse management system, a step towards intelligent WMS. Introduction to Lean Manufacturing will also be included in this course.

<table>
<thead>
<tr>
<th>Week</th>
<th>Module</th>
<th>Intended Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>At The End Of This Week, The Students Will Be Capable To:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Basic Terminologies In PPC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Role Of PPC Department</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Order Receiving</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Understanding A Techpack</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Role Of IE In PPC</td>
</tr>
<tr>
<td>2</td>
<td>Introduction</td>
<td>✓ Coordination Of PPC With Spinning</td>
</tr>
</tbody>
</table>
| 3  | MRP | ✓ Coordination Of PPC With Weaving/Knitting  
|    |     | ✓ Coordination Of PPC With Textile Processing  
| 4  | Work & Method Study | ✓ Define Work Study  
|    |     | ✓ Describe Importance Of Work Study  
|    |     | ✓ Explain Work Study As Direct Means Of Raising Productivity  
|    |     | ✓ Define Method Study  
|    |     | ✓ Understand Factors Involved In Method Study  
|    |     | ✓ Recording Techniques Of Method Study  
|    |     | ✓ Evaluate Any Ongoing Task W.R.T. Method Study  
| 5  | Work Measurement & Time Study | ✓ Define Work Measurement  
|    |     | ✓ Explain Advantages And Purpose Of Work Measurement  
|    |     | ✓ Understand Techniques Of Work Measurements  
|    |     | ✓ Define Time Study  
|    |     | ✓ Identify Basic Time Study Equipment  
|    |     | ✓ Explain Steps In Making Time Study  
|    |     | ✓ Record All Information Related To The Operation Under Consideration  
|    |     | ✓ Prescribe And Standardization Of Measured Operation Time  
| 6  | Learning Curves | ✓ Define Learning Curves  
|    |     | ✓ Be Acquainted With History Of Learning Curves  
|    |     | ✓ Different Approaches Of Calculating Time  
|    |     | ✓ Producing Learning Curves And Setting Standards  
|    |     | ✓ Calculate And Determine Time Required To Do A Job, Learning Rates Of An Organization, Process Or Individual Using Learning Curves.  
| 7  | Line Balancing | ✓ Define Line Balancing  
|    |     | ✓ Line Balancing Using Operator Skill History  
|    |     | ✓ Reduce Line Setting Time For Assembly Line  

**Mid-Semester Examination**

| 9  | Layout | ✓ Define Layout Planning  
|    |     | ✓ Layout Types And Flexibility At Work  
|    |     | ✓ Designing Process And Product Layouts  
|    |     | ✓ Define Material Handling  
| 10 | Operation Breakdown | ✓ Define The Term Operation Breakdown  
|    |     | ✓ Important Considerations For Making Operation Breakdown Bulletin And Machine Selection  
|    |     | ✓ Techniques And Tools Used For Operation Breakdown  
| 11 | Operation Breakdown | ✓ Exercise Of Making Operation Breakdown Of Different Top Garment Products:  
|    |     | I. T-Shirt  
|    |     | II. Polo-Shirt  
|    |     | III. Dress-Shirt  
| 12 | Operation Breakdown | ✓ Exercise Of Making Operation Breakdown Of Different Bottom Garment Products:  
|    |     | I. Slacks  

| 28 |
| 13 | **Operation Breakdown** | ✓ Exercise Of Making Operation Breakdown Of Different Made-Ups Products:  
I. Overall  
II. Box Pleated Curtain |
| 12 | **Operation Breakdown** | ✓ Exercise Of Making Operation Breakdown Of Different Bottom Garment Products:  
IV. Slacks  
V. Boxer Short  
VI. Trousers |
| 13 | **Operation Breakdown** | ✓ Exercise Of Making Operation Breakdown Of Different Made-Ups Products:  
III. Overall  
IV. Box Pleated Curtain |
| 14 | **Calculations Of Industrial Engineering In Garment Industry** | ✓ Formulas Of IE:  
I. Thread Consumption Calculation  
II. Capacity Calculation  
III. Production Target Calculation  
IV. Productivity Calculation  
V. Performance Calculation |
| 15 | **Calculations Of Industrial Engineering In Garment Industry** | ✓ Formulas Of IE:  
I. Efficiency Calculation  
II. WIP Calculation In Cutting, Sewing And Finishing  
III. Manpower Calculation  
IV. Machine Calculation |
| 16 | **Time Based Costing** | ✓ Understand Apparel Industry From Process Costing And Pricing Strategies Perspective.  
I. Define The Basic Logics For Costing Of Apparel Products  
II. Produce General Steps & Sequence Of Apparel Costing(Procedures)  
III. Calculate Yarn And Fabric Requirements For Different Products Of Knits/Woven  
IV. Compute Cost Of Different Finishing Processes  
V. Dying Process ii. Printing Process iii. Embellishments  
VI. Understand The Cutting And Sewing Operations Cost  
VII. Compute Cutting And Sewing Costs  
VIII. Compare And Analyze The Difference Between Different Sewing  
IX. Operation Costs  
X. Tabulate And Calculate Trims And Accessories Costs  
XI. Understand About The Costs Incurred Due To Packaging And Shipment Of Cargo. |

✓ **End Semester Examinations**
Recommended Books:

2. Innovative Quick Response Programs in Logistics and Supply Chain Management, T. C. Edwin Cheng, Tsan-Ming Choi, 2010
3. Textiles Technology, Julie Messenger, Helen Wilson, 2003

**TT- 6061: Research Thesis**

The Research Project module will enable participants 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 an understanding of the steps involved in research and development process and interpretation of the findings both orally and in writing. The research projects will be allotted to the students after the approval by the Research Committee.
4. **MS TEXTILE CHEMISTRY**

**Program Objectives**

MS Textile Chemistry Program aims to provide advanced training in all fields of textile chemistry like dyeing, printing and finishing with in-depth knowledge of the chemicals being used in textile processing industry and their environmental implications. The students will be trained to conduct independent investigations of problems which textile processing industry of Pakistan is currently facing and find their solutions. The program emphasizes the development of students’ potential for research and the technical and analytical skills needed for the design of new products and processes which are sustainable.

**Eligibility Criteria**

1. A candidate seeking admission in MS Textile Chemistry must possess a 16 years of education i.e BS in Textile Processing/Chemistry/Applied Chemistry/Industrial Chemistry degree or its equivalent with a minimum of CGPA 2.00/4.00 in semester system or 60% in annual/term system from an HEC recognized institute/university.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.
**Merit Criteria**

Admission merit will be prepared according to the following criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS or Equivalent</td>
<td>60%</td>
</tr>
<tr>
<td>GAT (General)</td>
<td>30%</td>
</tr>
<tr>
<td>Interview</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Credit Hours**

For award of MS Textile Chemistry, candidates must need to complete total credit hours of 30 out of which 24 credit hours of course work and 6 credit hours for research work/thesis.

**Study Duration**

The minimum duration of study will be 4 semesters and maximum of 8 semesters.

**Thesis Evaluation**

The thesis will be evaluated by one PhD expert of the relevant field from external university/institute in addition to internal examiner.

**Plagiarism Test**

The Plagiarism Test must be conducted on the Dissertation before its submission to the external expert as per HEC criteria.

**Available Chemistry/Textile Chemistry Labs**

1. Textile Processing Department Lab
2. National Textile Research Centre
3. Chemistry Laboratory (CL)
4. Chemistry Research Laboratory (CRL)
5. Dyes and Chemicals Synthesis Laboratory

**Semester-Wise Layout of Courses**

**Semester-I**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TP-5001</td>
<td>Chemistry of Dyes and Pigments</td>
<td>3(2,1)</td>
</tr>
<tr>
<td>2</td>
<td>TP-5002</td>
<td>Chemistry of Fibrous Polymers</td>
<td>2(2,0)</td>
</tr>
<tr>
<td>3</td>
<td>TP-5003</td>
<td>Surface Chemistry</td>
<td>2(2,0)</td>
</tr>
<tr>
<td>4</td>
<td>TP-5004</td>
<td>Textile Auxiliaries</td>
<td>2(2,0)</td>
</tr>
<tr>
<td>5</td>
<td>TP-5005</td>
<td>Advanced Analytical Techniques</td>
<td>3(2,1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

**Semester-II**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TP-5006</td>
<td>Coloration of Textiles</td>
<td>4(3,1)</td>
</tr>
<tr>
<td>2</td>
<td>TP-5007</td>
<td>Functionalization of Textiles</td>
<td>4(3,1)</td>
</tr>
<tr>
<td>3</td>
<td>TP-5008</td>
<td>Sustainability in Textiles</td>
<td>2(2,0)</td>
</tr>
<tr>
<td>4</td>
<td>TP-5009</td>
<td>Research Methodology</td>
<td>2(2,0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

**Semester III & IV**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TP-6001</td>
<td>Research Project</td>
<td>6(0,4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Credit Hours</td>
<td>30</td>
</tr>
</tbody>
</table>
Note:
- MS Textile Chemistry students will have to pass the 24 credit hours courses and 6 credit hours thesis.
- Summer semester will not be offered.
- Internal assessments include a seminar, quizzes and assignments of every student in each subject.
- Number of activities can be double to the number of credit hours of each subject.

Course Specifications

TP-5001: Chemistry of Dyes and Pigments
The overall objective of this course is to give students the general description of dyes & pigments, chemistry of dyes & pigments and their synthesis on lab scale as well as on industrial scale. The students will learn the nomenclature of dyes, different chromophoric system, classification of dyes according to their chemical structure, classification of dyes w.r.t. their application. The students will also learn the chemistry and synthesis of different types of organic, inorganic pigments and advance pigments like thermochromics and photochromic pigments. This course will also cover the synthesis and application of novel dyes with added functionality to impart UV-absorbent, antimicrobial and water repellency characteristics to the textiles.

TP-5002: Chemistry of Fibrous Polymers
The overall objective of this course is to impart knowledge about the chemistry, behavior and properties of natural, synthetic and smart fibrous materials. The students will learn the manufacturing, formation of all kind of fibres with technological advancement and the relation of their chemistry to the performance. The students will also learn the chemistry and behavior of smart, technical and high performance fibres and their application in their specific fields. At the end of this course, the students will be able to select fibres for all kind of textile applications ranging from apparel and sportswear to technical and protective textiles.

TP-5003: Surface Chemistry
The course treats the properties of interface and colloidal system such as adsorption, wettability, dispersion and electrical double layer etc., with emphasis on textile surfaces. It covers surface free energy, capillarity, wetting and water contact angle. The electrical aspects of surfaces such as electrical double layer, stern layer, electrophoresis electroosmosis, streaming potential and zeta potential. Double layer interaction (DLVO theory) are also included. Adsorption isotherms such as the laws of Nernst, Freundlich and Langmuir, and Fick’s law will be discussed.

TP-5004: Textile Auxiliaries
This course will focus on the chemistry and mechanism of reactions of various auxiliaries used in textile industry. These auxiliaries include sizing and desizing agents, detergents, surfactants, scouring agents, bleaching agents, dyeing auxiliaries, printing chemicals and finishing agents. The students will acquire from fundamental to advanced knowledge of these textile chemical agents and their impact on environment.

TP-5005: Advanced Analytical Techniques
The overall objective of this course is to provide knowledge for the evaluation of textile substrates. This course will give an introduction to different physical, chemical and mechanical characterization techniques, including XRD, SEM, TEM, NMR, chromatography, infrared spectroscopy, UV/Vis spectroscopy, Mass Spectroscopy atomic absorption spectroscopy, tensile testing as these are for composites and polymers. The student will also learn the use of differential scanning calorimetry and zeta sizer to measure zeta potential of different textiles.
TP-5006: Coloration of Textiles

This course will cover the application of different dyes on a variety of textile substrates. The students will learn the physical aspects of dyeing, the properties of polymeric fibrous materials, dyeing behavior, theory of machine involved in batch-wise and continuous dyeing processes, union dyeing, blend dyeing containing smart and technical textiles. The course will focus on advanced printing techniques such as digital printing of textile substrates and its application. The students will also gain the knowledge of thermodynamic aspect of dyeing including adsorption isotherm. During this course, students should be able to define and optimize the dyeing process of particular substrate. At the end of this course, the students will be able to dye different types of textiles including fibres, yarn, knitted fabric, woven fabric, and technical textiles made of different fibrous materials.

TP-5007: Functionalization of Textiles

The overall objective of this course is to teach students about the surface preparation, modification, and surface treatments of textiles. The students will learn the different techniques of functionalization such as physical vapor deposition, chemical vapor deposition, surface grafting, enzymatic surface modifications etc. The students will also learn the surface functionalization using plasma treatment, nanoparticles to impart different functionality to textiles such as antibacterial, superhydrophobicity, moisture management, and self-cleaning characteristics. At the end of this course, the students will be able to prepare textiles with multi-functionality in different fields of life such as active wear, sportswear, medical textile and protective textiles.

TP-5008: Sustainability in Textiles

This course covers fundamentals of sustainability and implications of materials and processes used in textile wet processing industry. The student study a range of sustainability principles that address lifecycle assessment, including eco-footprint analysis, embedded energy, and environmental impact of textile dyeing and finishing processes. The students will also be introduced to sustainable textile fibers, enzyme biotechnologies for sustainable textile processing, key sustainability issues in textile dyeing and environmentally friendly plasma technologies for textiles. It also covers latest technologies for sustainable textile dyeing.

TP-5009: 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, analyse and interpret the experimental data, and draw valid conclusions. Additionally, the students will be able to write a research proposal, critically analyse 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.

TP-6001: Research Project

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. 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.
5. **MS ADVANCE CLOTHING & FASHION**

**Program Objectives**

The MS Advance Clothing & Fashion program will aim to integrate design, theory, problem-solving, and research in relation to the problems of sewn products industry. The objectives of this program are to:

- Apply creative problem-solving techniques to develop sustainable solutions to contemporary issues challenging the sewn products industry.
- Give students an exposure of modern and advanced industrial developments, research methodologies and their applications in industrial environment.
- Develop novel approaches to solve technological problems and shortcomings.
- Appreciate technological, environmental, economical and cultural factors that may influence, manufacturing design, processing conditions and mode of applications.
- Strengthen the capabilities of graduates in production, quality, research and development activities in sewn products industry.
- Establish and strengthen linkage with the industry for the mutual benefits.

**Eligibility Criteria**

1. A candidate seeking admission to MS Advance Clothing & Fashion must possess a BS Textile Engineering, BS Textile Engineering Technology, BS Textile Science, BS Apparel Technology, Bachelor of Fashion Design, Bachelor of Textile Design or 16 years equivalent degree from HEC recognized institution with a minimum CGPA 2.00/4.00 or 3.00/5.00 in semester system or 60% marks in annual/term system.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.
**Merit Criteria**

Admission merit will be prepared according to the following criteria:

- BS or Equivalent: 60% weightage
- GAT (General): 30% weightage
- Interview: 10% weightage

**Study Duration**

The minimum duration of study will be 4 semesters and maximum of 8 semesters as per HEC guidelines.

**MS Thesis**

The topic for MS thesis will be assigned to the students by departmental research committee. MS thesis will be evaluated by one PhD expert of the relevant field from external university/institute in addition to departmental research committee.

**Plagiarism Test**

The plagiarism test must be conducted on the dissertation before its submission to the external expert as per HEC criteria.

**Total Credit Hours**

For award of MS Advance Clothing & Fashion, candidates must need to complete total credit hours of 30 out of which 24 credit hours of course work and 6 credit hours for research work/thesis.

**Semester-Wise Layout of Courses**

**Semester-I**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credits Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACF-5041</td>
<td>Advances in Sewn Product Industry</td>
<td>3-0-3</td>
</tr>
<tr>
<td>2</td>
<td>ACF-5042</td>
<td>Clothing Comfort</td>
<td>3-0-3</td>
</tr>
<tr>
<td>3</td>
<td>ACF-5043</td>
<td>Quality Management in Clothing</td>
<td>3-0-3</td>
</tr>
<tr>
<td>4</td>
<td>RM-5071</td>
<td>Research Methodology</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Semester-II**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACF-XXXX</td>
<td>Elective 1</td>
<td>3-0-3</td>
</tr>
<tr>
<td>2</td>
<td>ACF-XXXX</td>
<td>Elective 2</td>
<td>3-0-3</td>
</tr>
<tr>
<td>3</td>
<td>ACF-XXXX</td>
<td>Elective 3</td>
<td>3-0-3</td>
</tr>
<tr>
<td>4</td>
<td>ACF-XXXX</td>
<td>Elective 4</td>
<td>3-0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Semester-III**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACF-6041</td>
<td>Research Thesis-I</td>
<td>0-3-3</td>
</tr>
</tbody>
</table>

**Semester-IV**

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACF-6042</td>
<td>Research Thesis-II</td>
<td>0-3-3</td>
</tr>
</tbody>
</table>

**List of Elective Courses**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GM-5045</td>
<td>Performance Clothing</td>
<td>3-0-3</td>
</tr>
<tr>
<td>2</td>
<td>GM-5046</td>
<td>Product Development: Innovative &amp; Best</td>
<td>3-0-3</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>GM-5047</td>
<td>Lean Six Sigma</td>
<td>3-0-3</td>
</tr>
<tr>
<td>4</td>
<td>GM-5048</td>
<td>Project Management in Clothing</td>
<td>3-0-3</td>
</tr>
<tr>
<td>5</td>
<td>FD-5091</td>
<td>Clothing Project Design &amp; Practice</td>
<td>3-0-3</td>
</tr>
<tr>
<td>6</td>
<td>FD-5092</td>
<td>Fashion Trend &amp; Information Analysis</td>
<td>3-0-3</td>
</tr>
<tr>
<td>7</td>
<td>FD-5093</td>
<td>Fashion Material Creative Design</td>
<td>3-0-3</td>
</tr>
<tr>
<td>8</td>
<td>FD 5094</td>
<td>Fashion Brand Management</td>
<td>3-0-3</td>
</tr>
</tbody>
</table>

* The elective courses will be offered subject to the availability of resources.

**Scope of the Degree**

The graduates of this program would be able to get job and progress opportunities in diverse areas, some of them include:

1. Technical professionals for sewn products industry (home textiles, garments, leather, shoe industry etc).
2. Research and Development in public and private sector organizations.
3. Higher studies and research in the field of clothing and relevant interdisciplinary fields.
4. Teaching and research at university/post graduate college level.

**Available Labs**

1. Pattern Making Laboratory
2. Computer Aided Designing (CAD) Laboratory
3. Computer Aided Manufacturing Laboratory
4. Basic sewing Laboratory
5. Advanced Sewing Laboratory
6. SMART Textile Laboratory
7. Comfort Laboratory (NTRC)
8. Textile Testing Laboratory
6. MS Polymer Science & Engineering

The MS Polymer Science and Engineering Program aims to provide a technology-based polymer engineering education through the specially designed courses and the extracurricular research training, students will have a good knowledge about the development and prospect of polymer science & engineering within emerging scientific intersecting fields like photonic, magnetic functional polymer materials, biomedical polymer materials, polymeric membrane for separation as well as fine polymer materials, and furthermore, develop abilities of scientific research, product development, education and technical management.

Program Outcomes:

In the past half century, there has been a great increase in the importance of Polymer Science and Engineering to our society, especially in polymer sector like synthetic fibres, plastics, rubbers, composites etc. as a back bone of country’s economy. The need for trained, polymer scientist/engineer at all levels is on the rise as the use of advanced chemicals, materials and process has spread to almost all polymer sectors. Nowadays, technological, engineering and business problems are often of such complexity that they require a high level of product development and research. Whereas in the past polymer field was generally restricted to the conventional chemical processing and the field was not so much grown. Today there is an ever-growing demand for polymer expertise in all related fields of polymer, as well as in finance and business management. The department of polymer engineering has launched the program of MS Polymer Science and Engineering by keeping in view the following learning outcomes:
To train the manpower required to deal with the problems faced by the polymer industry through advance knowledge and skills so as to achieve reduced costs, flexibility and high quality.

To have more in-depth study of research projects of applied nature which are already going on in the existing engineering faculties of National Textile University.

To elevate the industry based research in the field of polymer science and engineering.

To fill the space of more advanced polymer scientist and engineer as far as sensitivity and demand of region is concerned.

To establish and enhance academia-industrial linkage for producing quality research of international repute.

In addition to above social concern, department has worked out in detail as far as employment perspectives of graduates are concerned.

**Eligibility Criteria**

1. A candidate seeking admission in MS Polymer Science and Engineering must possess one of the following with a minimum of CGPA 2.00/4.00 or 3.00/5.00 in semester system or 60% in annual/term system from HEC recognized institute/university:
   - B.Sc. /BE Engineering (Polymer/Materials/Chemical/Textile/Mechanical/Petroleum/Environmental), BS (Hons) Chemistry, Physics and Environmental Sciences, M.Sc. (Chemistry, Physics, Environmental Sciences)

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

**Merit Criteria**

The merit will be calculated as per following criteria:

- Intermediate 10% weightage
- BS Engineering or BS (Hons.) / B.Sc. + M.Sc. 40% / (20+20) % weightage
- GAT (General): 40% weightage
- Interview: 10% weightage

**Total Credit Hours**

For the award of MS Polymer Science & Engineering degree, candidates must need to complete total 30 credit hours (24 for course work and 6 for research thesis).

**Study Duration**

The minimum duration of study will be 4 regular semesters and maximum of 8 regular semesters.

**MS Thesis Evaluation**

The MS Thesis will be evaluated by one expert of the relevant field from external university/institute in addition to departmental evaluation committee.

**Plagiarism Test**

The Plagiarism Test must be conducted on the Dissertation before its submission to the external expert as per HEC criteria.
**Scope of the Degree**

The graduates of MS Polymer Science and Engineering may pursue their careers and progress opportunities in diverse areas including:

- Polymer producing companies, Rubber products manufacturing companies, petroleum refineries, composite manufacturing industries, synthetic fibre industries, polymer processing and fabrication units.
- Scale-up of new synthetic chemistry from laboratory development to pilot plant and large-scale production.
- Teaching and research at university/post graduate college level in disciplines of polymer science & engineering, materials science & engineering and polymer chemistry etc.
- Research and product development in public and private sector organizations (current hot topics include biodegradable polymers and compatibilizers for recycling polymers).
- Research and process development in polymer processing.

**Semester-Wise Layout of Courses**

The structure of MS Polymer Science and Engineering program is given as follows:

**Semester-I**

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSE-5071</td>
<td>Polymers Science, Engineering &amp; Applications</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PSE-5072</td>
<td>Advanced Characterization Techniques</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>3</td>
<td>PSE-5073</td>
<td>Polymer Matrix Composites</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>RM-5071</td>
<td>Research Methodology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Semester-II**

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSE-5075</td>
<td>Mechanics of Polymers</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PSE-5077</td>
<td>Polymer Rheology &amp; Viscoelasticity</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PSE-5076</td>
<td>Elastomeric Materials &amp; Processes</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PSE-5074</td>
<td>Polymer Membrane Design &amp; Applications</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Semester III & IV**

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSE-6071</td>
<td>Research Thesis</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credit Hours</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

**List of Courses**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSE-5071</td>
<td>Polymers: Science, Engineering &amp; Applications</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PSE-5072</td>
<td>Advanced Characterization Techniques</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>3</td>
<td>PSE-5073</td>
<td>Polymer Matrix Composites</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>RM-5071</td>
<td>Research Methodology</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PSE-5074</td>
<td>Polymer Membrane Design and Applications</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PSE-5075</td>
<td>Mechanics of Polymers</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PSE-5076</td>
<td>Elastomeric Materials &amp; Processes</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>PSE-5077</td>
<td>Polymer Rheology &amp; Viscoelasticity</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>PSE-5078</td>
<td>Polymer Chemistry</td>
<td>3</td>
</tr>
</tbody>
</table>
Course Specifications

PSE-5071: Polymers: Science, Engineering & Applications

This course covers the introduction of macromolecules (Polymers), polymer raw materials, structure property relationship of polymers, polymer crystallinity, polymer reactions, techniques of polymerization, engineering and specialty polymers, elastomers, polymer composites and recycling of polymers. Moreover, how plastics, rubber, and fibers are synthesized, processed into useful materials, characterized, and compounded with fillers and other additives to improve performance for specific applications.

PSE-5072: Advanced Characterization Techniques

This course introduces the fundamental theoretical framework for diffraction, spectroscopy and imaging methods used in the structural and compositional characterization of engineering materials. The laboratory portion of the course offers intensive instruction in the most widely practiced x-ray diffraction (XRD) methods for materials evaluation, and an introduction to electron microscopy using a scanning electron microscope (SEM) an energy dispersive spectrometer (EDS), and a transmission electron microscope (TEM), chromatography, infrared spectroscopy, UV/Vis spectroscopy, atomic absorption spectroscopy. Moreover, this course also emphasis on Mechanical testing, Thermal testing, chemical testing and Electrical testing of polymeric materials. The course will include several visits to the materials lab and an experimental term project.

PSE-5073: Polymeric Matrix Composites

This course describes about introduction of composite material, naming and classification of composite materials, molding methods of composite materials, Review of elasticity of anisotropic solids characterization of composite materials, Application of composite materials, the progress of composite materials, and importance of composite materials in 21st century.

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.
PSE-5074: Polymer Membrane Design and Applications

The course will describe in detail membrane separation technology and wide range of applications including water treatment and desalination. The course covers: global water shortages and need for membrane technology. Basic membrane types and their preparation Microfiltration, ultrafiltration, nanofiltration and reverse osmosis membrane processes and current applications in water treatment. Characteristic properties of membranes, Methods of testing.

PSE-5075: Mechanics of Polymers

This course covers the basics of mechanics, mechanical behavior of polymers, various kinds of stresses and strains, stress-strain diagram, concepts of viscoelasticity, linear viscoelasticity, stress relaxation, temperature dependence of relaxation modulus, stress relation as a function if molecular configurations, creep, linear viscoelastic creep, creep compliance as a function of time, mechanical models, mathematical models and mechanical testing of polymers.

PSE-5076: Elastomeric Materials & Processes

The course will focus on introduction to elastomeric materials, Classification of elastomers, Mastication process, Compounding ingredients for rubbers, Rubber blends, Thermoplastic elastomers, Processing, Design of elastomeric products, Comparison of Elastomer Properties. Data sources, Recycling and reuse of elastomeric materials. The course will also focus on application of elastomeric material in different industry.

PSE-5077: Polymer Rheology & Viscoelasticity

Definition and measurement of the material functions of complex fluids, continuum mechanics of stress and deformation, constitutive equations derived from both continuum and molecular theories, interrelation of material functions for both shear and elongational flows, linear and nonlinear elasticity and viscoelasticity, material functions of important classes of polymeric fluids, the role of rheological properties in material characterization and polymer processing.

PSE-5078: Polymer Chemistry


PSE-5079: Polymer Process Technologies

Technology and processing of synthetic resins (PU, PP, PE, etc), adhesive and sealants; Chemistry of Adhesives, Paints and Coatings; Polyurethane Foams, and Polymer Fibers; Surface preparation for adhesion, primers and coupling Agents. Process Techniques for various polymers for the following uses as synthetic fibers, adhesives, foams, plastics, synthetic rubber & surface coating compounds. Properties of polymers and their chemical structure, Polymer compounding, use of additives for improvement of qualities / properties of polymers.

PSE-5080: Nano-Materials Engineering

The course will be structured as a series of integrated lecture and discussion sessions that review foundational concepts in nanoscience in the context of recent research breakthroughs. Introduction to nanomaterials with an emphasis on their fabrication, structures, properties & applications. Special attention will be paid to carbon-based nanomaterials, including carbon nanotubes and graphene and Bionanomaterials. A range of techniques for characterizing nanomaterials (such as diffraction, microscopy & spectroscopy) will also be introduced.
PSE-5081: Separation Processes

An introduction to the principles and applications of diffusional separation processes involving gas-liquid, liquid-liquid and solid-liquid systems in equilibrium-stage and continuous-contact operations. Phase equilibria and the role of diffusion are also covered. The course includes design of separation processes for process industry and for clean technology, as well as the application of the methods to other systems - in particular environmental systems. Throughout emphasis is placed on problem solving and illustrative worked examples.

PSE-5082: Compounding Principles & Polymer Blending

Compounding materials considerations & evaluations, thermodynamics of miscibility and relationship to structure of components, polymer additives used in compounding, effect of additives on specific properties of polymers, dispersive and distributive mixing, compatibilization, blending procedures, compounding techniques, influence on mechanical properties and structure-property relationship of polymers.

PSE-5083: Advanced Functional Polymers

The course will focus on advance study of Nanostructured polymers, Chemistry in Polymer Science, Polyelectrolytes, Liquid crystalline polymers, Dendrimers, Fluorinated polymers, Supramolecular polymers, Environmentally responsive polymers, Polymers in cosmetic care/pharmaceutics, Polymer Hybrids.

PSE-5084: Polymer Coatings and their Applications

The course will cover the following areas: colloidal and interfacial chemistry of Coatings and Polymeric Materials, polymer synthesis, adhesion, surface and interfacial spectroscopy of Coatings and Polymeric Materials, rheology, nanomaterials design and synthesis, and surface chemistry and their application in industry. The course will also emphasis on special polymer coatings.

PSE-5085: Advanced Polymer Engineering

This course offers extensive study of engineering analysis and design techniques for synthetic polymers. Treatment of materials properties selection, mechanical characterization, and processing in design of load-bearing and environment-compatible structures are covered. Moreover dependence of properties on molecular structure & microstructure. Polymer rheology. Unit processing operations, formulation & uses of polymers, mechanical properties, degradation & failure methods.

PSE-5086: Nanotechnology

Introduction to Nanotechnology provides a broad overview of nanotechnology, discussing the fundamental science of nanotechnology and its applications to engineering, biomedical, and environmental fields. The course provides a background of the understanding, motivation, implementation, impact, future, and implications of nanotechnology. Other specialist topics in nanotechnology. The course will also discuss specific applications of nanotechnology in electronic devices, biomedical fields, environmental solutions, and energy production.

PSE-5087: Mold Design

The course will cover the fundamentals of injection mold design and give the student and understanding of mold types, basic mold construction, mold design and function. Topics include: shrinkage allowances, gate locations, cooling, runner balancing, stripper plates slide molds, two and three plate designs as well as molding machine considerations. Over the semester, the students will have the experience of collaborating to develop a complete mold design from scratch. Hands-on examination of parts, molds, and drawings are featured as well as CAD demos.
and a plant tour.

**PSE-5088: Advanced Polymer Composites**

This course aims to provide background knowledge of polymer and a basic understanding of modern polymer composites. The class will be balanced between science and engineering in the main subjects and prepare the students for further advances in the field of polymer and polymer composites. The module will teach polymer engineering related to structure-process-property relationship, fiber enforcement for engineering polymer composites, composite interface/interphase and micromechanics of polymer composites.

**PSE-5089: Modeling & Simulation of Polymers**

This course introduces the introduction to modelling and simulation, system analysis, classification of systems, system theory basics, its relation to simulation, model classification: conceptual, abstract, and simulation models, heterogeneous models, methodology of model building, simulation systems and languages, means for model and experiment description, principles of simulation system design, parallel process modelling, using Petri nets and finite automata in simulation, models of queuing systems, discrete simulation models, model time, simulation experiment control, continuous systems modelling, overview of numerical methods used for continuous simulation.

System Dymola/Modelica, combined simulation, the role of simulation in digital systems design, special model classes, models of heterogeneous systems, cellular automata and simulation, checking model validity, verification of models, analysis of simulation results, simulation results visualization. Model optimization, generating, transformation, and testing of pseudorandom numbers, stochastic models, Monte Carlo method, and overview of commonly used simulation systems.

**Research Thesis I & II**

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.
1. **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 equivalent with minimum CGPA 3.00/4.00 or 3.50/5.00 in semester system, 60% marks in annual system.
- Candidate must have PEC registration
- Candidate will have to pass NTU GAT (Subject) test within minimum 70 marks.
- It is mandatory to pass interview in order to compete on merit.
- Applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

**Admission Criteria**

- The admission merit list will be prepared according to the following criteria:
Program Structure

PhD Textile Engineering Program is a 3-8 years degree program consisting of 18 credit hours of course work and 30 credit hours of research work.

Semester-Wise Layout of Courses

**Semester-I**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TE-7101</td>
<td>Advanced Statistical Methods for Research</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TE-7102</td>
<td>Recent Development in textile Engineering</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>TE-7103</td>
<td>Modern testing and Characterization Methods</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>TE-7104</td>
<td>Prototype / Review Paper</td>
<td>1</td>
</tr>
</tbody>
</table>

**Semester-II**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TE-7XXX</td>
<td>Elective – I</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TE-7XXX</td>
<td>Elective – II</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TE-7XXX</td>
<td>Elective – III</td>
<td>3</td>
</tr>
</tbody>
</table>

**Semesters III-VIII**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XXXX</td>
<td>Research Thesis</td>
<td>30</td>
</tr>
</tbody>
</table>

**Total Credit Hours**: 48

List of Elective Courses

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Research Areas</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Advanced Materials</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>Engineered textile structures &amp; composites</td>
<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>Textile surface modification and chemical</td>
<td>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.</td>
</tr>
<tr>
<td>4</td>
<td>Clothing engineering</td>
<td>Science in clothing comfort; Smart clothes and wearable technology; Advances in apparel production; Clothing biosensory engineering; Clothing appearance &amp; fit; Biomechanical engineering of textile and clothing.</td>
</tr>
<tr>
<td>5</td>
<td>Technical Textiles</td>
<td>Medical and healthcare textiles; Smart fibers, fabrics and clothes; Functional textiles for protection and performance; Textiles in sports; High performance textiles and their applications.</td>
</tr>
<tr>
<td>6</td>
<td>Textile machinery and instrument</td>
<td>Instrumentation and control; Applied mechatronics; Mechatronic design in textile engineering; Design of textile machines; Mechanics and calculations of textile machinery.</td>
</tr>
<tr>
<td>7</td>
<td>Textile modeling and simulation</td>
<td>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</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8</td>
<td>Energy, environment and sustainability in</td>
<td>Sustainable textile production; Recycling in textiles; Environmental impact of textiles; Energy harvesting materials</td>
</tr>
</tbody>
</table>
2. **PhD in Advanced Materials**

**Aims and Objectives**

- To enhance the intellectual development of PhD graduates through creativity, analytical thinking, critical analysis, and innovative problem-solving.
- Produce a new generation of technologically advanced graduates to lead future developments in fields of advanced materials.
- Relate the physical and chemical structure of materials to their macroscopic properties governed by manufacturing and processing techniques.
- Provide insight into material’s requirements for current scientific and commercial applications.
- Use their in-depth understanding of material’s properties and behaviour in order to envisage and devise novel applications, particularly for high technology materials.
- Develop diagnostic and novel approaches to technological problems and shortcoming through interdisciplinary utilization of materials.
- Develop critical thinking, self-confidence and encourage creative/logical thinking and genuine contribution to the area.
- Appreciate technological, environmental, economical and cultural factors that may influence materials choice, manufacturing design, processing conditions and mode of application.
Eligibility Criteria

- Eighteen years of education in the relevant disciplines with minimum CGPA 3.00/4.00 or 3.50/5.00 in semester system, 60% marks in annual system from HEC recognized University / Institute. (PhD Admission Committee will decide relevancy of discipline. However, student may get pre-evaluation by Director, Graduate Programs (FET) before submission of application.

- Candidate will have to pass NTU GAT (Subject) test within minimum 70 marks.

- It is mandatory to pass interview in order to compete on merit.

- Applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

Admission Criteria

- The admission merit list will be prepared according to the following criteria:

  1. M.Sc./MS/Equivalent 50% weightage
  2. B.Sc./BE/Equivalent 30% weightage
  3. Interview Result 10% weightage
  4. Publication/Relevant experience 10% weightage

Program Structure

The PhD Advanced Materials Program is 3-8 years degree program consisting of 18 credit hours of course work and 30 credit hours of research work.

Semester-Wise Layout of Courses

Semester-I

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AM-7101</td>
<td>Advanced Statistical Methods for Research</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>AM-7102</td>
<td>Advanced Testing &amp; Characterization Methods</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>AM-7103</td>
<td>Recent Developments in Textile Industry</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>AM-7104</td>
<td>Review Paper</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>9</td>
</tr>
</tbody>
</table>

Semester-II

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AM-71XX</td>
<td>Elective – I</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>AM-71XX</td>
<td>Elective – II</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>AM-71XX</td>
<td>Elective – III</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>9</td>
</tr>
</tbody>
</table>

Semesters III-VIII

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AM-8090</td>
<td>Research Thesis</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Credit Hours</td>
<td>48</td>
</tr>
</tbody>
</table>

List of Elective Courses

- Thermodynamics and Kinetics of Materials
- Electronic and Mechanical of Materials
- Nano materials
- Biomaterials
- Heat and Mass Transfer
• Fluid Flow in Porous Media
• Finite Element Methods
• Woven structures for Advance Engineering Applications
• 3D Textile Structures (Woven, Knitted, Braided, Nonwoven)
• Fiber Reinforced Composite Materials
• Mechanics of Materials
• Shape Memory Materials
• Surfaces and interfaces

N.B. Any other course may also be chosen with the consent of Supervisors and PhD Program Coordinator. The approval of ASRB will be mandatory in such case.
FACULTY OF SCIENCE

Introduction

Faculty of Science consists of two departments namely the Department of Computer Science and Department of Applied Sciences. Department of Computer Science is committed to train and produce the 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 and Multimedia/Computer Graphics/ Image Processing. Both departments offer MS and PhD programs.

DEPARTMENT OF COMPUTER SCIENCE

Introduction

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 Computer Science, MS Software Engineering and PhD Computer Science at postgraduate level.
1. **MS COMPUTER SCIENCE**

The Faculty of Sciences offers 2-years MS in Computer Science (MSCS) program comprising 26 credit hours of course work and 6 credit hours of research work.

**Aims and Objectives**

The program objectives of master’s degree in Computer Science include:

- To prepare students for increasingly sophisticated applications of computer 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 could be supplement of the curriculum in other disciplines.

**Eligibility Criteria**

1. BS Computer Science/BS Information Technology/BS Software Engineering /M.Sc Computer Science / IT or 16 year equivalent education from HEC recognised university/institute with a minimum CGPA 2.00/4.00 or first division in annual system.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.
Merit Criteria

Admission merit will be prepared according to the following criteria:

- BS or Equivalent 60% weightage
- NTU GAT (General) 30% weightage
- Interview Marks 10% weightage
- Practical Experience preferable

Program Structure

MSCS is a 2-year program 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 program has 32 credit hours in total including 26 credit hours course work and 6 credit hours for research thesis. Each MSCS student must have to complete 12 credits from 4 core courses, 14 credits from elective courses (must include Research Methodology and Functional Textiles) and 6 credits of research work to achieve the MSCS degree. The scheme of studies for MSCS program is as under.

<table>
<thead>
<tr>
<th>Semester-I Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC-XXXX</td>
<td>Core Course-I</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Core Course -II</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Elective-I</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Elective-II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester-II Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC-5073</td>
<td>Core Course-III</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Core Course –IV</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Elective-III</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Elective-IV</td>
<td>3</td>
</tr>
<tr>
<td>CSC-XXXX</td>
<td>Elective-V</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester-III Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC-6072</td>
<td>MS Thesis-I</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester-IV Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC-6072</td>
<td>MS Thesis-II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
<td></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

Registration in “MS Thesis - I” is allowed provided the student has:

a. Earned at least 18 credits
b. Passed the “Research Methodology” course; and
c. CGPA is equal to or more than 2.5

Core Courses for MS (Computer Science)
At least four courses must be taken from the following
CSC-XXX Advanced Analysis of Algorithms
CSC-XXX Advanced Operating Systems
Course Specification

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-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, Inter process 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-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-sharedmemory, Aurora, Scoped behaviour and abstract datatypes, Enterprise, Process templates. Research Topics.
CSC-5078: Control Systems and Robotics


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 constructsample 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


CSC-5081: Network Security


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.

**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 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**


**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, tree 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 adocumentation package.

CSC-5094: Software System Quality


- 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 models, 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.
1. **PhD COMPUTER SCIENCE**

The Faculty of Science offers 3-8 years PhD Program 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.

**Eligibility Criteria**

1. MS/M.Phil Computer Science/IT/Software Engineering or equivalent with minimum 3.00/4.00 or 3.50/5.00 CGPA in semester system, 60% marks in annual system.
2. The applicant must pass NTU-GAT (Subject) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 70% cumulative score.
3. It is mandatory to pass interview in order to compete on merit.
4. Applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

**Merit Criteria**
Admission merit will be prepared according to the following criteria:

- M.Sc./MS/Equivalent 50 % weightage
- B.Sc./BE/Equivalent 30% weightage
- Interview result 10 % weightage
- Publication/Relevant experience 10% weightage

- The selected candidates will be given an acceptance letter by the Graduate Studies & Research Office.
- The students shall pay their dues within the stipulated time, failing which their admission shall be liable to be cancelled.

**Program Structure**
The PhD Computer Science Program is a 3-8 years degree program 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:

- Data Science
- Artificial Intelligence
- Information Systems
- Networking and Communication
- Machine Learning and Computer Vision
- Human Computer Interaction

**Scheme of Studies**

<table>
<thead>
<tr>
<th>Semester-I</th>
<th>Code</th>
<th>Subject Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSC-7018</td>
<td>Research Seminar</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CSC-XXXX</td>
<td>Advanced Research Methods</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CSC-XXXX</td>
<td>Elective-I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester-II</th>
<th>Code</th>
<th>Subject Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSC-XXXX</td>
<td>Elective-II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CSC-XXXX</td>
<td>Elective-III</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CSC-XXXX</td>
<td>Elective-IV</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semesters III-VIII</th>
<th>Subject Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Research Thesis</td>
<td>30</td>
</tr>
</tbody>
</table>

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

**List of Courses**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CSC-7001</td>
<td>Modeling of Web Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CSC-7002</td>
<td>Data Warehousing</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CSC-7003</td>
<td>Peer-To-Peer Systems</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CSC-7004</td>
<td>Multimedia Retrieval Techniques</td>
<td>3</td>
</tr>
</tbody>
</table>
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; OpenArchives Initiative; Encoding Standards (Markup Languages): Introduction and history of markup; Metadata use of markup languages; Document TypeDefinitions (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 Bibaand 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 MessyNow; 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


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.
Introduction of Department of Applied Sciences

National Textile University (NTU), Faisalabad is mandated to develop the scientific manpower and technical capability nationwide in order to achieve a speedy economic development of the country. As an academic institution, it offers and supports the programs that could bring about the effective fulfillment of its goals. Department of Applied Sciences being a part of Faculty of Science determines, promotes and facilities multidisciplinary research. Our faculty members are involved in research intra-departmental and inter-departmental. We have also active research collaborations with other institutes of the region and local industries. The faculty members have completed several research projects funded by national agencies including Higher Education Commission and several research projects are under progress. The department has state of the art research and academic laboratories equipped with sophisticated research facilities.

Brief Introduction to MS Mathematics

Department of Applied Sciences is committed to train and produce graduates that have extensive knowledge to the demanding fields that can be helpful for both national and international institutions. The department aims to offer MS Mathematics program with research alongside taught courses. The main objective of this program is to create self-motivated mathematicians who can fulfill the demand of current challenging fields. This program would be based on applied research to prepare students for professional career in research to facilitate academic and commercial sectors. In addition to that the program will provide a unique opportunity to graduates to strengthen their knowledge and work in scientifically multi-disciplines. These researchers could also have ability to help out different industry related problems through knowledge of mathematical modeling and scientific computational techniques. Especially in textile industry, problems would be modelled and solved to achieve reduced costs, flexibility and high quality.

Brief Introduction to PhD Chemistry

The National Textile University (NTU), Faisalabad is mandated to develop the scientific manpower and technical capability nationwide in order to achieve a speedy economic development of the country. As an academic institution, it offers and supports the programs that could bring about the effective fulfillment of its goals. As such, it is asked to help produce the critical mass of scientists in the field of Chemistry that will catalyze the development of NTU. Department of Applied Sciences being one of the basic academic divisions of NTU, has always been striving for the realization of this mandate. One manner of achieving this is to offer PhD Chemistry Program, in addition to its specific tasks of undertaking basic, applied, and mission oriented researches.
1. **MS MATHEMATICS**

The Department of Applied Sciences offers 2-years MS Mathematics comprising of 26 credit hours course work and 6 credit hours research work.

**Aims and Objectives**

- To inculcate habits of creative thinking and critical analysis.
- To make the student appreciate the uniqueness of mathematics as tool having the power of generalization and applications.
- 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-society bonding by tailoring the courses and the trainings offered according to needs of the end-user.

**Eligibility Criteria**

1. MSc/BS in Pure Mathematics/Applied Mathematics/Computational Mathematics (minimum 16-year education) or its equivalent with minimum CGPA 2.00/4.00 in semester system or 60% in annual system/term system from an HEC recognized institute/university.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or
Admission Process

Admission merit will be prepared according to the following criteria:

- Intermediate: 10% weightage
- BS Mathematics/BSc. + MSc.: 40/20+20% weightage
- NTU-GAT (General) Test: 40% weightage
- Interview: 10% weightage

Program Structure and Course Contents

MS Mathematics is spread over a minimum of 4 semesters and maximum of 8 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 32 credit hours in total including 26 credit hours of course work and 6 credit hours for research thesis.

The scheme of studies is given as under:

<table>
<thead>
<tr>
<th>Semester-I</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MA-5013</td>
<td>Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA-5009</td>
<td>Riemannian Geometry</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA-5023</td>
<td>Advanced Numerical Analysis</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA-50XX</td>
<td>Core Course-I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester-II</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MA-50XX</td>
<td>Elective Course-I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA-50XX</td>
<td>Elective Course-II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA-50XX</td>
<td>Elective Course-III</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA-50XX</td>
<td>Elective Course-IV</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>TEX-5078</td>
<td>Functional Textile</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester III and IV</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MA-5090</td>
<td>Research Thesis</td>
<td>6(3+3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Credit Hours</td>
<td>32</td>
</tr>
</tbody>
</table>

Note:
- MS students will have to pass 26 credit hours courses and 6 credit hours thesis.
- Department can offer any course from the list of approved courses based 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

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MA-5001</td>
<td>Commutative Algebra-I</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MA-5002</td>
<td>Homological Algebra-I</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>MA-5003</td>
<td>Commutative Algebra-II</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>MA-5004</td>
<td>Homological Algebra-II</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>MA-5005</td>
<td>Banach Algebra</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5006</td>
<td>Advanced Complex Analysis-I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5007</td>
<td>Advanced Complex Analysis-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5008</td>
<td>Topological Vector Spaces</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5009</td>
<td>Riemannian Geometry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5010</td>
<td>Integral Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5011</td>
<td>Inequalities Involving Convex Functions</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5012</td>
<td>Harmonic Analysis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5013</td>
<td>Partial Differential Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5014</td>
<td>Numerical Solutions of Ordinary Differential Equation</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5015</td>
<td>General Relativity-I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5016</td>
<td>Graph Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5017</td>
<td>Combinatorics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5018</td>
<td>Research Methodology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5019</td>
<td>Non-Newtonian Fluid Mechanics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5020</td>
<td>Advanced Analytical Dynamics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5021</td>
<td>Numerical Solutions of Partial Differential Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5022</td>
<td>Functional Analysis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5023</td>
<td>Advanced Numerical Analysis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5024</td>
<td>Mathematical Techniques</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5025</td>
<td>ODEs and Computational Linear</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5026</td>
<td>Group Theory</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>MA-5027</td>
<td>Advanced Mathematical Physics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5028</td>
<td>Theory of Spline Functions-I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5029</td>
<td>Theory of Spline Functions-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5030</td>
<td>Mathematical Spline Functions-I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5031</td>
<td>Mathematical Spline Functions-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5032</td>
<td>Design Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5033</td>
<td>Minimal Surfaces</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5034</td>
<td>General Relativity-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5035</td>
<td>Classical Field Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5036</td>
<td>Electrodynamics-I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5037</td>
<td>Electrodynamics-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5038</td>
<td>Magneto Hydrodynamics-I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5039</td>
<td>Magneto Hydrodynamics-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5040</td>
<td>Quantum Field Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5041</td>
<td>Lie Algebra &amp; Lie Groups</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5042</td>
<td>Computer Aided Geometric Designing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5043</td>
<td>Electrodynamics-I</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>MA-5044</td>
<td>Electrodynamics-II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5045</td>
<td>Acoustics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5046</td>
<td>Fluid Dynamics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5047</td>
<td>Fluid Mechanics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5048</td>
<td>Mathematical Techniques for BVPs</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5049</td>
<td>Advanced Analytical Dynamics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5050</td>
<td>Variational Inequalities</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5051</td>
<td>Integral Transform</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MA-5052</td>
<td>Inequalities involving Convex Functions</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
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**


**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**


**MA -5005: Banach Algebra**


**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**

MA -5008: Topological Vector Spaces

MA-5009: Riemannian Geometry

MA -5010: Integral Equations

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

MA -5013: Partial Differential Equations

MA -5014: Numerical Solutions of Ordinary Differential Equations

MA -5015: General Relativity-I

**MA-5016: Graph Theory**


**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**


**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.

**MA-5025: ODEs and Computational Linear Algebra**

MA -5022: Functional Analysis


MA -5023: Advanced Numerical Analysis


MA-5024: Mathematical Techniques


MA-5026: Group Theory


MA-5027: Advanced Mathematical Physics


MA-5028: Theory of Spline Functions-I

Parametric Curves: Affine Maps: Translation, Rotation, Reflection, Stretching, Scaling and shear. Barycentric

MA-5029: Theory of Spline Functions-II

Interpolatory cubic splines. The representation of \( s \) in terms of the values \( M_i = s(2)(x_i), i=0,1,2,...,k \). The representation of \( s \) in terms of the values \( m_i = s(1)(x_i), i=0,1,2,...,k \). Quadratic Hermite spline. Theorems regarding error analysis. Theorems regarding to Convergence of the D1, D2, natural and periodic splines. End conditions for cubic Hermite spline interpolation. E(\( \alpha \))-cubic splines.

MA-5030: Mathematical Modeling-I


MA-5031: Mathematical Modeling-II


MA-5032: Design Theory


MA-5033: Minimal Surfaces


MA-5034: General Relativity-II

MA-5035: Classical Field Theory


MA-5036: Electrodynamics-I


MA-5037: Electrodynamics-II


MA-5038: Magnetohydrodynamics-I


MA-5039: Magnetohydrodynamics-II


MA-5040: Quantum Field Theory

Classical field theory, Lagrangian mechanics, variational principle, vibrating stings, classical field theory, Lorentz transformations, Lorentz group, classical scalar fields, Klein-Gordon equation, complex scalar fields, energy-momentum tensor, electromagnetic field, Maxwell’s equations, spinor field, Dirac equation, symmetries and conservation laws, Noether’s theorem, translation invariance. Quantization of fields, canonical quantization of scalar fields, particle interpretation of quantum field theory. Interacting Quantum Fields, perturbation theory, time ordering, decay rate of an unstable particle, higher order perturbation theory, Wick’s theorem second order perturbation theory, renormalization.

MA-5041: Lie Algebra and Lie Groups

Definitions and examples of Lie algebras, ideals and quotients Simple, solvable and nilpotent Lie algebras radical of a Lie algebra, Semisimple Lie algebras; Engel’s nilpotency criterion; Lie’s and Cartan theorems Jordan-Chevalley decomposition Killing forms Criterion for semisimplicity, product of Lie algebras; Classification of Lie
algebras up to dimension 4; Applications of Lie algebras.

**MA-5042: Computer Aided Geometric Designing**

Linear interpolation, piecewise linear interpolation blossoms, barycentric coordinates in the plane, the de Casteljau algorithm, properties of Bezier curves, Bernstein polynomials, composite Bezier curves, degree elevation, the variation diminishing property, degree reduction, Polynomial curve constructions: Aitken’s Algorithm, Lagrange Polynomials, Lagrange interpolation, cubic Hermite interpolation, Piece-normal interpolation, B-Spline curves: B-spline segments, curves, Knot insertion, degree elevation, Greville Abscissae, smoothness. Constructing Splines Curves: Greville interpolation, modifying B-Spline curves, cubic spline interpolation, the minimum property, piecewise cubic interpolation. Rational Bezier and B-Spline Curves: Rational Bezier curves, Rational Cubic B-spline curves.

**MA-5043: Elastodynamics-I**


**MA-5044: Elastodynamics-II**


**MA-5045: Acoustics**

Fundamentals of vibrations. Energy of vibration. Damped and free oscillations. Transient response of an oscillator vibrations of strings, membranes and plates, forced vibrations. Normal modes, Acoustic waves equation and its solution, equation of state, equatin of cout, Euler’s equations, linearized wave equation, speed of sound in fluid, energy density, acoustic intensity, specific acoustic impedance, spherical waves, transmission from one fluid to another (Normal incidence) reflection at a surface of solid (normal and oblique incidence). Absorption and attenuation of sound waves in fluids, pipes cavities waves guides; underwater acoustics.

**MA-5046: Fluid Dynamics**


**MA-5047: Fluid Mechanics**

Navier-Stoke’s equation and exact solutions, dynamical similarity and Reynold’s number, Turbulent flow, Boundary layer concept and governing equations, laminar flat plate boundary layer: exact solution, momentum, integral equation, use of momentum integral equation for flow with zero pressure gradient, pressure gradient in boundary-layer flow, Reynold’s equations of turbulent motion. Magnetohydrodynamics, MHD equations, fluid drifts, stability and equilibrium problems.

**MA-5048: Mathematical Techniques for BVPs**

Green’s function method with applications to wave-propagation. Regular and singular perturbation techniques with applications variational methods. A survey of transform techniques: Wiener-Hopf technique with
applications to diffraction problems.

**MA-5049: Advanced Analytical Dynamics**


**MA-5050: Variational Inequalities**

Variational problems, existence results for the general implicit variational problems, implicit Ky Fan’s inequality for monotone functions, Jartman stampacchia theorem for monotone for compact operators, Selection of fixed points by monotone functions, Variational and quasivariational inequalities for monotone operators.

**MA-5051: Integral Transform**

Laplace transform, Application to integral equations, Fourier transforms, Fourier sine and cosine transform, Inverse transform, Application to differentiation, Convolutions theorem, Application to partial differential equations, Hankel transform and its applications, Application to integration, Mellin transform and its applications.

**MA-5052: Inequalities involving Convex Functions**

Jensen’s and related inequalities, 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-5053: Structural Dynamics**


**MA-5054: Special Topics in Advance 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-5055: 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.

**TEX -5078: Functional Textile**

2. MS PHYSICS

Program Objectives
The MS Physics Program aims to provide advance training in science and technology of various branches of Physics with an aim to train students with latest technologies, and to conduct an independent investigation of a research problem and establish new industry-academia linkages.

Eligibility Criteria
1. BS/MSc. in Physics (minimum 16 years of education) degree or its equivalent with a minimum CGPA of 2.00/4.00 in semester system or 60% in annual system / Term system from an HEC recognized institute/university.

2. The applicant must pass NTU-GAT (General) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 50% cumulative score.

3. The applicant must not be already registered as a student in any other academic program in Pakistan or abroad.

Merit Criteria
Admission merit will be prepared according to the following criteria:

- Intermediate 10% weightage
- BS Physics /BSc. + MSc. 40 / 20%+20% weightage
- NTU-GAT (General) Test 40% weightage
- Interview 10% weightage
Total Credit Hours
For award of MS Physics, candidates must need to complete total credit hours of 32 out of which 26 credit hours of course work and 6 credit hours for research work/thesis.

Study Duration
The minimum duration of study will be 4 semesters and maximum of 8 semesters. Each Semester has at least 18 weeks including 1 week for mid semester and 1 week for final examination.

MS Thesis Evaluation
The MS thesis will be evaluated by one external PhD examiner of the relevant field taken from external university / institute in addition to departmental evaluation committee.

Plagiarism Test
The Plagiarism test must be conducted on the Dissertation before its submission to the external expert as per HEC criteria.

Scope of the Degree
The MS Physicist would be able to get a good job in the diverse fields, some of them include:

1. Teaching and research at university/post graduate college level in the departments of Physics.
2. Research and Development in public and private sector organizations.
3. Product development in public and private sector organizations.
4. Higher studies and research in Physics and the relevant fields.

Semester Wise Layout of Courses

Semester-I

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PH-5001</td>
<td>Methods of Mathematical Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>2</td>
<td>PH-5002</td>
<td>Quantum Mechanics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>3</td>
<td>PH-5003</td>
<td>Electrodynamics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>4</td>
<td>PH-5004</td>
<td>Classical Mechanics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

Semester-II

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PH-5005</td>
<td>Statistical Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>Elective-I</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>Elective -II</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>Elective - III</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>Elective-IV (Functional Textile)</td>
<td>2(2-0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>14</td>
</tr>
</tbody>
</table>

Semester III & IV

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PH-5090</td>
<td>MS Thesis</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Credit Hours</td>
<td>32</td>
</tr>
</tbody>
</table>

Note:
- MS students will have to pass the 26 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 a seminar, quizzes and assignments of every student in each subject.
- Number of activities (quizzes, assignment, presentations etc.) will be double to the number of credit hours of each subject.

**LIST OF OFFERED COURSES (24 credit to be taken in 2 semesters)**

*PH-5001, PH-5002, PH-5003, PH-5004, PH-5005 are compulsory courses.*

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PH-5001</td>
<td>Methods of Mathematical Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>2</td>
<td>PH-5002</td>
<td>Quantum Mechanics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>3</td>
<td>PH-5003</td>
<td>Electrodynamics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>4</td>
<td>PH-5004</td>
<td>Classical Mechanics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>5</td>
<td>PH-5005</td>
<td>Statistical Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>6</td>
<td>PH-5006</td>
<td>Methods and Techniques of Experimental Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>7</td>
<td>PH-5007</td>
<td>Magnetism And Magnetic Material</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>8</td>
<td>PH-5008</td>
<td>Material Science</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>9</td>
<td>PH-5009</td>
<td>Thin Film Deposition Techniques</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>10</td>
<td>PH-5010</td>
<td>Fundamentals of Nano-Science</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>11</td>
<td>PH-5011</td>
<td>Semiconductor Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>12</td>
<td>PH-5012</td>
<td>Physics of Solar Cell</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>13</td>
<td>PH-5013</td>
<td>Atomic Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>14</td>
<td>PH-5014</td>
<td>Atomic Spectroscopy</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>15</td>
<td>PH-5015</td>
<td>Reservoir Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>16</td>
<td>PH-5016</td>
<td>X-Ray Crystallography</td>
<td>3(3,0)</td>
</tr>
<tr>
<td>17</td>
<td>PH-5017</td>
<td>Solid State Electronic Devices</td>
<td>3(3,0)</td>
</tr>
<tr>
<td>18</td>
<td>PH-5018</td>
<td>Growth And Characterization Of Solids</td>
<td>3(3,0)</td>
</tr>
<tr>
<td>19</td>
<td>PH-5019</td>
<td>Plasma Physics</td>
<td>3(3,0)</td>
</tr>
<tr>
<td>20</td>
<td>PH-5020</td>
<td>Special Topics In Advanced Physics-I</td>
<td>3(3,0)</td>
</tr>
<tr>
<td>21</td>
<td>PH-5021</td>
<td>Special Topics In Advanced Physics-li</td>
<td>3(3,0)</td>
</tr>
<tr>
<td>22</td>
<td>PH-5090</td>
<td>Research Thesis</td>
<td>6(0-18)</td>
</tr>
</tbody>
</table>

**Total Credit hours** 30

**Course Specifications**

**PH-5001: Methods of Mathematical Physics**


**Recommended Books:**
PH-5002: Quantum Mechanics

Waves and particles: Introduction to fundamental idea of Quantum mechanics. Electromagnetic waves and photons; Light quanta and the plank-Einstein relations, wave particle duality, Analysis of young double slit experiment, Quantum unification of two aspect of light, The Principle of spectral decomposition, Material particle and matter waves; The de Broglie relations, Wave functions: the Schrodinger equation, Quantum description of a particle Wave packets; Free particle, Form of the wave packet at given time, Heisenberg uncertainty relation, Time evolution of free wave packet, Particle in a time independent Scalar potential; Separation of variables. Stationary states, one dimensional square potential. Order of magnitude of the wave length associated with the material particle, Constraints imposed by the uncertainty relation, the uncertainty relation and the atomic parameters, An experiment illustrating the uncertainty relation, A simple treatment of a two dimensional wave packet, the relation between one and three dimensional problem, One dimensional Gaussian wave packet: spreading of wave packet, Stationary state of a particle in one dimensional square well, behaviour of wave packet at a potential step. The mathematical tool of quantum mechanics: The postulates of quantum mechanics: Spin1/2 particle: The one-dimensional harmonic oscillator: General properties of angular momentum in Quantum mechanics: Particle in a central potential: the hydrogen atom:

Recommended Books:
- Quantum Mechanics by Dirac, P. A. M (Oxford University Press)

PH-5003: Electrodynamics

Introduction to Electrostatics:
Method of Images, Point Charge in the Presence of a Grounded Conducting Sphere, Point Charge in the Presence of a Charged, Insulated, Conducting Sphere, Point Charge Near Conducting Sphere at Fixed Potential, Conducting Sphere in a Uniform Electric Field by Method of Images, Green Function for the Sphere; General Solution for the Potential, Conducting Sphere with Hemi-spheres at Different Potentials, Orthogonal Functions and Expansions, Separation of Variables; Laplace Equation in Rectangular Coordinates, A Two-Dimensional Potential Problem; Summation of Fourier Series, Fields and Charge Densities in Two-Dimensional Corners and Along Edges, Introduction to Finite Element Analysis for Electrostatics.

Boundary-Value Problems in Electrostatics-II:
Laplace Equation in Spherical Coordinates, Legendre Equation and Legendre Polynomials, Boundary-Value Problems with Azimuthal Symmetry, Behaviour of Fields in a Conical Hole or Near a Sharp Point, Associated

**Recommended Books:**

**PH-5004: Classical Mechanics**

Survey of the elementary principles, Variational principles and Lagranges’ equations, Oscillations, The classical mechanics of the special theory of relativity, Hamiltonian equations of motion, canonical transformations, Hamilton-Jacobi theory and Action angle variable, Classical Chaos, Canonical perturbation theory, Introduction to the Lagrangian and Hamiltonian formulations for continuous systems and fields, Classical mechanics of liquids and deformable solids; stress, deformation and strain flow.

**Recommended Books:**

**PH-5005: Statistical Physics**

Intensive and extensive quantities, thermodynamic variables, thermodynamic limit, thermodynamic transformations. Classical ideal gas, first law of thermodynamics, application to magnetic systems, heat and entropy, Carnot cycle. Second law of thermodynamics, absolute temperature, temperature as integrating factor, entropy of ideal gas. Conditions for equilibrium, Helmholtz free energy, Gibbs potential, Maxwell relations, chemical potential. First-order phase transition, condition for phase coexistence. The statistical approach: phase

**Recommended Books:**
- Introduction to Statistical Physics, Kerson Huang, (Taylor and Francis, 2001).

**PH-5006: Methods and Techniques of Experimental Physics**


**Recommended Books:**
- Richard Wrolflson and Jay M. Pasachoff, (1999), Physics for Scientists and Engineers, Published by Addison Wesley / Longman Inc.
- B.D. Cullity, (1978), Elements of X-ray Diffraction, Published by Addison-Wesley Publ. Co. Inch. USA.

**PH-5007: Magnetism and Magnetic Materials**

Recommended Books:
- Kannan M. Krishnan, (2016), Fundamentals and Applications of Magnetic, Oxford University Press

PH-5008: Material Science


Recommended Books:
- U.C. Jindal, (2012), Material Science and Metallurgy, Pearson

PH-5009: Thin Film Deposition Techniques


Recommended Books:
- Hartmut Frey and Hamid R Khan, (2015), Handbook of Thin Film Technology, Springer
• Krishna Seshan, (2012), Handbook of Thin Film Deposition, Elsevier, 3rd edition
• Charlee Fansler, (2008), Aluminum Nitride Thin Films: Deposition for Fabrication, Characterization and Fabrication of Surface Acoustic Wave, VDM Verlag Dr. Müller
• Md. Habibur Rahman Habib and Md. Harun-Or Rashid, (2013), Thin Film Deposition: Theory & Applications in Solar Cell, Lambert academic Publishing
• John E. Mahan, (2000), Physical Vapor Deposition of Thin Films, Wiley
• Yuan Lin, (2016), Advanced Nano Deposition Methods, Wiley-VCH
• Peter M. Martin, William Andrew, (2009), Handbook of Deposition Technologies for Films and Coatings, Science Applications and Technology.

PH-5010: Fundamentals of Nanoscience


Recommended Books
• Kurt W. Kolasinski, (2012), Surface Science: Foundations of Catalysis and Nanoscience, WILEY
• Hans-Eckhardt Schaefer, (2010), Nanoscience: The Science of the Small in Physics, Engineering, Chemistry, Biology and Medicine, Springer
• Chris Binns, (2010), Introduction to Nanoscience and Nanotechnology, WILEY
• Gabor L. Hornyak and H.F. Tibbals, (2008), Introduction to Nanoscience and Nanotechnology, CRC press
• Alain Nouailhat, (2008), An Introduction to Nanoscience and Nanotechnology, ISTE Ltd.
• Daniel L. Schodek, Paulo Ferre, (2009), Nanomaterials, Nanotechnologies and Design” An Introduction for Engineers.

PH-5011: Semiconductor Physics

Introduction/Elementary Properties of Semiconductors, Crystal Structure, Atomic Bonding, Intrinsic and Extrinsic

**Recommended Books**

**PH-5012: Physics of Solar Cells**

**Recommended Books**
PH-5013: Atomic Physics


Recommended Books:
- Vasant Natarajan, (2015), Modern Atomic Physics, CRC Press

PH-5014: Atomic Spectroscopy


Recommended Books
- Terry L. Meek, (2010), Introduction to Spectroscopy, Atomic Structure and Chemical Bonding, University of the West Indies Press.

PH-5015: Reservoir Physics

Petro (porosity, permeability, saturation, capillary phenomena), properties of fluids (water, oil, gas) and an introduction to reservoir. It will present the interpretation of well tests, types of recovery mechanisms (multi-
phase flow, primary and secondary recovery) and the field development. Reservoir Characterization and Modeling. The workflow of reservoir characterization and modeling as routinely used in the oil industry. The presentation will be illustrated by practical work using actual data. Deterministic and stochastic modeling, volumetric calculation and uncertainties will be discussed at each stage, with a focus on geology, seismic and geostatistical methods. On shore and offshore hydrocarbon exploration methods. Shallow water and deep water exploration problems.

Recommended Books:
- Dr. Oliver C. Mullins, (2008), The Physics of Reservoir Fluids: Discovery Through Downhole Fluid Analysis, Schlumberger press

PH-5016: X-ray Crystallography
Crystal systems, Bravais lattices and Miller indices, Point Group, space groups and systematic absences, Structure Vs lattices, Optical diffraction and the Laue and Bragg experiments, The Ewald construction, Powder diffraction techniques, Reciprocal lattices and Diffraction, Mathematical definition of reciprocal lattices and geometrical relationships to direct (Bravais)-lattices, Role of reciprocal lattice in diffraction-the condition for constructive interference, Structural factors, Integrated intensities and the phase problem, Patterson technique and direct methods, Systematic absences and symmetry, Structure refinement, least squares, Debye-Waller factors, Data collection, unit cell and symmetry, Intensities, Data reduction, Structure solutions, Finishing Touches.

Recommended Books:

PH-5017: Solid State Electronic Devices

**Recommended Books:**
- M. Shur, (1990), Semiconductor Devices, Prentice Hall.

**PH-5018: Growth and Characterization of Solids**


**Recommended Books:**
- Ivan V Markov, (2003), Crystal Growth for Beginners: Fundamentals of Nucleation, Crystal Growth and Epitaxy, Imperial College Press
- C. Kittel, (1996), Introduction to Solid State Physics, 8th Edition Published by nawarajbhandari.

**PH-5019: Plasma Physics**

Introduction to plasma, occurrence of plasmas in nature, concept of temperature, Debye shielding, criteria for plasmas, applications of plasma. Single particle motion, motion of charged particles in uniform E and B fields, motion of charged particles in non-uniform E and B fields, motion of charged particles in time varying E and B fields, adiabatic invariants. Plasmas as fluids, relation of plasma to ordinary electromagnetic, the fluid equation of motion, equation of continuity, the complete set of fluid equations, plasma approximations. Waves in plasmas, representation of waves, group velocity, plasma oscillations, electron plasma waves, sound waves, ion waves, validity of plasma approximation, comparison of ion wave and electron wave, electrostatic electron oscillations perpendicular to B, electrostatic ion waves perpendicular to B, the lower hybrid frequency, EM waves with Bo=0,
EM waves perpendicular to Bo, cutoffs and resonances, EM waves parallel to Bo, hydro-magnetic waves, magneto-sonic waves, basic nuclear fusion reaction rates and power density, radiation losses from plasmas, operational conditions, Lawson criteria, magnetic confinement fusion, inertial confinement fusion.

**Recommended Books:**
- James E. Drummond, (2013), Plasma Physics, Dover Books on Physics

**PH-5020: Special Topics in Advanced Physics-I**

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

**PH-5021: Special Topics in Advanced Physics-II**

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

**Aims and Objectives**

Department of Applied Sciences of NTU, being one of the basic academic divisions of the University, has always been striving for the realization of this mandate. One manner of achieving this is to offer PhD Chemistry Program, in addition to its specific tasks of undertaking basic, applied, and mission-oriented researches. The main objective of this degree is to create self-motivated chemists who can fulfill the demand of current challenging fields. This postgraduate degree is based on applied research to prepare students for professional career in research. In addition to that, the program provides a unique opportunity to graduates to strengthen their knowledge and work in multi-disciplines. Our researchers have also ability to help out different industry related problems through knowledge of education and research especially in the context of textile industry.

**Admission Criteria**

1. MS/M.Phil Chemistry or equivalent degree with minimum CGPA 3.00/4.00 or 3.50/5.00 in semester system or 60% marks in annual system.
2. The applicant must pass NTU-GAT (Subject) test conducted by National Textile University, as per HEC guidelines and adopted by Advanced Studies and Research Board of NTU, Faisalabad with a minimum of 70% cumulative score.
3. It is mandatory to pass interview in order to compete on merit.
4. Applicant must not be already registered as a student in any other academic program in Pakistan or abroad.
**Merit Criteria**

Admission merit will be prepared according to the following criteria:

- M.Phil./MS Chemistry 50% weightage
- M.Sc./BS Chemistry 30% weightage
- Publications/Relative Experience 10% weightage
- Interview / Research Aptitude 10% weightage

*An HEC or other scholarship holder will be given preference for admission.

**Duration of the Program**

- The period for completion of PhD program shall be 3 - 8 years, one year for 18 credit hours course work and two years for research, the period shall be counted from the commencement of course work.

- The maximum permissible period for submission of PhD thesis will be 16 semesters (8 Years) including course work. 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 PhD candidate has to take PhD level course work of minimum 18 credit hours with the consent of his/her supervisor.
- The course contents are 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**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-XXXX</td>
<td>Elective Course – I</td>
<td>3</td>
</tr>
<tr>
<td>CH-XXXX</td>
<td>Elective Course – II</td>
<td>3</td>
</tr>
<tr>
<td>CH-XXXX</td>
<td>Elective Course – III</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** 9

**Semester-II**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-XXXX</td>
<td>Elective Course – IV</td>
<td>3</td>
</tr>
<tr>
<td>CH-XXXX</td>
<td>Elective Course – V</td>
<td>3</td>
</tr>
<tr>
<td>CH-XXXX</td>
<td>Elective Course – VI</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** 9

**Semesters III-VIII**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-9090</td>
<td>Research Thesis</td>
<td>30</td>
</tr>
</tbody>
</table>

**Total Credit Hours** 48

**Research Paper Requirement**

Before final submission of thesis for evaluation, the PhD 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 is acceptable for the 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 after due approval.)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CH-9001 Advanced Physical Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CH-9002 Inorganic Materials Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>CH-9003 Physical Organic Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CH-9004 Nuclear Magnetic Resonance in Organic Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>CH-9005 Advanced Mass Spectrometry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CH-9006 Advanced Polymer Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CH-9007 Special Organic Materials</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CH-9008 Advanced Photochemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>CH-9009 Advanced Surface Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CH-9010 Chemistry of Advanced Composite Materials</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CH-9011 Advanced Applied Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>CH-9012 Applied Environmental Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>CH-9013 Nanochemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>CH-9014 Biophysical Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>CH-9015 Advanced Chemical Treatment of Textiles</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>CH-9016 Advanced Textile Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>CH-9017 Advanced Analytical Techniques</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>CH-9090 Research Thesis</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

CH-9001: Advanced Physical Chemistry


CH-9002: Inorganic Materials Chemistry


CH-9003: Physical Organic Chemistry

History and development: Evolution of a hybrid discipline, energychanges 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-9004: Nuclear Magnetic Resonance in Organic Chemistry**


**CH-9005: 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-9006: Advanced Polymer Chemistry**


**CH-9007: Special Organic Materials**

Organic dyes: Chromophore structure, synthesis of azodyes and cyanins, reactive vs. direct textile dyes, Chemiluminescence, photochromics, 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 poly(paraphenylenes), band structure, synthesis, electroluminescence and light emitting diodes (LED’s).

**CH-9008: Advanced Photochemistry**


**CH-9009: 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- & CO2-
methanation, water-gas shift, Fischer-Tropsch synthesis reactions. Catalysts for syntheses of: ammonia, nitric acid, chemical fertilizers etc.

**CH-9010: Chemistry Advanced Composite Materials**


**CH-9011: 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-9012: Applied Environmental Chemistry**


**CH-9013: Nanochemistry**


**CH-9014: Biophysical Chemistry**


**CH-9015: 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-9016: Advanced Textile Chemistry**

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

**CH-9017: Advanced Analytical Techniques**

FACULTY OF MANAGEMENT SCIENCES

Introduction
Faculty of Management Sciences (FMS) is playing an important role in imparting quality business education in the region. The faculty aims to develop theoretical and practical understanding among students about core business curriculum so that the students can effectively use this knowledge in contemporary business world. The faculty take pride in developing awareness among students about social and ethical considerations so that they take into account moral consequences in decision making.

One of the major goals is to produce individuals with good leadership skills with a blend of knowledge related to management, marketing and textiles. Teaching faculty is fully committed to provide exciting, challenging and rewarding experiences to students during their studies, and to make every possible effort to help them in reaching their full potential.
1. **MS BUSINESS ADMINISTRATION** (Thesis Based) (Marketing, HRM & Finance)
2. **MBA** (Project Based) (Marketing, HRM & Finance)

**Eligibility Criteria**

A candidate must have 16 Years relevant Business Education BBA-BSTMM-MBA-M.Com or 16-years relevant equivalent degree from HEC recognized University / Institute with minimum 2.00/4.00 CGPA in semester system or 50% in annual system.

**Merit Criteria**

- BBA (4 Years), BSTMM (4 Years) BBS, M.Com or 16 year equivalent degree 60% weightage
- NTU-GAT (General) Test 30% weightage
- Interview 10% weightage

**PROGRAM LEARNING OUTCOMES (PLOs)**

**Master of Science in Business Administration (MSBA)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Attributes</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Core Business Education</td>
<td>An ability to understand and apply theoretical knowledge related to core business subjects at a level expected from graduates with MSBA degree.</td>
</tr>
<tr>
<td>2</td>
<td>Research Skills</td>
<td>An ability to do research to understand, analyze and contribute in the academic discussions at a level expected from graduates with MSBA degree.</td>
</tr>
<tr>
<td>3</td>
<td>Critical Thinking</td>
<td>An ability to demonstrate critical thinking approach to research at a level expected from graduates with MSBA degree.</td>
</tr>
<tr>
<td>4</td>
<td>Teaching Skills</td>
<td>An ability to communicate and disseminate knowledge at higher education level.</td>
</tr>
</tbody>
</table>

**Program Structure for MS Business Administration**

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MGT-6091</td>
<td>Advance Research Methods</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>2</td>
<td>MGT-6092</td>
<td>Strategic Finance</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>3</td>
<td>MGT-6093</td>
<td>Strategic Marketing</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>4</td>
<td>MGT-6094</td>
<td>Organization Theory &amp; Design</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>5</td>
<td>MGT-6095</td>
<td>Project Management</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>6</td>
<td>MGT-6096</td>
<td>Leadership and Organizational Behavior</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>7</td>
<td>-</td>
<td>Elective-I</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>8</td>
<td>-</td>
<td>Elective-II</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>Elective-III</td>
<td>(3-0-3)</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
<td>Elective-IV (Functional Textiles)</td>
<td>(2-0-2)</td>
</tr>
<tr>
<td>11</td>
<td>-</td>
<td>Thesis / Dissertation</td>
<td>(6-0-6)</td>
</tr>
</tbody>
</table>

**Total** 35

Note: Institute may Change / shuffle or substitute the sequence of courses during the program as per requirement.
Program Structure for MBA

MBA program is comprised over 32 Cr.Hrs. HEC Business Education Roadmap-2019 will be followed for MBA program.

Course Specifications

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 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 other’s 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 student 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 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**

This course is designed to sharpen the ability to diagnose and solve a range of organizational challenges. Through readings, lecturer, cases, and experiential exercises, students will investigate concepts from the social sciences that are useful for understanding the organizational process, and apply these frameworks to particular situations with the view of rendering a given company. Students will also acquire an understanding of frameworks covering leadership, team roles, and group development as well as theories addressing leadership, conflict resolution, and team decision making. Practical knowledge will enable participants to understand the tools, techniques, skills and leadership style required to supervise individuals and manage a team and their performance effectively by giving them appropriate and constructive feedback.
Academic Rules

1. MS Programs (All)

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 program 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.
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 incharge of the program. 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 program 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 program 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 program.

1.12 Degree Requirements & Duration

All MS programs students must have a minimum CGPA 2.50/4.00 to achieve the degree of their respective
programs. The minimum duration of a MS program (except MS Business Administration 3 Semester-1.5 Year) is 4 regular semesters and maximum of 8 regular semesters (4 Years) as per HEC.

**PhD Programs**

**1.3 Course Work**

**1.3.1 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

**1.3.2 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.

**1.3.3 Course Work Load**

- The PhD candidate has to take PhD level course work of 18 credits.
- The course contents shall be proposed by the concerned Faculty Board of Studies, recommended by the Advanced Studies & Research Board (ASRB) and approved by the Academic Council.
- All courses given in PhD program will be designated by 700.
- A course may range from one credit to four credits.
- 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.

**1.3.4 Attendance Requirement**

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

**1.3.5 Residency Requirement**

- PhD program comprises full-time course work and research work.
- Study leave is mandatory for in-service candidates enrolled in PhD

**1.3.6 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:
  - Mid-semester examination: 30%
  - Assignments/quizzes/seminars etc.: 30%
  - 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 C+ letter grade 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.
Grading Criteria
Student’s performance is evaluated by following grading criteria.

Course grades (letter grades) are awarded to students based on their relative performance in the course. If the student’s strength of class is twenty (20) or more then grades are calculated using statistical methods, recommended by HEC for relative grading system (HEC’s “Policy Guidelines for Uniform Implementation of Semester Based Examination System - 2015”). If the class strength is less than twenty (20), then absolute grading system is used.

Relative Grading System
Following grading criteria is used for relative grading system (in case of class strength is 20 or more)

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Grade Point</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>4.00</td>
<td>Exceptional</td>
</tr>
<tr>
<td>A</td>
<td>4.00</td>
<td>Outstanding</td>
</tr>
<tr>
<td>A-</td>
<td>3.66</td>
<td>Excellent</td>
</tr>
<tr>
<td>B+</td>
<td>3.33</td>
<td>Very Good</td>
</tr>
<tr>
<td>B</td>
<td>3.00</td>
<td>Good</td>
</tr>
<tr>
<td>B-</td>
<td>2.66</td>
<td>Above Average</td>
</tr>
<tr>
<td>C+</td>
<td>2.33</td>
<td>Average</td>
</tr>
<tr>
<td>C</td>
<td>2.00</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>C-</td>
<td>1.66</td>
<td>Pass</td>
</tr>
<tr>
<td>D+</td>
<td>1.33</td>
<td>Low Pass</td>
</tr>
<tr>
<td>D</td>
<td>1.00</td>
<td>Marginal Pass</td>
</tr>
<tr>
<td>F</td>
<td>0.00</td>
<td>Fail</td>
</tr>
<tr>
<td>I</td>
<td>--</td>
<td>Incomplete</td>
</tr>
<tr>
<td>W</td>
<td>--</td>
<td>Course Withdrawn</td>
</tr>
</tbody>
</table>

Absolute Grading System
Following absolute grading system will be used in case class strength is less than twenty (20).

<table>
<thead>
<tr>
<th>Marks (%)</th>
<th>Grade Point</th>
<th>Letter</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 and Above</td>
<td>4.00</td>
<td>A+</td>
<td>Exceptional</td>
</tr>
<tr>
<td>85-89.9</td>
<td>4.00</td>
<td>A</td>
<td>Outstanding</td>
</tr>
<tr>
<td>80-84.9</td>
<td>3.66</td>
<td>A-</td>
<td>Excellent</td>
</tr>
<tr>
<td>75-79.9</td>
<td>3.33</td>
<td>B+</td>
<td>Very Good</td>
</tr>
<tr>
<td>71-74.9</td>
<td>3.00</td>
<td>B</td>
<td>Good</td>
</tr>
<tr>
<td>68-70.9</td>
<td>2.66</td>
<td>B-</td>
<td>Above Average</td>
</tr>
<tr>
<td>64-67.9</td>
<td>2.33</td>
<td>C+</td>
<td>Average</td>
</tr>
<tr>
<td>61-63.9</td>
<td>2.00</td>
<td>C</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>58-60.9</td>
<td>1.66</td>
<td>C-</td>
<td>Pass</td>
</tr>
<tr>
<td>54-57.9</td>
<td>1.33</td>
<td>D+</td>
<td>Low Pass</td>
</tr>
<tr>
<td>50-53.9</td>
<td>1.00</td>
<td>D</td>
<td>Marginal Pass</td>
</tr>
<tr>
<td>Below 50</td>
<td>0.00</td>
<td>F</td>
<td>Fail</td>
</tr>
<tr>
<td></td>
<td>--</td>
<td>I</td>
<td>Incomplete</td>
</tr>
<tr>
<td></td>
<td>--</td>
<td>W</td>
<td>Course Withdrawn</td>
</tr>
</tbody>
</table>

- “W” stands for withdrawn course and has no grade point equivalent and credit hours for withdrawn courses will not be count towards the credit hours taken in the semester.
- “I” stands for incomplete course.
- Fraction of marks in a course shall be up to 2 digits.
1.3.7 Comprehensive Examination

- On completion of course work in two semesters, comprehensive examination (1st attempt) will be conducted in next 8 weeks.
- It shall consist of Written and Oral Examinations (70%: 30%).
- Student shall choose 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 concerned Dean / HoD, concerned faculty Director, Director, Graduate studies & research and subject experts / teachers whose subjects have been chosen by the students.
- 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, 2nd and last chance will be given to pass comprehensive examination in next 16 weeks. If a student does not qualify the comprehensive examination in the second attempt, he/she will be dropped out from PhD program.
- The course work and comprehensive exam must be completed within initial two years of the program.

1.3.8 Computation of Semester GPA and CGPA

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

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

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

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

Research Work

2.2.2 Synopsis

- After qualifying comprehensive examination, a student shall prepare and submit his/her synopsis/research proposal for PhD research work in next 6 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.

2.2.3 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.

2.2.4 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 Office of the Graduate Studies & Research for onward transmission to ASRB for approval / evaluation. A PhD student will present his/her progress (included published work) in form of presentation (progress seminar) once in a year.
2.2.5 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.

Sub Committee of ASRB

Following sub-committee acts on behalf of Advanced Studies & Research Board of NTU to recommend PhD examiners (external & Internal) and recommend award of degree. Constitution of the committee is as under:

1. Director GSR (Convener)
2. Dean Academics (Member)
3. Concerned Dean (Member)
4. Concerned HoD (Member / If applicable)
5. Concerned Supervisor (Member)
6. Concerned Director Graduate Programs (Secretary)

This committee presents report regarding its recommendation in the upcoming meeting of ASRB.

2.2.6 Appointment of Examiners (Existing)

- ASRB recommends 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 appoints 2 national and 2 foreign external examiners out of the recommended panel for thesis evaluation.

2.2.7 Thesis Evaluation

- The Director GSR gets the thesis evaluated within maximum of 6 months after the date of submission to his office. Before forwarding the thesis to the examiner, the Director GSR arranges to conduct plagiarism test for the thesis.
- If any of the examiner suggests minor modifications/revision, this should be incorporated by the students within 3 months and certified by the supervisors.
- No viva voce is held unless all the examiners recommend the thesis for defense.
- 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.

2.2.8 Final Thesis Defence

- The final defense 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 may 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. However, the Rector, in anticipation to the approval by the executive committee/syndicate, is authorized to approve the award of degree to a candidate who successfully defended thesis. However, action of the Rector shall be reported to the executive committee/syndicate in the next meeting for confirmation.
2.3 PhD Duration

- The minimum period for completion of PhD program shall be minimum 3 years (as per HEC), one year for 18 credit hours coursework and two 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 8 years (as per HEC).

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 a Ph.D Degree

```
MS/M Phil Equivalent (18 years education)
CGPA>3.00

Course work of 18 credit hours

Comprehensive Exam
(Maximum two attempts)

No
Success

Yes

Synopsis, Research Proposal

Research Work (3-4 years)

Publication of one research paper in HEC recognized journal

Thesis Evaluation

Public Defense followed by Oral examination

Award of PhD Degree
```
## Fee of Structure of All MS Programs
(Except MS & MBA Business Administration 1.5 Year)

<table>
<thead>
<tr>
<th>Fee Type</th>
<th>Semester Wise Amount in PKR</th>
<th>1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>4&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission Fee</td>
<td>(Once)</td>
<td>20,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Certificate Verification Fee</td>
<td>(Once)</td>
<td>2,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Processing Fee</td>
<td>(Once)</td>
<td>-</td>
<td>5,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>University Security</td>
<td>(Refundable)</td>
<td>5,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Red Crescent Donation</td>
<td>(Once)</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>University Card Fee</td>
<td>(Once)</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Degree Fee</td>
<td>(Once)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5,000</td>
</tr>
<tr>
<td>Tuition Fee</td>
<td>(Per Semester)</td>
<td>27,000</td>
<td>27,000</td>
<td>18,000</td>
<td>18,000</td>
</tr>
<tr>
<td>Library Fee</td>
<td>(Per Semester)</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Examination Fee</td>
<td>(Per Semester)</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Medical Fee</td>
<td>(Per Semester)</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Transport Fee for Non-Boarder</td>
<td>(Per Semester)</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Student Activities Fund</td>
<td>(Per Semester)</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Endowment Fund</td>
<td>(Per Semester)</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>68,400</td>
<td>46,000</td>
<td>32,000</td>
<td>37,000</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Fee Type</th>
<th>Semester Wise Amount in PKR</th>
<th>1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>4&lt;sup&gt;th&lt;/sup&gt;</th>
<th>5&lt;sup&gt;th&lt;/sup&gt;</th>
<th>6&lt;sup&gt;th&lt;/sup&gt;</th>
<th>7&lt;sup&gt;th&lt;/sup&gt;</th>
<th>8&lt;sup&gt;th&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission Fee</td>
<td>(Once)</td>
<td>20,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Certificate Verification Fee</td>
<td>(Once)</td>
<td>2,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Processing Fee</td>
<td>(Once)</td>
<td>-</td>
<td>5,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>University Security</td>
<td>(Refundable)</td>
<td>5,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Red Crescent Donation</td>
<td>(Once)</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>University Card Fee</td>
<td>(Once)</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Degree Fee</td>
<td>(Once)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tuition Fee</td>
<td>(Per Semester)</td>
<td>27,000</td>
<td>27,000</td>
<td>18,000</td>
<td>18,000</td>
<td>18,000</td>
<td>18,000</td>
<td>18,000</td>
<td>18,000</td>
</tr>
<tr>
<td>Library Fee</td>
<td>(Per Semester)</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Examination Fee</td>
<td>(Per Semester)</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Medical Fee</td>
<td>(Per Semester)</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>Transport Fee (Non-Boarder)</td>
<td>(Per Semester)</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Student Activities Fund</td>
<td>(Per Semester)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Endowment Fund</td>
<td>(Per Semester)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>65,400</td>
<td>43,000</td>
<td>29,000</td>
<td>34,000</td>
<td>29,000</td>
<td>29,000</td>
<td>29,000</td>
<td>29,000</td>
</tr>
</tbody>
</table>
MSBA & MBA (1.5 Years)

<table>
<thead>
<tr>
<th>Fee Type</th>
<th>Semester Wise Amount in PKR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
</tr>
<tr>
<td>Admission Fee</td>
<td></td>
</tr>
<tr>
<td>Certificate Verification Fee</td>
<td></td>
</tr>
<tr>
<td>Processing Fee</td>
<td></td>
</tr>
<tr>
<td>University Security</td>
<td></td>
</tr>
<tr>
<td>Red Crescent Donation</td>
<td></td>
</tr>
<tr>
<td>University Card Fee</td>
<td></td>
</tr>
<tr>
<td>Degree Fee</td>
<td></td>
</tr>
<tr>
<td>Tuition Fee</td>
<td></td>
</tr>
<tr>
<td>Library Fee</td>
<td></td>
</tr>
<tr>
<td>Examination Fee</td>
<td></td>
</tr>
<tr>
<td>Medical Fee</td>
<td></td>
</tr>
<tr>
<td>Transport Fee (Non-Boarder)</td>
<td></td>
</tr>
<tr>
<td>Student Activities Fund</td>
<td></td>
</tr>
<tr>
<td>Endowment Fund</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77,400</strong></td>
</tr>
</tbody>
</table>

**Thesis Delay Fine Policy**

1. If a student submit his/her thesis after minimum duration of degree period / submitting all regular semester dues following thesis delay fine will be charged:

   i. Rs. 5,000/- only will be charged as thesis delay fine in 4th semester* (for MS Business Administration students only)

   All Other MS Programs:

   ii. Rs. 5,000/- only will be charged as thesis delay fine in 5th semester*
   iii. Rs. 6,000/- only will be charged as thesis delay fine in 6th semester*

*Examination Fee will be charged separately

2. While if a student who will register / repeat any previous subject/s along with thesis, 1/3rd of tuition fee of last regular semester will also be charged other than above fine.

3. PhD student who have submitted his/her final thesis in Graduate Office for internal / external evaluation, will not be charged any dues.
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).

Note:

% age of fee shall be applicable on all components of fee, except for security and admission charges.

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

Director
Graduate Studies & Research
Dr. Zulfiqar Ali
Tel: 041-9230081-90, Ext: 211-257

Director Graduate Programs,
Faculty of Engineering & Technology
Dr. Sheraz Ahmad
Tel: 041-9230081-90, Ext: 108

Director, Graduate Programs, Faculty of Science
Dr. Nadeem Nasir
Tel: 041-9230081-90, Ext: 231

Director
Graduate Programs, Faculty of Management Science
Dr. Sajjad Ahmad Baig
Tel: 041-9230081-90, Ext: 264

Director, Faculty of Engineering & Technology
Dr. Yasir Nawab
Tel: 041-9230081-90, Ext: 211

Dean, Faculty of Science / Director QEC
Prof. Dr. Zahid Rizwan
Tel: 041-9230081-90, Ext: 159

Director, Humanities & Social Science
Dr. Zafar Javed
Tel: 041-9230081-90, Ext: 230

Registrar
Mr. Salman Saif
Tel: 041-9230097
Tel: 041-9230081-90, Ext: 158

Controller of Examinations
Mr. Muhammad Zabihullah Khan
Tel: 041-9230081-90, Ext: 127
admission@ntu.edu.pk, coe@ntu.edu.pk

Director Finance
Mr. Zulfikar Ahmad
Tel: 041-9230081-90, Ext: 121

Advisor Students
Dr. Amjid Javed
Tel: 041-9230078, 041-9230081-90, Ext: 128

Senior Librarian
Mr. Mushtaq Ahmad
Tel: 041-9230081-90 Ext: 150

Chairman Department of Yarn Manufacturing
Dr. Bilal Qadir
Tel: 041-9230081-90, Ext: 181

Chairman Department of Weaving
Dr. Syed Talah Ali Hamdani
Tel: 041-9230076
Tel: 041-9230081-90, Ext: 211

Chairman, Department of Knitting
Dr. Yasir Nawab
Tel: 041-9230081-90, Ext: 170

Coordinator Department of Textile Processing
Dr. Munir Ashraf
Tel: 041-9230081-90, Ext: 208

Chairman Department of Garment Manufacturing
Dr. Abher Rashid
Tel: 041-9230081-90, Ext: 212

Chairman Department of Polymer Engineering
Dr. Yasir Nawab
Tel: 041-9230081-90, Ext: 210

Chairman, Department of Materials & Testing
Dr. Sheraz Ahmad
Tel: 041-9230081-90, Ext: 108

Chairman Department of Computer Science
Dr. Muhammad Asif
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
Dr. Zafar Javed
Tel: 041-9230081-90, Ext: 230

Mr. Arshad Mahmood
Admission Officer
Office of the Graduate Studies & Research
Tel:(+92-41) 9230081-90(Ext; 257-258)
Fax: +(92-41) 9230098
e-mail: arshad@ntu.edu.pk / ogsr@ntu.edu.pk

Mr. Saqib Amjad
Office Assistant
Office of the Graduate Studies & Research
Tel:(+92-41) 9230081-90(Ext; 257-258)
Fax: +(92-41) 9230098
e-mail: saqibamjad@ntu.edu.pk
Disclaimer:

Whilst the University endeavours to ensure that the information provided in this booklet is accurate at the time of publication, however it does not accept liability for any errors or omissions. It is issued for the general guidance of postgraduate students taking admission in the programme.

The University intends to offer the courses and facilities described in the booklet but it reserves the right to withdraw or make alterations in these courses or facilities if deemed necessary without any prior notice.