# CONTENTS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Message from the Worthy Vice Chancellor</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Message from the Dean, Faculty of Engineering &amp; Technology</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Message from the Director, ICE&amp;T</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Message from the Principal, CEET</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>Message from the Chairman, DPE&amp;T</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>Brief History of Faculty of Engineering &amp; Technology</td>
<td>7</td>
</tr>
<tr>
<td>7.</td>
<td>Rules &amp; Regulations of Semester System</td>
<td>8</td>
</tr>
<tr>
<td>8.</td>
<td>Postgraduate Program Faculty</td>
<td>12</td>
</tr>
<tr>
<td>9.</td>
<td>M.Sc. Program in Chemical Engineering &amp; Technology</td>
<td>17</td>
</tr>
<tr>
<td>10.</td>
<td>Syllabi &amp; Courses for M.Sc. (Engg.) Chemical Engineering</td>
<td>18</td>
</tr>
<tr>
<td>11.</td>
<td>Doctor of Philosophy Program (Ph.D.) in Chemical Engineering</td>
<td>24</td>
</tr>
<tr>
<td>12.</td>
<td>Syllabi &amp; Courses for Doctor of Philosophy Program (Ph.D.)</td>
<td>25</td>
</tr>
<tr>
<td>15.</td>
<td>M. Phil Program in Polymer Technology</td>
<td>40</td>
</tr>
<tr>
<td>16.</td>
<td>Syllabi &amp; Courses for M. Phil Polymer Technology</td>
<td>41</td>
</tr>
<tr>
<td>17.</td>
<td>Laboratories</td>
<td>45</td>
</tr>
<tr>
<td>18.</td>
<td>University – Industry Interaction</td>
<td>47</td>
</tr>
<tr>
<td>19.</td>
<td>Research Projects</td>
<td>47</td>
</tr>
<tr>
<td>20.</td>
<td>Disclaimer</td>
<td>48</td>
</tr>
</tbody>
</table>
MESSAGE FROM WORTHY VICE-CHANCELLOR

The University of the Punjab is the leading University of Pakistan. It has maintained its excellence in education, training and research in various fields of arts, social sciences, engineering and technology.

The University aims at high standards of quality education compatible with national needs and comparable to international universities of high repute abroad. It has always attracted talented students coming from all walks of life and regions within its territorial limits and all provinces of Pakistan under exchange program.

The University recognizes an integrated and inter-disciplinary approach to coordinate and cooperative teaching among the various disciplines belonging to different faculties of constituent parts of the University under one umbrella. The Faculty of Engineering & Technology is one of the most developed faculties of the University. It has developed since 1917 with a long history of dedicated and devoted teachers and researchers in various fields of Engineering & Technology. The alumni of this institution are serving at higher professional positions in industrial/research organizations and universities at home and abroad.

The faculty comprises of Institute of Chemical Engineering & Technology, College of Engineering & Emerging Technologies, Institute of Quality and Technology Management, Centre for Coal Technology and Department of Textile Engineering which offer various engineering courses at graduate and post-graduate levels.

The University is committed to provide best possible facilities in terms of faculty staff, laboratories, libraries and environment for R&D activities leading to higher degrees. I hope that the talented candidates will be joining the engineering degree courses with the strong commitment to keep up the tradition of this Institution and help maintain the flag of the University high in the sky.

Prof. Dr. Mujahid Kamran
MESSAGE FROM THE DEAN OF THE FACULTY

Welcome to the Faculty of Engineering & Technology. We offer the best engineering environment coupled with the intellectual and technological resources. Faculty of Engineering and Technology is uniquely positioned to educate the technological leaders of tomorrow. Our goal is to position our engineering graduates to be problem solvers, project leaders, communicators, and ethical citizens of a global community.

In this technology-driven era, the socio-economic status of a country is directly or indirectly gauged by its potent engineering skills. Engineers are the builders of better world for mankind. The prestigious Institute of Chemical Engineering & Technology under the Faculty of Engineering & Technology, University of the Punjab, has been consistently catering to the needs of qualified and trained professional manpower in the form of chemical engineers and metallurgical engineers for the respective national industries over the past many decades. The alumni of the Institute have prodigiously contributed towards the development of process industry as well as various allied industries in Pakistan. Their performance at home and abroad is equally commendable.

In year 2005, the College of Engineering and Emerging Technologies was established under the Faculty. At present, the College is offering four years engineering degree courses in two disciplines, namely, Metallurgy & Materials Engineering and Electrical Engineering, thereto the program will be extended to other state-of-the-art disciplines.

Keeping in view the modern needs of manufacturing and services sector in the country, Institute of Quality & Technology Management was established in 2002 under this Faculty. The IQTM offers different Programs from B.Sc. (Engg.) to Ph.D level in the field of Industrial Engineering & Quality Management.

The teaching staff at the Faculty of Engineering & Technology is highly qualified, competent, dedicated, erudite, professionally experienced, and adequately capable of shaping the future engineers.

Taking this opportunity, I call upon the prospective graduates to transform the flashes of scientific imagination and engineering inspiration that form the stepping-stones, for making impossible of today possible of tomorrow. The staunch challenge confronting the future engineers is the ultimate exploitation of national resources through indigenous engineering & technology development.

Faculty of Engineering & Technology is producing outstanding engineers, with great moral values, who are contributing in a prosperous and technologically advanced Pakistan and I look forward to scintillate future of the engineering profession and our beloved country.

Prof. Dr. M. Taqi Zahid Butt
MESSAGE FROM THE DIRECTOR, ICE&T

On behalf of the faculty members, staff and current students of Institute of Chemical Engineering & Technology, I welcome you at one of the most prestigious and oldest seat of learning in the region. I believe that the opportunity to undertake postgraduate study at the University of the Punjab is privilege and I hope you will accept the challenges of life that lies before you. This Institute is committed to exploration and advancement of professional knowledge in the field of Chemical Engineering & Technology.

Today practically almost all the chemical and process industries in the country are being manned by the graduates of the Institute of Chemical Engineering and Technology. The alumni of the Institute have contributed significantly to the industrial growth and economic development of the country by helping in the design, construction, commissioning, operation and management of many important chemical plants, petroleum refineries and a number of allied industrial units. They are holding highly responsible positions in Pakistan Atomic Energy Commission, Pakistan Council of Scientific and Industrial Research, Chemical and Process Industries, both in the private and public sector, Defense Organizations, Universities, and Government Departments. The Institute has been privileged in a sense that 19 of its alumni were honoured with National Awards by the Government of Pakistan, which is the highest number from any single institution in the country.

Prof. Dr. Aamir Ijaz
MESSAGE FROM THE PRINCIPAL, CEET

Materials such as metals, ceramics, semi-conductors, polymers (Plastics) glasses, dielectrics, fibers, wood, sand, stone and composites play a vital role not only in our way of life, but also in the well-being and security of nations. The Materials Engineer is expected to design, develop and fabricate materials according to their applications at economical cost. The course for B.Sc. (Enng.) Metallurgy & Materials Engineering offered by Department of Metallurgy and Materials Engineering (CEET) comprises the most advanced technologies for the development of new materials, their structure, properties processing and applications in addition to other useful common materials. The department has developed a curriculum which is a blend of theory and practical. Its theoretical part focuses on the fundamental concepts of materials and relationship between composition, structure, property, processing and applications. Interdependence of theory and practice has been given special consideration under the supervision of highly qualified and experienced faculty members.

It is challenging field for the intelligent, hardworking and devoted students who have ambition to study advanced materials for the ever expanding importance and uses for the modern civilization. We have maintained most modern library and advanced laboratories in the Department of Metallurgy and Materials Engineering.

Polymeric and composite materials have gained an increased importance in modern life that can be ascertained from a wide variety of products with applications ranging from the packaging of foods to the manufacturing integrated circuits and biomaterials. The industrial demand for scientists and engineers who have expertise in the manufacture and use of these materials is growing and an adequate supply of such professionals is critical to the development and advancement of industrial infrastructure in the country.

Prof. Dr. Rafiq Ahmad
MESSAGE FROM THE CHAIRMAN, DPE&T

I am pleased to introduce Department of Polymer Engineering and Technology which has embarked upon a journey of unprecedented growth towards excellence. The Department of Polymer Engineering & Technology was established in 2004 but it became functional in 2006. By the fiscal support of HEC and logistical push of the Punjab University, adroitness has been established successfully within the Faculty of Engineering and Technology. About 100 million rupees were invested, in amassing various laboratory equipments for polymer & material synthesis, characterization, and processing under one roof. We have established seven high class research laboratories which are equipped with more than fifty state-of-the-art research equipments. Moreover, we are working on various research projects based on biomaterial, multifunctional composites, multipurpose membrane synthesis, novel polymer synthesis and improved paint manufacturing etc in collaboration with various universities, R&D organizations and industries. In proximity with HEC we are at the forefront of expanding scientific knowledge through research and development. Our department is engaged in creating high impact national and international research in the field of polymer, material science and engineering.

A two year multidisciplinary M.Phil Polymer Technology program has been offered. Keeping in view the modern needs of research, we are planning to extend this M.Phil Program to indigenous Ph.D program in Polymer Science and Engineering. We are in the process of redesignating the M.Phil Polymer Technology program to M.Sc Polymer Engineering for engineering students and M.Phil Polymer Technology for science students. The department is also planning to start a four year B.Sc Polymer Engineering and Technology program in near future.

The teaching staff at the Department of Polymer Engineering and Technology is highly qualified, motivated, competent and dedicated with superb professional experience to develop and groom the best scientists and engineers for industry and academia. My team is leaving no stone unturned for promoting quality education and productive research which is beneficial for the university and for the technical, economic and professional growth of the country at large.

I feel privilege and honor to invite you to be a part of the Department of Polymer Engineering & Technology so that you get acquainted with fastest rising multi-disciplinary department and its programs which offers holistic education, unparallel teaching practices, and cutting edge research opportunities. We will equip you to work as a skillful engineer and effective scientist in multidimensional environment of industries, academia, private & government sector and in personal business activities.

Prof. Dr. Tahir Jamil
BRIEF HISTORY OF THE FACULTY OF ENGINEERING & TECHNOLOGY

1917: A two-year course, leading to B.Sc. Degree in Technical Chemistry was started by Punjab University at Forman Christian College Lahore.
1925: A two-year course was replaced by a three years course leading to B.Sc. (Hons) Degree followed by a one year M.Sc. (Hons.) course in Technical Chemistry.
1939: University of the Punjab merged the B.Sc. (Hons) course of Chemistry and Technical Chemistry by modifying the syllabi in such a manner that the B.Sc. (Hons) in Chemistry included the necessary course requirements for admission to M.Sc. (Hons) in Technical Chemistry.
1941: The department temporarily shifted at the Punjab College of Engineering and Technology, Mughalpura as an independent department of Chemical Technology.
1946: The department was shifted to Punjab University, Old Campus.
1948: The department was raised to the status of the Institute of Chemical Technology.
1950: A four-year School Course in Chemical Technology was started.
1957: The improvement in syllabi and course of reading was carried out and this resulted, ultimately, in the institution of parallel course leading to B.Sc. (Hons.) Tech degree in Chemical Engineering.
1966: Chemical Technology was accorded recognition as a professional subject by the University.
1970: The following professional degree courses were launched

- B.Sc (Engg.) Chemical Engineering
- B.Sc. (Engg.) Metallurgy and Materials Science
- M.Sc. (Engg.) Chemical Engineering
- M.Sc (Engg.) Metallurgy and Materials Science

1982: The Faculty of Engineering and Technology was established at the University of the Punjab with the purpose of expanding its educational/training programs in the allied disciplines to meet the demands of newly emerging technologies in the country.

2002: Institute of Quality & Technology Management was established under the Faculty of Engineering & Technology.
2002: Centre for Coal Technology was established under the Faculty of Engineering & Technology.
2005: College of Engineering & Emerging Technologies was established under the Faculty of Engineering & Technology and is offering the following programs:

- B.Sc (Engg.) Metallurgy & Materials Engineering
- M.Sc. (Engg.) Metallurgy and Materials Engineering
- B.Sc. (Engg.) Electrical Engineering
- M.Phil Polymer Technology

2010: Department of Textile Engineering & Technology was established under the Faculty of Engineering & Technology.
RULES & REGULATIONS OF SEMESTER SYSTEM

GRADING SYSTEM

Letter grading should only be used for representing the individual courses and not for semester GPA or CGPA.

Equivalence in numerical grades, letter grades and grade points will be as follows:

<table>
<thead>
<tr>
<th>Percent Marks</th>
<th>Letter Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 &amp; above</td>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>80-84</td>
<td>A-</td>
<td>3.70</td>
</tr>
<tr>
<td>75-79</td>
<td>B+</td>
<td>3.30</td>
</tr>
<tr>
<td>70-74</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>65-69</td>
<td>B-</td>
<td>2.70</td>
</tr>
<tr>
<td>61-64</td>
<td>C+</td>
<td>2.30</td>
</tr>
<tr>
<td>58-60</td>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>55-57</td>
<td>C-</td>
<td>1.70</td>
</tr>
<tr>
<td>50-54</td>
<td>D</td>
<td>1.00</td>
</tr>
<tr>
<td>Below 50</td>
<td>F</td>
<td>0.00</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>W</td>
<td></td>
</tr>
</tbody>
</table>

i. Maximum possible Grade Point Average is 4.00.

ii. Minimum Cumulative GPA for obtaining 2 year MS/M.Phil. (course work and comprehensive) is 2.50. In order to qualify in the examination of semester a student must obtain at least GPA 2.50 and in individual subject not less than 2.30 in mid term / final examination / session work separately in written, as well as in practical.

iii. If GPA / CGPA of a student remains <2.50 (but >2.30) the student shall be given one chance (only once) to repeat two subjects (2-6 Credit Hours) in order to improve CGPA in MS/M.Phil. If GPA / CGPA of a student remain <2.50 he/she shall be dropped from studies.

iv. In MS/M.Phil. leading to Ph.D. only those students who maintained CGPA ≥ 3.0 in MS / M.Phil shall be able to opt for Ph.D. and after qualifying comprehensive examination (GPA ≥ 3.0) status of such students shall be changed to Ph.D. MS / M.Phil Degree shall not be conferred on these students

v. Minimum Cumulative Grade Point Average for Ph.D. (course work and comprehensive) is 3.00.
vi. A fraction of mark in a course is to be counted as ‘1’ mark e.g. 64.1 or 64.9 is to be count as 65.

vii. Letter Grade and Grade Point scheme for a course will be used as given above.

viii. In order to calculate the GPA, multiply Grade Point with the Credit Hours in each Course to obtain total grade points, add up to cumulative Grade Points and divide by the total number of Credit Hours to get the GPA for a Semester.

\[
\text{GPA} = \frac{\sum (\text{GP} \times \text{Credit Hours})}{\text{Total Credit Hours of a semester}}
\]

ix. For calculating CGPA, sum total of GPs in a semester earned in different courses multiplied by respective credit hour of a course and divided by total numbers of credit hours.

\[
\text{CGPA} = \frac{\sum (\text{GP} \times \text{Credit Hours})}{\text{Total Credit Hours of all courses in that program}}
\]

RE-SIT EXAMINATION

The students who cannot appear in examination because of genuine excuse / reason shall be allowed to appear in re-sit examination within one week after the examination subject to the payment of special examination fee of Rupees 1000/- for each course. If the number of courses is more than 2 then a lump sum of Rs. 2500/- shall be paid as special examination fee to the department,

RE- ADMISSION ON MEDICAL / EMERGENCY GROUNDS

A student who discontinues studies on medical/emergency ground will be allowed to seek re-admission in the same semester next year after paying semester fees. During the period of discontinuation of studies all the facilities shall be withdrawn which are normally available to regular students.
M.Sc./M.Phil.

<table>
<thead>
<tr>
<th>Course/Degree</th>
<th>%age marks</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
<td>55%</td>
<td>60%</td>
<td>70%</td>
<td>=&gt;80%</td>
</tr>
<tr>
<td>Matric</td>
<td>Marks</td>
<td>4</td>
<td>5</td>
<td>7.5</td>
<td>8.5</td>
</tr>
<tr>
<td>F.A / F.Sc.</td>
<td>Marks</td>
<td>4</td>
<td>5</td>
<td>7.5</td>
<td>8.5</td>
</tr>
<tr>
<td>B.A/B.Sc/BS (Hons.) 4 Years/MBBS/BDS</td>
<td>CGPA</td>
<td>2.5</td>
<td>3.0</td>
<td>3.40</td>
<td>=&gt;3.80</td>
</tr>
<tr>
<td></td>
<td>Marks</td>
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<td>15</td>
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Ph.D

<table>
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<tr>
<th>Course/Degree</th>
<th>%age Marks</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
<td>=&gt;80%</td>
<td></td>
</tr>
<tr>
<td>Matric</td>
<td>Marks</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>F.A / F.Sc.</td>
<td>Marks</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>B.A/B.Sc</td>
<td>Marks</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>M.A/M.Sc. (Pass Courses)</td>
<td></td>
<td>6</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

|                  |            |      |      |      |      |
|                  |            | 2.5  | 3.0  | 3.40 | =>3.80 |
| B.A/B.Sc (Hons) (4 years) |            | 8    | 12   | 14   | 16   |
| M.A/M.Sc. (Semester) |            | 4    | 6    | 7    | 8    |
| M.Sc. / M.Phil (18 Years) | Marks     | 6    | 7    | 8    |

Note: Qualification from Institutions other than the University of the Punjab will be equalized by the Equivalence Committee of the University of the Punjab. Ph.D. programme emphasizes full time coursework/research. Part-time coursework or research is not permissible. Study leave is mandatory for in service students. For facilitating University’s own staff, workload of a teacher/officer admitted in Ph.D. will be reduced to half.

Last academic merit in the admission 2011-2012

<table>
<thead>
<tr>
<th>Name of Program</th>
<th>Last year Merit (Self Supporting/Replica 2011)</th>
</tr>
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<tbody>
<tr>
<td>M.Sc (Engg) Chemical Engineering</td>
<td>2.65/4.0 CGPA</td>
</tr>
<tr>
<td>M.Sc (Engg) Metallurgy &amp; Materials Engineering</td>
<td>2.60/4.0 CGPA</td>
</tr>
<tr>
<td>M. Phil Polymer Technology</td>
<td>2.50/4.0 CGPA</td>
</tr>
</tbody>
</table>
PROCEDURE FOR APPLICATION, ADMISSION AND REGISTRATION

1. An applicant seeking admission to MS / MS leading to Ph.D; M.Phil / M.Phil leading to Ph.D and Ph.D. programmes shall apply on a prescribed form within the due date given in the advertisement for admission.

2. The application shall be submitted to the administrative office of the respective Department/ Institute/Centre/College/School in which the student wishes to pursue his/her studies.

3. The Departmental Doctoral Programme Committee (DPC - Chairman, all Professors & Associate Professors, one senior most Assistant Professor/Lecturer, holding Ph.D. degree) shall scrutinize the applications received for eligibility. In departments where there is no Professor/Associate Professor, Doctoral Programme Committee (DPC) will be constituted by the Vice-Chancellor on the recommendations of the Dean of the Faculty/Chairperson DPCC. In such cases for the evaluation of synopsis, 2-3 experts will be co-opted.

4. An applicant shall be judged on the basis of the following criteria for admission:
   a) Academic qualifications* 40 Marks
   b) Publications in HEC approved journals - (1 Mark per publication)-05 Marks
   c) Professional experience in relevant field - 05 Marks (One Mark for each year for job in the relevant field / as per Departmental preference)
   d) Written/Entry test (comprehension of the subject, General aptitude for research) - 40 Marks
   e) Interview -10 Marks

Minimum marks for qualifying the written test & interview separately - 50%. Only those candidates who qualify the written test [designed by the respective department] will be called for an interview.

The Doctoral Programme Committee shall recommend to the Dean of Faculty concerned/ Chairperson DPCC for approval of the names of applicants, who are found eligible for studies leading to MS / MS leading to Ph.D M.Phil / M.Phil leading to Ph.D and Ph.D. degrees along with the name of supervisor/s for research. The selected candidates shall pay their dues (Annex-I) within stipulated time, failing which their admission shall be liable to be cancelled. Students of MS / MS leading to Ph.D; M.Phil / M.Phil leading to Ph.D have to complete 24-30 credit hour course work before converting to Ph.D, where Ph.D students have to complete 18 credit hour course work. The DPC/Faculty Council (as the case may be) will approve the title/synopsis. Final approval will be by Advanced Studies and Research Board (ASRB).

*Break up of 40 marks for academic qualifications:
POSTGRADUATE PROGRAM FACULTY

Institute of Chemical Engineering & Technology

Professors

1. Dr. Aamir Ijaz  
B.Sc. (Engg.) Chemical Engineering,  
M.Sc. (Nuclear Engg.),(QAU) Pak.  
M.Sc. (Engg.) Energy Engineering, (USA)  
Ph.D. (UK), P.E.

2. Dr. Arshad Chughtai  
B.Sc. (Engg.) Chemical Engineering,  
M.Sc. (Nuclear Engg.) (QAU) Pak.  
Ph.D. (UK), P.E.

3. Dr. Niaz Ahmad Akhtar (On leave)  
B.Sc. (Engg.) Chemical Engineering,  
Ph.D. (UK), P.E.

4. Dr. Muhammad Ali  
B.Sc. (Engg.) Chemical Engineering,  
M.Sc. (Engg.) Chemical Engineering,  
Ph.D. (UK), P.E.

5. Dr. Abdullah Khan Durani  
B.Sc. (Engg.) Chemical Engineering  
M.Sc. (Engg.) Chemical Engineering  
Ph.D. (Pak), P.E.

6. Dr. Mahmood Saleem  
B.Sc. (Engg.) Chemical Engineering  
M.Sc. (Engg.) Chemical Engineering  
Ph.D. (Austria), P.E.

7. Dr. Rafi Ullah Khan  
B.Sc. (Engg.) Chemical Engineering,  
M.Sc. (Engg.) Chemical Engineering,  
M.Sc. Computer Science,  
Ph.D. (Germany), P.E.

8. Dr. Shahid Munir  
B.Sc. (Engg.) Chemical Engineering  
M.Sc. (Engg.) Chemical Engineering  
M.B.A. (Marketing)  
Ph.D. (UK), P.E.

Associate Professors

1. Dr. Ayyaz Muhammad (On leave)  
B.Sc. (Engg.) Chemical Engineering  
M.Sc. (Engg.) Chemical Engineering  
Ph.D. (Malaysia), P.E.
2. **Dr. Amir Shafeeq**  
   B.Sc. (Engg.) Chemical Engineering  
   M.Sc. (Engg.) Chemical Engineering  
   M.B.A. (Marketing),  
   Ph.D. (Malaysia), P.E.

**Assistant Professors**

1. **Dr. Amjad Pervez**  
   M.Sc. Applied Mathematics  
   M.Phil, Ph.D. (QAU) Pak.

2. **Dr. Muhammad Rashid Usman**  
   B.Sc. (Engg.) Chemical Engineering  
   M.Sc. (Engg.) Chemical Engineering  
   Ph.D. (UK), P.E.

3. **Dr. Syed Nadir Hussain**  
   B.Sc. (Engg.) Chemical Engineering  
   M.Sc. (Engg.) Chemical Engineering  
   Ph.D. (UK), P.E.

4. **Dr. Waheed Afzal (On leave)**  
   B.Sc. (Engg.) Chemical Engineering,  
   M.S. Total Quality Management,  
   Ph.D. (France), P.E.

5. **Dr. Hafiz Muhammad Anwaar Asghar**  
   B.Sc. (Engg.) Chemical Engineering  
   M.Sc. (Engg) Chemical Engineering  
   Ph.D. (UK), P.E.

6. **Dr. Arshid Mahmood Ali (On leave)**  
   B.Sc. (Engg.) Chemical Engineering  
   M.Sc. (Engg.) Chemical Engineering  
   Ph.D. (NZ), P.E.

7. **Dr. Javeed Ashraf Awan**  
   B.Sc. (Engg.) Chemical Engineering,  
   M.Sc. (Engg.) Chemical Engineering,  
   Ph.D. (France), P.E.

**VISITING FACULTY**

1. **Dr. Abdul Sattar**  
   M.Sc. Tech. (PU)  
   Ph.D. (UK)

2. **Dr. Tahir Jamil**  
   Chairman, Department of Polymer Engineering and Technology  
   University of the Punjab Lahore  
   M.Sc, M.Phil (QAU)  
   Ph.D (USA)
Department of Metallurgy & Materials Engineering

Professors

1. **Dr. M. Taqi Zahid Butt (Dean)**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   Ph.D. (UK), P.E.  
   Post Doc. (UK), Post Doc. (Japan)

2. **Dr. Rafiq Ahmad (Principal)**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   M.Sc. (Engg.) Metallurgical Engineering (UET)  
   Ph.D. (UK), P.E.

3. **Dr. Abdus Salam**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   Ph.D. (UK), P.E.

Assistant Professors

1. **Dr. Muhammad Kamran**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   M.Sc. (Engg.) Metallurgical Engineering (Pak)  
   Ph.D. (Austria), P.E.

2. **Engr. Aamir Nadeem Malik**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   M.Sc. (Engg.) Metallurgy & Engineering, P.E.

3. **Dr. Asma Salman (on leave)**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   M.Sc. (Engg.) Metallurgical Engineering (UET)  
   Ph.D. (New-Zeeland), P.E.

4. **Dr. Aqil Inam**  
   B.Sc. (Engg.) Metallurgy & Materials Science (UET)  
   M.Sc. (Engg.) Metallurgical Engineering  
   Ph.D. (UK), P.E.

5. **Dr. Mohsin Ali Raza**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   M.Sc. (Engg.) Materials Science with specialization in Nanomaterials & Nanotechnology, (KTH, Sweden)  
   Ph.D. (UK), P.E.

6. **Dr. Tahir Ahmad**  
   B.Sc. (Engg.) Metallurgy & Materials Science  
   M.Sc. (Engg.) Metallurgy and Materials Science  
   Ph.D. (Malaysia), P.E.
Lecturers

1. Dr. Irfan Qadeer (on study leave)
   B.Sc. (Engg.) Metallurgy & Materials Science
   M.Sc. (Engg.) Materials Engineering (Sweden)
   Ph.D. (Sweden), P.E.

2. Mr. Salman Aziz (on study leave)
   B.Sc. (Engg.) Metallurgy & Materials Science
   M.Sc. (Engg.) Metallurgy and Materials Science (UET)

3. Mr. Kashif Mairaj Deen
   B.Sc. (Engg.) Metallurgy & Materials Science
   M.Sc. (Engg.) Metallurgy and Materials Engineering P.E.

4. Mr. Muhammad Atif Makhdoom (on study leave)
   B.Sc. (Engg.) Metallurgy & Materials Science (UET)
   M.Sc. (Engg.) Metallurgical Engineering (UET), P.E.

5. Mr. Faraz Hussain
   B.Sc. (Engg.) Metallurgy & Materials Science
   M.Sc. (Engg.) Metallurgical Engineering (UET), P.E.

6. Mr. Fahad Riaz
   B.Sc. (Engg.) Metallurgy & Materials Science
   M.Sc. (Engg.) Metallurgy and Materials Science

7. Ms. Sehrish Mukhtar
   B.Sc. (Engg.) Metallurgy & Materials Science

VISITING FACULTY

1. Prof. Dr. Ijaz Hussain Khan
   M.Sc. (Tech.), M.Sc. (Chem.),
   D.I.C. (London), A.I.M.
   Ph.D. (UK)

2. Prof. Dr. Aamir Ijaz
   B.Sc. (Engg.) Chemical Engineering
   M.Sc.(Nuclear Engg.), (QAU) Pak.
   M.Sc. (Engg.) Energy Engineering, (USA)
   Ph.D. (UK), P.E.

3. Prof. Dr. Arshad Hussain Qureshi
   Department of Mechanical Engineering
   University of Engineering and Technology, Lahore
Department of Polymer Engineering & Technology

Professors
1. **Dr. Tahir Jamil**
   M.Sc. M.Phil.
   Ph.D (USA)

Assistant Professor (IPFP)
1. **Dr. Misbah Sultan**
   M.Sc. Chemistry, M. Phil. Chemistry,
   Ph.D. Chemistry

Lecturers
1. **Engr. Shahzad Maqsood Khan**
   B.Sc. (Engg.) Chemical Engineering,
   M.Sc. (Engg.) Chemical Engineering,
   Ph.D. (In progress)
2. **Engr. Aneela Sabir**
   B.Sc. (Engg.) Chemical Engineering,
   M.Sc. (Engg.) Chemical Engineering,
3. **Engr. Muhammad Shafiq**
   B.Sc. (Engg.) Chemical Engineering,
   M.Sc. (Engg.) Chemical Engineering,

VISITING FACULTY
1. **Prof. Dr. Muhammad Zubair**
   M.Sc. Chemistry, M. Phil Chemistry,
   Ph. D Chemistry,
   Chairman, Applied Chemistry Government College University Faisalabad
2. **Dr. Asif Ali Qaiser**
   B.Sc. (Engg.) Chemical Engineering
   M.Sc. (Engg) Chemical Engineering
   Ph.D. (Engg) Chemical Engineering
   Chairman, Department of Polymer and Process Engineering UET Lahore
3. **Dr. Atif Javed**
   B.Sc. (Engg.) Polymer and Process Engineering
   Ph.D. Chemical Engineering
   Assistant Professor, Department of Polymer and Process Engineering UET Lahore
4. **Dr. Abdul Ghaffar**
   M.Sc. Chemistry, M. Phil. Chemistry,
   Ph.D. Chemistry
   Assistant Professor, Institute of Chemistry UET Lahore
5. **Dr. Farhan Saeed**
   B.Sc. (Engg.) Chemical Engineering
   M.Sc. (Engg) Polymer and Process Engineering
   Ph.D. Chemical Engineering
   Department of Polymer and Process Engineering UET Lahore
M.Sc. Programme in Chemical Engineering & Technology

Eligibility Criteria for M.Sc. (Engg.) Chemical Engineering (Self Supporting Evening Program)

B. Sc. (Engg.) Chemical Engineering from HEC recognized Institutions
1st Division / 2.50 CGPA

No. of seats for M.Sc. (Engg.) 45
No. of seats for M.Sc. (Engg.) 02 (Foreign Students)

Admission Criteria

As per University Rules
SYLLABI & COURSES FOR M.Sc (ENGG) CHEMICAL ENGINEERING

The coursework has been designed according to the regulations of University of the Punjab for an M. Phil degree program. These regulations describe the M. Sc (Engg) Chemical Engineering academic program consisting of four semesters. The first two semesters contain 24 credit hours of coursework while one year research comprising 3rd and 4th semester is of 6 credit hours. The total credit hours are 30.

### First Semester

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<th>Sr. No.</th>
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### Second Semester

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### Third Semester

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**Detail of the Credit Hours**

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<td><strong>Total Credit Hours</strong></td>
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Detail of Courses

First Semester

**CHE610  APPLIED ENGINEERING MATHEMATICS**


**Recommended books:**


**CHE611  ADVANCED CHEMICAL REACTION ENGINEERING**


**Recommended books:**

CHE 612  ADVANCED SEPARATION PROCESSES
Multicomponent gas-absorption: Diffusion and mass transfer theories, column operation, nature and behavior of solvents, and role of novel solvents such as ionic liquids. Advanced adsorptive and membrane separations. Gas cleaning: Mass force separators, particles removal from flue gases of coal/biomass combustion, wet scrubbers with condensation (CWS), and wet electrostatic precipitators (WESP).

Recommended books:

CHE 613  RESEARCH METHODOLOGY

Recommended books:

CHE 614  BIOCHEMICAL ENGINEERING
Introduction and principles of cell biology, genetics, chemistry, biochemistry, and chemical engineering to biological processes. Overview of biological basics: Enzyme kinetics and immobilization techniques, cell metabolism, and stoichiometry of microbial growth. Design and analysis of bioreactors: Mixing, aeration, and sterilization. Instrumentation and control in bioprocesses. Operating considerations for

**Recommended books:**


**Second Semester**

**CHE 620 ADVANCED TRANSPORT PHENOMENA**

Review of introductory topics in transport phenomena. Fluid flow: Velocity distribution with more than one independent variable, turbulent flow models, velocity distribution in turbulent flow, and flow of non-Newtonian fluids. Heat transfer: Temperature distribution with more than one independent variable and temperature distribution in turbulent flow. Mass transfer: Concentration distribution with more than one independent variable, concentration distribution in turbulent flow, and interphase transport in non-isothermal mixtures.

**Recommended books:**


**CHE 621 ADVANCED PROCESS DYNAMICS AND CONTROL**

Multiloop and multivariable control. MATLAB Simulink applications in process control.

**Recommended books:**

**CHE 622    ADVANCED CHEMICAL ENGINEERING THERMODYNAMICS**

**Recommended books:**

**CHE 623    SUSTAINABLE ENERGY SYSTEMS**

**Recommended books:**

**Third Semester**
**CHE 630  RESEARCH THESIS PART-I**
Duration of the research thesis will be two semester. In research thesis part-I, the student will complete the following tasks:
1. Literature search on the allocated research project
2. Design of experiments and initial experimentation
3. Fabrication/modification of the experimental set up

**Fourth Semester**
**CHE 640  RESEARCH THESIS PART-II**

The student will complete experimentation and writeup of the research thesis and submit within the stipulated period of the fourth semester.
Doctor of Philosophy Program (Ph.D) in Chemical Engineering

Eligibility Criteria for Ph.D (Engg) Chemical Engineering

M.Sc. (Engg.) Chemical Engineering from HEC recognized Institutions
1st Division / 3.0 CGPA

No. of seats Ph.D (Engg.) 10

Admission Criteria

As per University Rules
SYLLABI & COURSES FOR DOCTOR OF PHILOSOPHY PROGRAM

(Ph.D)

The Doctor of Philosophy Degree is awarded in recognition of significant and original contribution to the existing pool of knowledge in the field of Chemical Engineering. The candidate must pass the taught courses (18 Credit Hours) and submit a written thesis as proof of his contribution to the pool of knowledge which is evaluated by foreign experts as per university policy. The candidate should be able to:

1. Suggest new areas/dimensions/horizon for research
2. Perform independent investigations
3. Understand and apply the research outputs, and
4. Correlate and communicate the findings in an acceptable manner.

The minimum course requirements for Ph. D. degree in Chemical Engineering are as follows:

Coursework for Ph. D. in Chemical Engineering

<table>
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<th>Sr. No.</th>
<th>Module</th>
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<th>Credit Hours</th>
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<tr>
<td>1</td>
<td>811</td>
<td>Analytical techniques in engineering research</td>
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<tr>
<td>2</td>
<td>812</td>
<td>Process modeling and simulation</td>
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<tr>
<td>3</td>
<td>813, 814, 815, 816</td>
<td>Elective-I: Any one from the following courses: Heterogeneous catalysis; Surface Engineering; Membrane Technologies; Gasification technologies</td>
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**Total** 08 01 09

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<td>820</td>
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<td>2</td>
<td>821</td>
<td>Advanced Thermodynamics: phase and reaction equilibria</td>
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<td>3</td>
<td>822, 823</td>
<td>Elective-II: Any one from the following: Chemical Product Design; Computational Fluid Dynamics;</td>
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<td>824</td>
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<td>Gas Cleaning Technologies</td>
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<td>Process intensification;</td>
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<td>826</td>
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<td>Combustion Engineering</td>
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**First Semester**

**CHE 811  ANALYTICAL TECHNIQUES IN ENGINEERING RESEARCH**
In depth understanding of various analytical techniques required for Engineering Research like:
- Chromatographic Techniques: Gas Chromatography, HPLC, GPC.
- Spectorscopic Technique, UV/VIS Atomic Adsorption, FTIR. NMR, Mass, XRD, ICP
- Thermal Analysis: DSC, TGA, TMA
- Characterization techniques; Polymers, Materials and Catalysts Characterization Techniques.

**Recommended Books:**

**CHE 812  PROCESS MODELING AND SIMULATION**
Modeling and simulations of Chemical Engineering Processes. Emphasis on the formation of a model using ordinary and partial differential equations, and on the solution of the model using numerical methods. Testing the validity of the model using various case studies available in published literature or from real industrial facility. Development of computer code for the purpose of model verification for various problem sizes.

**Recommended Books:**
Elective-I: Any one from the following courses:

**CHE 813 HETROGENEOUS CATALYSIS**

**Recommended Books:**

**CHE 814 Surface Engineering**
Indepth surface morphology and physical attributes, surface chemistry, surface complications in reaction engineering, surface modeling and design, latest problems in surface engineering

**Recommended Books:**

**CHE 815 MEMBRANE TECHNOLOGIES**
Overview of membrane science and technology, Membrane transport theory, membrane and modules, Types of membrane processes: RO, micro-filtration, ultra-filtration, pervaporation, Electrodialysis, applications

**Recommended Books:**

**CHE 816 GASIFICATION TECHNOLOGIES**
Characterization of coal and biomass for gasification, Gasification theory and modeling, Design of gasifiers, Hydrothermal gasification, Production of synthesis gas, its purification and conditioning, Production of synthetic fuels and chemicals through gasification
Recommended Books:

CHE 817 Research Seminar-I
Students/Researchers will be required to present talks on important topics related to their area of research.

Second Semester

CHE 820 EXPERIMENTAL DESIGN AND DATA ANALYSIS
B: Data analysis techniques: Analysis of scientific data, Data modeling and management, Randomness and probability, Statistical analysis including linear regression, analysis of variance, logistic regression, categorical data analysis, and non-parametric methods.

Recommended Books:

CHE 821 ADVANCED THERMODYNAMICS: phase and reaction equilibria
Developing an advanced level of understanding of the concepts in thermodynamics of complex processes in diverse fields. Models of Phase equilibria for multicomponent systems for both reactive and non-reactive systems as well as surface phenomena will be discussed in details.

Recommended Books:
Elective-II Any one from the following:

**CHE 822 CHEMICAL PRODUCT DESIGN**
Introduction, needs, ideas, and selection of product design, product manufacturing and molecular products, commodity products, micro-structures and future applications.

**Recommended Books:**

**CHE 823 COMPUTATIONAL FLUID DYNAMICS**

**Recommended Books:**

**CHE 824 GAS CLEANING TECHNOLOGIES**
Process gas characterization, Process gas heat recovery, including waste heat boilers and heat exchangers, Process gas conditioning, including combustion chambers, water-cooled ducts, and evaporative coolers, Flue gas desulfurization (FGD)
Process NOx control, Gas cleaning system equipment, selection, including baghouses, scrubbers, electrostatic precipitators (ESP’s) and fans, Process intensification;
Audit and assessment of existing process operations with respect to productivity, efficiency, and environmental considerations, Benchmarking of energy consumption in process operations, Determination of GHG emissions associated with process operations, and development of process strategies aimed at reduction of GHG’s, Evaluation of material inputs, equipment capabilities and operating practices aimed at improved operating efficiency and reduction of GHG generation

**Recommended Books:**

**CHE 825  PROCESS INTENSIFICATION**
Process Intensification (PI) is increasingly being used as an effective way to expand productive capacity and update ageing batch processes without the need for large civil engineering investment. The technology is well-established and as it often achieves yield improvements and waste reductions, the present economic climate is driving the number of applications at a rapid rate of growth. Process Intensification offers:
- Higher yields and better product consistency and repeatability
- Energy savings and reduced operating costs
- Plan capital cost reductions
However achieving success with an intensified process is more than just selecting the right reactor. It may require the redesign of other operations, improvements to the chemistry through changes to operating conditions and/or catalysis. PI can help control, instrumentation and on-line analytics. These are some of the factors important to industrialists seeking a move towards PI, all of which require a good understanding of the underlying mechanisms and principles. The understanding of these key mechanisms and principles can also be applied to process scale up more generally, helping to achieve more successful development to full scale.

**Recommended Books:**

**CHE 826  COMBUSTION ENGINEERING**
Premixed and non-premixed flames, laminar and turbulent combustion phenomena, Ignition, extinction, Flame propagation, Flame structure, Instabilities and swirl, Flame
spread, Multi-phase reactants, Development and validation of reaction kinetics, and reduction of reaction mechanisms, modeling of combustion systems for conventional, alternative, surrogate fuels, pollutants, particulate and aerosol formation and abatement, Advances in diagnostic and computational methods in combustion, Measurement and simulation of scalar and vector properties, Novel techniques and state-of-the art applications of combustion, Combustion technologies and systems, including Fluidized bed systems, Internal combustion engines, Gas turbines, Small- and large-scale stationary combustion and power generation, Catalytic combustion, Combustion synthesis, Combustion under extreme conditions, and New concepts

**Recommended Books:**

**CHE 827   RESEARCH SEMINAR-II**
Students/Researchers will be required to present talks on important topics related to their area of research.
Eligibility Criteria for M.Sc (Engg) Metallurgy & Materials Engineering  
(Self Supporting Evening Program)

B.Sc. (Engg.) Metallurgy and Materials Science/Metallurgy and Materials Engineering/Metallurgical Engineering

No. of seats M.Sc. (Engg.)  40

Admission Criteria

As per University Rules
SYLLABI & COURSES FOR M.Sc (ENGG) METALLURGY & MATERIALS ENGINEERING

1st Semester

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<td>1</td>
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<td>MS 612</td>
<td>Production Management</td>
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<td>Characterization Techniques</td>
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<td>MME 621</td>
<td>Research Project</td>
<td>0</td>
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<td><strong>7</strong></td>
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4th Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Subject</th>
<th>Credit Hours</th>
<th>Total</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Theory</td>
<td>Practical</td>
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<tr>
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<td>MME 621</td>
<td>Research Project</td>
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<td></td>
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</tbody>
</table>

*MME 621 is the final year project which will spread over two semesters starting from 3rd semester.

Note: 1 Contact Hour of Theory = 1 Credit Hour
5 Contact Hours of Practical = 1 Credit Hour

Total Credit Hours = 33
1st Semester
MME 511 CORROSION ENGINEERING

Recommended Books:

MME 512 DEFORMATION AND FRACTURE OF METALS

Recommended Books:

MME 513 MANUFACTURING PROCESSES
Manufacturing processes, Theory of plasticity, Hot and cold working, Factors influencing hot working processes, Strain rate, friction and lubrication in metal working processes, Workability, Forging, Stress analysis of forging, Rolling, Torque and force required in rolling, Extrusion, Deformation behavior and effect of lubrication in extrusion process, Hydrostatic extrusion, Wire and rod drawing, Residual stresses in rod, wire and tubes, Sheet metal forming processes, Factors effecting bending, stretch forming and deep drawing, Forming limit criteria, Recent developments in metal working processes.

Recommended Books:

2nd Semester
MME 521 SOLIDIFICATION PROCESSES
Nucleation and growth, Solidification models, Solidification of pure metal, Solidification of alloys, Eutectic solidification, Segregation, Grain refinement, Modification of Al-Si alloys, Nucleation and growth of graphite, Entrapment of impurities and filtration, Filling modes and filling behavior, Gas porosity, Degassing process and techniques, Solidification shrinkage, Effect of feeding criteria and mechanisms on solidification shrinkage, Concept of Niamas point, Initiation and growth of shrinkage porosity, Linear contraction, Concept of heat transfer and its application in moulds and dies, Specialized casting techniques, Structure, defects and properties of the finished casting.

Recommended Books:

MME 522 ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS

Recommended Books:

MME 523 COATING TECHNIQUES

Recommended Books:
2. A. A. Tracton, "Coatings technology handbook", Taylor & Francis, 2005

**GS 524 Research Methodology**

This course involves the discussion and application of research methodology, important for the successful completion of M.Sc. (Engg.) Metallurgy & Materials Engineering research project. Topics involve literature search techniques, design of experiments and statistical analysis of data.

**3rd Semester**

**MME 611 HEAT TREATMENT OF METALS AND ALLOYS**


**Recommended Books:**


**MS 612 PRODUCTION MANAGEMENT**

Introduction and Evolution of Management Science
Nature and Scope of Operation Management
Introduction to Production/Operation management, functions and classifications of production systems, Models and their classification, Hierarchy of decision making in Production & Operation management, recent trends in Production & operation Management.

Production Operation Strategy
Productivity; Strategies, Competitiveness, Mission, Goal Decision Making, Decision making environment and Decision tree, models of decision making.

Resource Allocation-Linear Programming
Model formulation; Analysis of linear programming model, Types of integer programming problems; solution procedure. Graphical approach, Simplex method, Application of linear programming. Forecasting: Type, Techniques, Time Span, Accuracy.

Design of Production systems

Quality Management
Basics of Quality Management, Quality Management Gurus, Quality Awards, Quality Certification (ISO 9000), Statistical Process Control, Variations and Control, Six Sigma Quality

Supply Chain Management

Need for studying supply chain management, Benefits of effective Supply Chain Management, Elements to supply chain management, Creating an Effective Supply Chain E-Commerce, its advantages & disadvantages, Requirements for a successful Supply Chain, Performance Metrics, Fill rate, Inventory turnover, Challenges in Supply Chain, Barriers to integration of separate organizations, Response Time, Purchasing Interfaces, The purchasing cycle, Value analysis, Centralized versus decentralized Purchasing, Ethics in Purchasing, Supplier Management.

**Recommended Books:**

**MME 613 CHARACTERIZATION TECHNIQUES**
Classical, Electrochemical and Radiochemical Analysis
Optical and X-Ray Spectroscopy
Mass Spectroscopy
Spark Source Mass Spectrometry, Gas Analysis by Mass Spectrometry.
Metallographic techniques
Optical Metallorgraphy, Image Analysis.
Diffraction Methods
Electron Optical Methods
Chromatography
Gas Chromatography, Mass Chromatography, Ion Chromatography.

**Recommended Books:**

**4th Semester**

**MME 621 Project**

The students shall perform experimental investigation on the prescribed research topics assigned to them in 3rd semester and prepare the required project thesis for submission and for Viva-Voce examination.
M. Phil. Program in Polymer Technology

Eligibility Criteria for M. Phil. in Polymer Technology
(Self Supporting Evening Program)

Polymer Engineering  Chemical Engineering
Petroleum Engineering  Metallurgy & Material Engineering
Civil Engineering   Mechanical Engineering
Textile Engineering  Environmental Engineering

- Students of following Sciences Disciplines are eligible to apply
  M.Sc. Environmental Sciences/ B.Sc. Hons Environmental Sciences

No. of seats M.Sc. (Engg.)  40

Admission Criteria

As per University Rules
SYLLABI & COURSES FOR M. PHIL. IN POLYMER TECHNOLOGY

First Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>Theory</th>
<th>Lab</th>
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<tr>
<td>PT 601</td>
<td>Fundamental of Polymer Sciences</td>
<td>3</td>
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<td>PT 602</td>
<td>Polymer Synthesis and Characterization</td>
<td>3</td>
<td>0</td>
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<tr>
<td>PT 603</td>
<td>Polymer Rheology &amp; Processing</td>
<td>3</td>
<td>1</td>
<td>4</td>
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<tr>
<td>PT 604</td>
<td>Materials Synthesis and Characterization Laboratory</td>
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Second Semester

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<tr>
<td>PT 605</td>
<td>Advanced Composite Materials</td>
<td>3</td>
<td>0</td>
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<tr>
<td>PT 606</td>
<td>Membrane Science and Application</td>
<td>2</td>
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<tr>
<td>PT 607</td>
<td>Advance Polymers</td>
<td>2</td>
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<tr>
<td>PT 608</td>
<td>Elastomeric Materials</td>
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Third Semester

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<td>Polymer Process Technologies</td>
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<td>PT 610</td>
<td>Polymer Reaction Kinetics</td>
<td>2</td>
<td>0</td>
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<td>PT 620</td>
<td>Research Thesis Part I</td>
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Fourth Semester

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<td><strong>4</strong></td>
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</table>

Total Credit Hours = 32
FIRST SEMESTER

PT 601 FUNDAMENTAL OF POLYMER SCIENCES
Credit Hours: 3 + 0
Introduces basic concepts about polymers to persons with a chemistry, physics, or engineering degree. A survey of preparative methods of polymers; physical chemistry of polymer molecules in solution, liquid, and solid phases; thermodynamics and statistics of polymers; methods of characterization; mechanical properties, fabrication techniques, science and engineering of large molecules, correlation of molecular structure and properties of polymers in solution and in bulk, control of significant structural variables in polymer synthesis.

PT 602 POLYMER SYNTHESIS AND CHARACTERIZATION
Credit Hours: 3 + 0
Polymer structure, classification of polymerization reactions, theory and practice of step growth polymerization, radical polymerization, ionic polymerization, ring-opening polymerization, polymerization by transition metal catalysts. Stereo-regulation and conformation of polymers. Structure-property relations. Polymers degradation and stability with special emphasis on thermal and photo-degradation. Experimental techniques in polymer characterization: Investigation of polymer structure by infrared (IR) spectroscopy. Molecular weight characterization by gel permeation chromatography (GPC) and viscosimetry; Rheological properties by Rheometer; Morphological characterization by Thermal Methods: Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), Dynamic Mechanical Analysis (DMA), Thermomechanical Analysis (TMA). Characterization of mechanical properties by tensile testing.

PT 603 POLYMER RHEOLOGY & PROCESSING
Credit Hours: 3 + 1
Definition and measurement of the material functions of complex fluids, continuum mechanics of stress and deformation, constitutive equations derived from 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. Application of engineering principles to the analysis of polymer processes such as extrusion, roll coating, mixing, etc. Applied fluid dynamics, with attention to heat and mass transfer processes. Basic technique for the rheological characterization of thermoplastic and thermoset resins; "hands-on" experience with the equipment used in polymer processing methods such as extrusion, injection molding, compression molding; techniques for mechanical characterization and basic principles of statistical quality control.
PT 604 MATERIAL SYNTHESIS AND CHARACTERIZATION LABORATORY
Credit Hours: 0 + 1
Preparation and characterization of the most important polymer types. Radical, cationic, anionic polymerization; copolymerization; Ziegler-Natta polymerization; step growth polymerization; suspension and emulsion polymerization. Characterization of polymers by up to fifteen methods, including spectroscopic (nuclear magnetic resonance, Raman, infrared), mechanical (tensile, dynamic mechanical, rheological), microscopic (electron and optical microscopy), and physiochemical (intrinsic viscosity, differential scanning, gel permeation chromatography). Lectures provide a state-of-the-art description of these and additional polymer characterization methods.

SECOND SEMESTER

PT 605 ADVANCED COMPOSITE MATERIALS
Credit Hours: 3 + 0
Definitions and classification, natural composites. Property enhancement by reinforcement and orientation, matrix interface, synthetic fibers, properties and processing of composites with metallic, ceramic and polymeric matrices, interface reactions, mechanical and thermal properties of composite materials, stress relaxation and creep studies, dynamical mechanical properties, toughening mechanism and mechanical failure in polymeric materials.
Introduction, Historical perspective and classification of nanomaterials, Present and future applications of nanotechnology, nanotechnology for Catalysis, nanoreactors, nanocomposites polymers, Sol-Gel Processing, Solution Precipitation, Water–Oil Microemulsion (Reverse Micelle) Method, Commercial Production and Use of nanoparticles, Specific heat and melting point of polycrystalline materials, Chemistry of Carbon nanotubes

PT 606 MEMBRANE SCIENCE AND APPLICATION
Credit Hours: 2 + 0
Advanced separation processes theory. Membrane technology has become an important unit operation in many technical processes and in life science, especially as a clean and energy saving alternative to traditional processes. Membrane Technology And Applications, Membrane Separation Technology, Reverse Osmosis Membrane Technology, Water Membrane Technology, Membrane Filtration Technology.

PT 607 ADVANCE POLYMERS
Credit Hours: 2 + 0
Conducting polymers, Shape memory polymers, liquid crystalline polymers, Electroactive polymers, Stimuli responsive polymers, Biopolymers, Biodegradable Polymers, etc. These material systems repeatedly dramatically react to small changes in
their external environment in a predictable manner. An introduction to the technology of adhesives, sealants and coatings. Relevant adhesion theories and practices. Test methods for mechanical properties and durability.

PT 608 ELASTOMERIC MATERIALS
Credit Hours: 2 + 0
Introduction to elastomeric material, structural requirements for elastomeric properties, theory of elasticity, Rubber Elasticity: Basic Concepts and Behavior, Chemistry of elastomeric material, Polymerization: Elastomer Synthesis, Modified natural elastomeric material, Polyester thermoplastic elastomers, Thermoplastic polyurethane elastomers, Advances in silicone based elastomeric material. Acrylic-based elastomers, highly saturated nitrile elastomers, Developments in diene-based Rubbers, Molecular foundations of polymer viscoelasticity. Rouse-Bueche theory, Boltzmann superposition principle, mechanical models, distribution of relaxation and retardation times, interrelationships between mechanical spectra, the glass transition, secondary relaxations, dielectric relaxations.

THIRD SEMESTER

PT 609 POLYMER PROCESS TECHNOLOGIES
Credit Hours: 2 + 0
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.

PT 610 POLYMER REACTION KINETICS
Credit Hours: 2 + 0
Engineering principles applied to the analysis and design of polymerization processes. Polymerization kinetics, ideal polymerization reactors, heat and mass transfer, reactor dynamics and optimization, mixing effects. Case studies of important industrial processes. Plant design.

PT 620 Research Thesis Part I
Credit Hours: 0 + 4
The students shall collect literature and submit synopsis of prescribed research topics assigned to them in third semester.

FOURTH SEMESTER

PT 630 Research Thesis Part II
Credit Hours: 0 + 4
The students shall perform experimental investigations on the prescribed research topics assigned to them in third semester and prepare the required project thesis for submission and for viva voce examinations.
LABORATORIES
(Chemical Engineering/Metallurgy, Materials Engineering & Polymer Engineering & Technology)

In order to provide better training, the theoretical instructions in various disciplines are complemented and substantiated by intensive laboratory work. The Institute has all along endeavored to purchase and make available the most modern equipment and other laboratory facilities.

A number of laboratories are functioning in the Faculty under the following nomenclature to cater for the practical training of the students in different subjects:

(i) Physical Chemistry (xi) Heat-Treatment
(ii) Particulate Solids Technology (xii) Composite Materials
(iii) Unit Process (xiii) Mechanical Properties Testing
(v) Unit Operations (xv) Plastic Technology
(vi) Petroleum Engineering (xvi) Corrosion Engineering
(vii) Instrumentation and Process Control (xvii) Chemical Process Technology
(viii) Fuel Engineering (xviii) Foundry Shop
(ix) Metallography (xix) Ceramics & Glasses
(x) Engineering Drawing

Experimental and Analytical Facilities at Postgraduate Level

1. Bubble Column Reactor
2. Stirred Tank Reactor
3. Three-Phase Fluidized Bed Contactor
4. Gulwin Liquid – Liquid Extraction Unit
5. Polymer Synthesis Facilities
6. Injection Moulding Machine
7. Pulp Production and Paper Sheet Formation Apparatuses
8. Furnas & Ovens
9. Paper Characteristics Studies Equipments
10. GAMRY Potentisotat Instrument
(a) DC Corrosion Evaluation Technique
(b) Electrochemical Impedance Spectroscopy (EIS) Technique
(c) Electrochemical Frequency Modulation (EFM) Technique
11. Climatic Chamber with Humidity and Temperature Controllers
12. Sand Blasting/Spray Painting Equipment
13. Petrolite Corrosion Rate Meter
14. Induction Furnace
15. Button Arc Furnace
16. Pit Furnace
17. Moulding Sand Testing Equipment
18. Optical Microscope Equipped with Image Analyser
19. Metallography Equipment
<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment Description</th>
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<tbody>
<tr>
<td>20.</td>
<td>Microhardness Tester</td>
</tr>
<tr>
<td>21.</td>
<td>Hardness Tester (Rockwell, Brinel, Vicker)</td>
</tr>
<tr>
<td>22.</td>
<td>Universal Testing Machine</td>
</tr>
<tr>
<td>23.</td>
<td>Differential Thermal Analysis (DTA)</td>
</tr>
<tr>
<td>24.</td>
<td>Differential Scanning Chlorinator (DSC)</td>
</tr>
<tr>
<td>25.</td>
<td>Size Reduction Lab.</td>
</tr>
<tr>
<td>27.</td>
<td>Joining End Quench Hardening Machine</td>
</tr>
<tr>
<td>28.</td>
<td>Surface Toughness Meter</td>
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<tr>
<td>29.</td>
<td>Mechanical Workshop</td>
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<td>30.</td>
<td>Gas Chromatograph</td>
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<tr>
<td>31.</td>
<td>HPLC</td>
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<tr>
<td>32.</td>
<td>UV/Vis Spectrophotometer</td>
</tr>
<tr>
<td>33.</td>
<td>Atomic Absorptions Spectrometer</td>
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<tr>
<td>34.</td>
<td>Catalyst Characterization Instrument</td>
</tr>
<tr>
<td>35.</td>
<td>BET Nitrogen Adsorption Unit</td>
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<tr>
<td>36.</td>
<td>Rheometer</td>
</tr>
<tr>
<td>37.</td>
<td>Laser Size Analyser</td>
</tr>
<tr>
<td>38.</td>
<td>Universal Testing Machine Floor Type</td>
</tr>
<tr>
<td>39.</td>
<td>Dynamic Mechanical Analyzer with Accessories</td>
</tr>
<tr>
<td>40.</td>
<td>Hardness Tester with different measuring ranges</td>
</tr>
<tr>
<td>41.</td>
<td>Pendulum Impact Testing Machine</td>
</tr>
<tr>
<td>42.</td>
<td>Lab Attritor</td>
</tr>
<tr>
<td>43.</td>
<td>Lab Scale Reactor</td>
</tr>
<tr>
<td>44.</td>
<td>Lab Mixing Extruder bench type</td>
</tr>
<tr>
<td>45.</td>
<td>Solution Viscometer</td>
</tr>
<tr>
<td>46.</td>
<td>High Temperature Press (Hydraulic)</td>
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<tr>
<td>47.</td>
<td>Gas permeability tester</td>
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<td>48.</td>
<td>Ultrasonic Cleaner</td>
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<tr>
<td>49.</td>
<td>Cylindrical Mandrel Bending Tester</td>
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<td>50.</td>
<td>Drying Time Recorder</td>
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<tr>
<td>51.</td>
<td>Drying Time Recorder</td>
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<tr>
<td>52.</td>
<td>Wet Abrasion Scrub Tester</td>
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<td>53.</td>
<td>Tubular Impact Tester</td>
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<td>54.</td>
<td>Gloss Master</td>
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<tr>
<td>55.</td>
<td>Fineness Grind Gauge 0-100UMS wide</td>
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<tr>
<td>56.</td>
<td>Adjustable Film Applicators</td>
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<tr>
<td>57.</td>
<td>Hardness Tester</td>
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<tr>
<td>58.</td>
<td>Pinhole Detector</td>
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<tr>
<td>59.</td>
<td>Opacity Meter</td>
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<tr>
<td>60.</td>
<td>Spindle Viscometer</td>
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<tr>
<td>61.</td>
<td>Coating Thickness Tester</td>
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<tr>
<td>62.</td>
<td>Research Microscope</td>
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<tr>
<td>63.</td>
<td>Simultaneous Differential Scanning Calorimeter</td>
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<tr>
<td>64.</td>
<td>Thermo Gravimetric Analyzer (SDT Q600)</td>
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<tr>
<td>65.</td>
<td>Differential Scanning Calorimeter (DSC Q 200)</td>
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<tr>
<td>66.</td>
<td>Thermo Mechanical Analyzer (TMA Q400)</td>
</tr>
<tr>
<td>67.</td>
<td>Rheometer</td>
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<tr>
<td>68.</td>
<td>Gel Permeation Chromatograph (GPC)</td>
</tr>
<tr>
<td>69.</td>
<td>Fourier Transform Infrared Spectrophotometer (FTIR)</td>
</tr>
</tbody>
</table>
University-Industry Interaction

The Institute is striving hard to establish strong liaison with the industry. This link is needed to meet the challenges of Global Competition. The industrial sector sponsor the research projects relevant to their interest. The industry provides funds for chemicals, equipment fabrication and cost of literature and other informations. The University provides facilities for supervision of research project, research worker and other facilities required to solve the industrial problems.

In this regard meetings are being organized with different organizations like Qurshi Industries (Pvt.) Limited, Packages Limited, Sui Northern Gas Pipe Line Limited, Sui Southern Gas Company, Textile Processing Units, Chenab Engineering and other process and metallurgical industries. It is hoped that these links will grow in future and will be beneficial for the country. To strengthen university industry interaction, recently MOU has been signed with Shafi-Reso-Chem. (Pvt) Ltd.

Research Projects funded by Higher Education Commission / Punjab University

<table>
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<tr>
<th>Sr. No.</th>
<th>Project Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Fast Pyrolysis of Agricultural Residues for the production of Bio Oil</td>
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<tr>
<td>2</td>
<td>Development and Characterization of Promoted Iron Catalysts for Fischer</td>
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<td>Tropsch Synthesis to Study Gas to Liquid Technology</td>
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<tr>
<td>3</td>
<td>Comparative Study of Combustion of Various Solid Wastes in</td>
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<td>Combination with Coal in a Circulating Fluidized Bed Combustar (CFBC)</td>
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<td>4</td>
<td>Identification and Mitigation of Internal Corrosion in Gas Transmission</td>
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<td>Pipelines due to CO$_2$, H$_2$S, Moisture and Bacteria</td>
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<tr>
<td>5</td>
<td>Catalytic Hydrodechlorination of Chlorophenol</td>
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</tbody>
</table>
Disclaimer

The prospectus is informational and should not be taken as binding on the Faculty. Each aspect of the educational setup, ranging from the admission procedure to the examination regulations or discipline, requires continual review by the competent authorities. The Faculty, therefore, reserves the right to change/amend any rule/s and regulations applicable to students whenever it is deemed appropriate or necessary.