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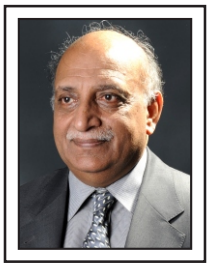

MESSAGE FROM WORTHY VICE-CHANCELLOR

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 the 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. (Engg.) 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 re-designating 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:

Percent Marks	**Letter Grade**	**Grade Points**
85 & above	A	4.00
80-84	A-	3.70
75-79	B+	3.30
70-74	B	3.00
65-69	B-	2.70
61-64	C+	2.30
58-60	C	2.00
55-57	C-	1.70
50-54	D	1.00
Below 50	F	0.00
Withdrawal	W	

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 1ess 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.

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

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.

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

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.

Course/Degree		%age marks				
		50%	55%	60%	70%	=>80%
Matric	Marks	4	5	7.5	8.5	10
F.A / F.Sc.	Marks	4	5	7.5	8.5	10
B.A/B.Sc/BS (Hons.) 4 Years/MBBS/BDS		CGPA				
		2.5	3.0	3.40	=>3.80	
	Marks	8	15	17	20	

Ph.D

Course/Degree		%age Marks			
		50%	60%	70%	=>80%
Matric	Marks	4	6	7	8
F.A / F.Sc.	Marks	4	6	7	8
B.A/B.Sc	Marks	4	6	7	8
M.A/M.Sc. (Pass Courses)			6	7	8
		CGPA			
B.A/B.Sc (Hons) 4 years		2.5	3.0	3.40	=>3.80
	Marks	8	12	14	16
M.A/M.Sc. (Semester)	Marks	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

Name of Program	**Last year Merit (Self Supporting/Replica 2011)**	
	CGPA (Semester)	Percentage (Annual)
M.Sc (Engg) Chemical Engineering	2.65/4.0 CGPA	69%
M.Sc (Engg) Metallurgy & Materials Engineering	2.60/4.0 CGPA	67%
M. Phil Polymer Technology	2.50/4.0 CGPA	60%

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 Durrani
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
Ist 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

Sr. No.	Module	Subject	Credit Hours		
			Theory	Practical	Total
1.	CHE 610	Applied Engineering Mathematics	2	1	3
2.	CHE 611	Advanced Chemical Reaction Engineering	3	–	3
3.	CHE 612	Advanced Separation Processes	3	–	3
4.	CHE 613	Research Methodology	2	–	2
5.	CHE 614	Biochemical Engineering	2	–	2
Total			**12**	**1**	**13**

Second Semester

Sr. No.	Module	Subject	Credit Hours		
			Theory	Practical	Total
1.	CHE 620	Advanced Transport Phenomena	3	–	3
2.	CHE 621	Advanced Process Dynamics and Control	3	–	3
3.	CHE 622	Advanced Chemical Engineering Thermodynamics	3	–	3
4.	CHE 623	Sustainable Energy Systems	2	–	2
Total			**11**	–	**11**

Third Semester

Sr. No.	Module	Subject	Credit Hours		
			Theory	Practical	Total
1.	CHE 630	Research Thesis	3	---	3
Total			**3**	**---**	**3**

Fourth Semester

Sr. No.	Module	Subject	Credit Hours		
			Theory	Practical	Total
1.	CHE 640	Research Thesis	3	–	3
Total			**3**	**–**	**3**

Detail of the Credit Hours

1st Semester	13
2nd Semester	11
3rd Semester	03
4th Semester	03
Total Credit Hours	**30**

Detail of Courses

First Semester

CHE610 APPLIED ENGINEERING MATHEMATICS

Boundary-value problems for ordinary differential equations. General features and classification of partial differential equations. Numerical solution of parabolic and elliptical partial differential equations. Finite element methods. Applications of MATLAB PDE Toolbox for solving partial differential equations.

Recommended books:

1. Hoffman, J.D., (2001), Numerical methods for engineers and scientists, 2nd ed., Marcel Dekker, Inc.
2. Rice, R.G. and Do, D.D., (1995), Applied mathematics and modeling for chemical engineers, John Wiley & Sons, Inc.
3. Davis, M.E., (1984), Numerical methods & modeling for chemical engineers, John Wiley & Sons, Inc.
4. Burden, R.L. and Faires, J.D., (2005), Numerical analysis, 8th ed., Thomson Books.
5. Chapra, S.C. and Canale, R.P., (2010), Numerical methods for engineers, 6th ed., McGraw-Hill.
6. Beers, K.J., (2007), Numerical methods for chemical engineering: Applications in MATLAB, Cambridge University Press.
7. Jenson, V.G. and Jeffreys, G.V., (1977), Mathematical methods in chemical engineering, Academic Press.

CHE611 ADVANCED CHEMICAL REACTION ENGINEERING

Homogeneous and Heterogeneous reaction rate expressions.Characterization of solid catalysts.General characteristics of heterogeneous reactors.Simultaneous mass and heat transportswith chemical reaction in porous catalysts. Analysis and design of gas-liquid reactors: Mechanically agitated vessels, bubble columns, and packed columns. Non-catalytic reactors. Analysis and design of three phase reactors: slurry reactors, trickle bed reactors, and fluidized bed reactors.

Recommended books:

1. Harriot, P., (2003), Chemical Reactor Design, Marcel Dekker Inc. New York.
2. Richardson, J. F. and Peacock, D. G., (1994), Chemical Engineering, Vol. III, 3rd Edition, Butternorth.
3. Trambouze, P. and Euzen J.-P., (2004), Chemical Reactors; From Design to Operations, TECHNIP, France.
4. Spiel, L., (1999), Chemical Reaction Engineering, 3rd Edition John Wiley and Sons Inc.
5. Deckwer, W. D., (1992), Bubble Column Reactors, John Wiley & Sons Inc.

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:

1. Coulson & Richardson's (2010), Chemical Engineering Volume-II 5th Edition Butternorth.
2. J. D. Seader, Ernest J. Henley and D. Keith Roper, (2010), "Separation Process Principles".
3. Christie J. Geankoplis, (2003), "Transport Processes and Separation Process Principles" 4th Edition .
4. Philip c. Wankit, (2011), "Separation Process Engineering: Includes Mass Transfer Analysis" 3rd Edition.
5. C. Judson King, (1980), "Separation Processes", McGRAW-Hill Book Company.
6. Richard W. Baker, (2004), "Membrane Technology and Applications" 2nd Edition, McGRAW-Hill Book Company.

CHE 613 RESEARCH METHODOLOGY

Introduction to research and its components.Literature search techniques. Literature review process.Research problem identification.Development of research methodology. Design of a research plan.Design of experiments.Data evaluation including statistical data analysis. Publishing reports and articles. Writing a research proposal.

Recommended books:

1. Williamsons, K. "Research Methods for students, Academics and Professionals: Information management and system, 2nd Edition, Woodhead Pyblishing Cambridge, U.K. (2002).
2. Ranjit Kumar, (2005), "Research Methodology: a step-by step guide for beginners"2nd Edition, Calif Publishing, London, U.K.
3. R Barker Bausell, (1999), "Advanced Research Methodology: an annotated guide to sources: Scarecrow Press Publishing, London, U.K.

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

bioreactors for suspension and immobilized cultures.Recovery and purification of products.Economic analysis of biological processes.

Recommendedbooks:

1. Bailey, J. E. and Ollis, E.F., (1986), Biochemical Engineering Fundamentals, 2nd ed., McGraw Hill.
2. Blanch, H. W. and Clark, D.S., (1997), Biochemical Engineering, Marcel Dekker.
3. M. Doble, A.K. Kruthiventi and V.G.Gaikar (2004), Biotransformations and Bioprocesses Marcel Dekker.
4. Shuler, M.L. and Kargi, F., (1992), Biochemical Engineering Basic Concepts, Prentice Hall.

Second Semester

CHE 620 ADVANCED TRANSPORT PHENOMENA

Review of introductory topics in transport phenomena. Fluid flow: Velocity distribution with more than one independent variable, turbulentflowmodels, velocity distribution in turbulent flow, and flow of non-Newtonian fluids. Heat transfer: Temperature distribution with more than one independent variable and temperaturedistribution 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:

1. Bird, R.B., Stewart, W.E., and Lightfoot, E.N., (2007), Transport Phenomena, 2nd ed., John Wiley & Sons, Inc.
2. Welty, J.R., Wicks, C.E., and Wilson, R.E., and Rorrer, G.L., (2007), Fundamentals of momentum, heat, and mass transfer, 5th ed., John Wiley & Sons, Inc.
3. Slattery, J.C., (1999), Advanced transport phenomena, Cambridge University Press.
4. Tosun, I., (2007), Modeling in transport phenomena, a conceptual approach, 2nd ed., Elsevier B.V.
5. Leal, L.G., (2007), Advanced transport phenomena: Fluid mechanics and convective transport processes, Cambridge University Press.
6. Malkin, A.Y., (1994), Rheology fundamentals, ChemTec Publishing.

CHE 621 ADVANCED PROCESS DYNAMICS AND CONTROL

Dynamic process modeling and simulation.Design of feedback process control systems.Stability and performance analysis.Tuning of feed back controllers.Modern frequency response techniques.Enhancement of single loop control. Advanced controller: Feedforward control, ratio control, cascade control, and override control.

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

Recommended books:

1. Seborg, D. E., Edgar, T. F., Mellichamp, D. A., (2012), Process Dynamics and Control, 3rd Edition, John Wiley & Sons Inc.
2. Smith C. A. and Corripio, A. B., (2006), Principles and Practice of Automatic Process Control,3rd Edition, John Wiley & Sons Inc.
3. Marlin, T. E., (2000), Process Control: Designing Processes and Control System For dynamic Performance, 2nd Edition, McGraw Hill.

CHE 622 ADVANCED CHEMICAL ENGINEERING THERMODYNAMICS

Review of terminology of thermodynamics including the chemical potential, partial molar properties, the Gibbs-Duhem equation, fugacity and fugacity coefficient, activity and activity coefficient, and standard states. Fugacities in mixture of gases.Fugacities in mixture of liquids.Excess Gibbs free energy models.Advanced treatment of solubility of gases in liquids.Chemical reaction equilibria for non-ideal conditions.Introduction to molecular thermodynamics.

Recommended books:

1. Prausnitz, J.M., Richthentaler, R.N., de Avezedo, E.G., (1999), Molecular thermodynamics of fluid-phase equilibria, 3rd ed., Prentice-Hall PTR, New Jersey.
2. Ott, J.B., Boerio-Goates, (2000), Chemical thermodynamics advanced applications, Academic Press, San Diego.
3. O'Connell, J.P. and Haile, J.M., (2005), Thermodynamics for applications, Cambridge University Press, New York.
4. Smith, J.M., Van ness, H.C., and Abott, M.M., (2005), Introduction to chemical engineering thermodynamics, 7th ed., McGraw-Hill, New York.
5. Koretsky, M.D., (2004), Engineering and chemical thermodynamics, John Wiley & Sons, Inc.
6. Sandler, S.I., Chemical, (2006), Biochemical, and engineering thermodynamics, 4th ed., John Wiley & Sons, Inc.

CHE 623 SUSTAINABLE ENERGY SYSTEMS

Introduction to alternate and renewable energy systems (solar, biomass conversions, wind, and geothermal).Society's present needs and future energy demands.Renewable energy generation, supply and sustainability, storage, and distribution.Efficient energy management and utilization.Energy conservation and auditing methods.Environmental policies/regulations in the context of energy supply and consumption patterns.

Recommended books:

1. Quaschning, V., (2004), Understanding Renewable Energy System.

2. Gevorkian, P., (2006), Sustainable Energy System Engineering, McGraw-Hill.
3. Dincer, I. and Zamfirescu, C., (2011), Sustainable Energy System and Applications, Springer.
4. Hanjalic, K. and Krol, R. L., (2008), Sustainable Energy Techninologies, Springer.
5. Boyle, G., (2004), Renewable Energy, 2nd ed., OxfordUniversity Press.
6. Boyle, G., Everett, B., Ramage, J., (2004), Energy Systems and Sustainability: Power for a Sustainable Future, OxfordUniversity Press.

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
Ist 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

1st Semester

Sr. No.	Module	Subject	Credit Hours		Total
			Theory	Practical	
1	811	Analytical techniques in engineering research	3		3
2	812	Process modeling and simulation	2		2
3	 813 814 815 816	Elective-I: Any one from the following courses: Hetrogeneous catalysis; Surface Engineering; Membrane Technologies; Gasification technologies	3		3
4	817	Research Seminar - I		1	1
Total			**08**	**01**	**09**

2nd Semester

Sr. No.	Module	Subject	Credit Hours		Total
			Theory	Practical	
1	820	Experimental design and data analysis	2		2
2	821	Advanced Thermodynamics: phase and reaction equilibria	3		3
3	 822 823	Elective-II: Any one from the following: Chemical Product Design; Computational Fluid Dynamics;	3		3

	824 825 826	Gas Cleaning Technologies Process intensification; Combustion Engineering			
4	827	Research Seminar-II	---	1	1
Total			**08**	**01**	**09**
			Total Credit Hours		**18**

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:

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, (2007), Principles of Instrumental Analysis, Wiley.
2. Francis Rouessac, A. Rouessac, (2007), Chemical Analysis: Modern Instrumentation Methods and Techniques, 2nd Edition Wiley.

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:

1. William B. J. Zimmerman , (2004), Process modeling and simulation with finite element methods, Wiley.
2. B. Wayne Bequette, (2003), Process control: modeling, design, and simulation, CRC Press.
3. Koji Koyamada, Shinsuke Tamura, Osama Ono, (2007), Systems Modeling and Simulation: Theory and Applications, Wiley.
4. Jorge Ancheyta, (2011), Modeling and Simulation of Catalytic Reactors for Petroleum Refining, CRC Press.

Elective-I: Any one from the following courses:

CHE 813 HETROGENEOUS CATALYSIS

Catalytic activity and turn over frequency, Catalyst Preparation, Catalysts Characterization, Catalytic Reactors, Case Studies, Heterogeneously Catalyzed Process in Industry, Environmental Catalysis.

Recommended Books:

1. Jens Hagen, (2006), Industrial Catalysis: A practical approach, Wiley.
2. Julian R.H.Ross, (2007), Heterogenous Catalysis: Fundamentals and Applications.
3. J.W. Niemantsverdriet, (2007), Spectrocopy in catalysis, third Ed, Wiley.

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:

1. Peter Martin, (2011), Introduction to Surface Engineering and Functionally Engineered.
2. Andrew Batchelor, Loh Nee Lam, (2010), Margam Chandrasekaran, Materials Degradation and Its Control by Surface Engineering, Wiley.

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:

1. Norman N Li, Anthony G. Fane, W. S. Winston Ho, (2011), Advanced Membrane Technology and Applications, Wiley.
2. Nidal Hilal, Mohammad Khayet and Chris J Wrijht (2012), membrane Modification; Technology and Applications, CRC Press.
3. K. Mohanty and M.K. Purkait, Memberane Technologies and Applications, (2011), CRC Press.

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:

1. David A. Bell, Brian F. Towler, (2010), Maohong Fan, Coal Gasification and Its Applications, Wiley.
2. Prabir Basu, (2010), Biomass Gasification and Pyrolysis: Practical Design and Theory, CRC Press.
3. Robert C. Brown, Christian Stevens, (2011), Thermochemical Processing of Biomass: Conversion Into Fuels, Wiley.

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

A: Design of experiments: FUNDAMENTAL STATISTICAL CONCEPTS; Statistical Inference, Inferences on Means and Standard Deviations; Various Design techniques like Factorial Design, Randomised Design, Design using Quantitative predictors and factors and Design using Fitting Response surfaces, Model Assessment and Variable Selection Techniques.

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:

1. Klaus Hinkelmann, Oscar Kempthorne, (2002), Design and Analysis of Experiments: Introduction to experimental design, Wiley.
2. Živorad R. Lazić, (2006), Design of Experiments in Chemical Engineering: A Practical Guide, Wiley.
3. Robert Lee Mason, Richard F. Gunst, James L. Hess, (2003), Statistical Design and Analysis of Experiments, CRC Press.
4. Anthony J. Hayter, (2012), Probability and Statistics for Engineers and Scientists, Wiley.

CHE 821 ADVANCDE 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:

1. Giovanni Astarita, (1989), Thermodynamics: An Advanced Textbook for Chemical Engineers, Wiley.

2. Frank Weinhold, (2009), Classical and Geometrical Theory of Chemical and Phase Thermodynamics, CRC Press.
3. Kalyan Annamalai, Ishwar K. Puri, Milind A. Jog, (2011), Advanced Thermodynamics Engineering, Wiley.

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:

1. Warren D. Seider, J. D. Seader, Daniel R. Lewin, (2010), Product & process design principles, Wiley.
2. M. Ng, Rafiqul Gani, Kim Dam-Johansen, (2007), Chemical Product Design : Toward a Perspective Through Case Studies, Wiley.

CHE 823 COMPUTATIONAL FLUID DYNAMICS

Introduction, Governing Equations of Fluid Flow and Heat Transfer, Classifications of Equations, Turbulence and its Modeling, The Finite Volume Method for Diffusion Problems in Two and Three Dimensions, Difference between Finite Volume and other Numerical Methods, Examples, LES and DNS methods and their Solution Techniques.
The Finite Volume Method for Convection/Diffusion problems, Central Difference Scheme, Discretizations, Conservativeness, boundedness, transportiveness, Upwinding Differencing Scheme, Hybrid Differencing Scheme, The SIMPLE and PISO Algorithms, Applications of Boundary Conditions. The Finite Volume Method of Unsteady Flows, Steady state Calculations using Pesudo-Transient Approach , Solution of Discretized Equation, Gaussian Elimination, The Tri-Diagonal Matrix Algorithm for 2D and 3D Applications, Use of CFD Software FLUENT to Solve Typical Chemical Engineering Problems

Recommended Books:

1. J. Ferziger, M. Peric; (2002), Computational Methods for Fluid Dynamics, 3rd Ed.– Springer.
2. Versteeg, H. and Malalasekra, W., (2007), An Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2nd Ed., Prentice Hall.
3. Patankar. S. V., (1980), Numerical heat transfer and fluid flow, Hemisphere.

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:

1. Ke Liu, Chunshan Song, Velu Subramani, (2010), Hydrogen and Syngas Production and Purification Technologies, Wiley.
2. Bruce G. Miller , (2010), Clean Coal Engineering Technology, Wiley.

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:

1. David Anthony Reay, Colin Ramshaw, Adam P. Harvey,(2010), Process Intensification: Engineering for Efficiency, Sustainability by Butterworth-Heinemann
2. K. Sankaranarayanan, (2010), Efficiency and Sustainability in the Energy and Chemical Industry, CRC Press.

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:

1. Kenneth W. Ragland, Kenneth M. Bryden, (2010), Combustion Engineering, Wiley.
2. Bruce G. Miller (M.S.), Bruce G. Miller, David A. Tillman, (2008), Combustion Engineering Issues for Solid Fuel Systems, CRC Press.
3. Irvin Glassman, Richard A. Yetter, (2008), Combustion, Wiley.
4. Samir Sarkar, (2010) Fuels & combustion, third Edition, CRC Press.

CHE 827 RESEARCH SEMINAR-II

Students/Researchers will be required to present talks on important topics related to their area of research.

M.Sc. Program in Metallurgy & Materials Engineering

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

Ist Semester

Sr. No.	Module	Subject	Credit Hours		Total
			Theory	Practical	
1	MME 511	Corrosion Engineering	3	1	4
2	MME 512	Deformation and Fracture of Metals	3	1	4
3	MME 513	Manufacturing Processes	2	0	2
Total			**8**	**2**	**10**

2nd Semester

Sr. No.	Module	Subject	Credit Hours		Total
			Theory	Practical	
1	MME 521	Solidification Processes	3	1	4
2	MME 522	Electrical and Magnetic Properties of Materials	2	0	2
3	MME 523	Coating Techniques	2	0	2
4	GS 524	Research Methodology	1	0	1
Total			**8**	**1**	**9**

3rd Semester

Sr. No.	Module	Subject	Credit Hours		Total
			Theory	Practical	
1	MME 611	Heat Treatment of Metals and Alloys	2	1	3
2	MS 612	Production Management	3	0	3
3	MME 613	Characterization Techniques	2	0	2
4	MME 621	Research Project	0	1	1
Total			**7**	**2**	**9**

4th Semester

Sr. No.	Module	Subject	Credit Hours		Total
			Theory	Practical	
1	MME 621*	Research Project	0	5	5
Total			**0**	**5**	**5**

*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
3 Contact Hours of Practical = 1 Credit Hour

Total Credit Hours = 33

1st Semester

MME 511 CORROSION ENGINEERING

Introduction to Corrosion Engineering, Electrochemistry of Corrosion Processes, High Temperature Oxidation of Metals and Alloys, Thermodynamics of Corrosion and Pourbaix Diagrams, Kinetics of Corrosion and Polarization, Forms of Corrosion; Pitting and Crevice Corrosion, Galvanic Corrosion, Stress-Corrosion Cracking, Intergrannular Corrosion, Microbiological Influenced Corrosion, Erosion-Corrosion, Cavitation Damage, Corrosion Fatigue and Fretting Corrosion. Passivity; Types of Passivity, Conditions for Passivation, Kinetics of Passivity. Corrosion Control Methods; Cathodic Protection, Anodic Protection, Metallic, Inorganic and Organic Coatings, Inhibitors and Passivators. Materials Selection; Selection of Materials for Corrosive Environments, Corrosion Testing and Monitoring; AC and DC Techniques.

Recommended Books:

1. Herbert H. Uhlig and R. Winston Revie, "Corrosion and Corrosion Control", John Wiley & Sons, Inc., 2008.
2. Mars G. Fontana, "Corrosion Engineering", Tata McGraw-Hill Publishing Co. Ltd., 2006.
3. I.H. Khan, "Corrosion Technology Volume-I" I.C.E.T, Punjab University and AFAQ, 2010.
4. "Kenneth R. Trethewey, "Corrosion for Science & Engineering", Addison Wesley Longman, 1996.
5. Pierre R. Roberge, "Handbook of Corrosion Engineering", Mc-Graw Hill, 2000.
6. Zaki Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science & Technology Books, 2006.

MME 512 DEFORMATION AND FRACTURE OF METALS

Theory of Dislocations, Dislocation Types, Movement of Dislocations, Partial Dislocations, Kinks and Jogs, Dislocations in FCC Metals and their Properties, Force, Strain Energy and Line Tensions Associated with Dislocations, Dislocation Intersections, Role of Dislocations in Plastic Deformation of Metals, Role of High and Low Angle Grain Boundaries in Plastic Deformation, Mechanisms Associated with Strengthening of Metals and Alloys, Yield Point Phenomenon in Mild Steels, Strain Aging.

Fracture Behavior of Materials used in Engineering, Fracture Types, Surfaces and their Study of Interpretation, Fracture Toughness, Impact Testing, Griffith's Theory of Fracture.

Recommended Books:

1. G.E. Dieter, "Mechanical Metallurgy", Mc-Graw Hill, 1991.
2. D. Hull and D.J. Bacon, "Introduction to Dislocations", Pergamon Press, 1986.
3. R.W.K. Honeycomb, "The Plastic Deformation of Metals", Edward Arnold, 1985.
4. Thomas H. Courtney, "Mechanical Behavior of Materials", Mc-Graw Hill, 2000.

5. Vernon John, "Introduction to Engineering Materials", McMillan Press Ltd., 1994.

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:

1. R.C. Creese, "Introduction to Manufacturing Processes and Materials", Taylor and Francis, 1999.
2. G.E. Dieter, "Mechanical Metallurgy", Mc-Graw Hill, 1991.
3. S. Kalpakjian and S.R. Schmid, "Manufacturing Processes for Engineering Materials", Pearson Education, Inc., 2003.
4. Paul De Garmo, Mlack, and Kohsar, "Processing Methods in Manufacturing", Prentice Hall, USA, 2000.
5. M. P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley & Sons, Inc. 2007.
6. M.F. Ashby and D.R.H. Jones, "Engineering Materials-2", Pergamon, 2005 .

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 Niama 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:

1. M.C. Flemings, "Solidification Processing", McGraw-Hill, 1974.
2. W. Kurz and D.J. Fisher, "Fundamentals of Solidification", Trans Tech Publication Ltd, 2005.
3. ASM Metals Handbook, "Casting", Volume 15, ASM International, 1991.
4. J. Campbell, "Castings", Butterworth-Heinemann, 2003.

5. J. E. Gruzleski and B. M. Closset, "The Treatment of Liquid Aluminum-Silicon Alloys", American Foundrymen's Society Inc., 1999.
6. J. Campbell, "Casting Practice", Butterworth-Heinemann, 2005.

MME 522 ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS

Intrinsic Semiconduction, Extrinsic Semiconduction, Temperature Dependence of Carrier Concentration, Factors that affect Carrier Mobility, Hall Effect, Semiconductor Devices, Conduction in Ionic Materials, Electrical Properties of Polymers, Capacitance, Field Vectors and Polarization, Types of Polarization, Frequency Dependence of the Dielectric Constant, Dielectric Strength, Dielectric Materials, Ferroelectricity, Piezoelectricity.

Basic Concepts, Diamagnetism and Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Soft Magnetic Materials, Hard Magnetic Materials, Magnetic Storage, Superconductivity.

Recommended Books:

1. P. Campbell, "Permanent Magnet Materials and Their Application", Cambridge University Press, 1996.
2. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley & Sons, Inc., 2007.
3. W. F. Smith, "Principles of Materials Science and Engineering", McGraw-Hill, 1995.
4. L. I. Berger and Lev I. Berger, "Semiconductor Materials", CRC Press, 1997.
5. W. E. Hatfield and J. H. Miller, "High-Temperature Superconducting Materials: Preparations, Properties, and Processing", Marcel Dekker, 1988.

MME 523 COATING TECHNIQUES

Basic principles of corrosion control, Corrosion control by barrier coatings. Hard chrome plating, Decorative Chromium plating, Ni Plating, Electroless Ni Plating, Electroless Ni-P-Co coating. Thin magnetic coatings for magnetic applications. Zn plating, Brass plating, Silver Plating, Gold Plating. Hot dip Galvanized coating, Al coating of steel. Oxidation spray coating. Oxidation protective coatings, Phosphate conversion coating. Chromate conversion coatings, aluminum anodizing. High Temperature coatings, high temperature coating systems, physical vapor deposition (PVD). Chemical vapor deposition (CVD), Ion Implantation, Plasma Coating.

Recommended Books:

1. A. A. Tracton, "Coatings Technology: Fundamentals, Testing, and Processing Techniques", CRC Press, 2006.
2. A. A. Tracton, "Coatings technology handbook", Taylor & Francis, 2005
3. N. Kanani, "Electroplating - Basic Principles, Processes and Practice", Elsevier Ltd, 2004.

4. ASM Metals Handbook, "Surface Engineering", Volume 5, ASM International, 1991.

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

Relation of Structural Changes and Kinetics of Transformation to Continuous Heat Treatment, Annealing, Normalizing, Hardening and Tempering of Steels. Hardening and Tempering of Constructional and Tool Steels, Dimensional Changes during Hardening and Tempering, Heat Treatment of High Strength Low Alloy Constructional Steels, Precipitation Hardening, Thermomechanical Treatment, Austempering, Martempering, Maraging, Ausforming, Zero Rolling.

Recommended Books:

1. G. Krauss, “Steels Heat Treatment & Processing”, ASM, 1995.
2. R. E. Reed-Hill, R. Abbaschian and L. Abbaschian, "Physical Metallurgy Principles", Cengae Learning, 2009.
3. K.E. Thelning, “Heat treatment of Steel”, Butterworth-Heinemann, 2000.
4. R.W.K. Honeycombe and H. K. D. H Bhadeshia, “Steels: Microstructure and Properties”, Butterworth-Heinemann, 2000.
5. J. W. Martin, "Precipitation Hardening", Butterworth-Heinemann, 1998.

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

Design Process, product life cycle and liability, research and development, standardization, reliability, availability Facilities Layout: Basic types, cellular layout, line balancing method, Design of Work system: Job Design, Work measurement, Compensation Breakeven Analysis and Capacity Planning.
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:

1. William J. Stevenson, "Production/Operations Management", McGraw-Hill, 1998.
2. Richard B. Chase and Nicholas J. Aquilano, "Production and Operations Management: Manufacturing and Services", Irwin Professional Publishing, 1998.
3. Elwood S. Buffa and Rakesh K. Sarin, "Modern Production/Operations Management", Wiley, 1987.

MME 613 CHARACTERIZATION TECHNIQUES

Classical, Electrochemical and Radiochemical Analysis
Classical Wet Analytical chemistry, Elemental and Functional Group Analysis, High-Temperature combustion, Inert Gas Fusion, Radio-Analysis.
Optical and X-Ray Spectroscopy
Inductively Coupled Plasma Atomic Emission Spectroscopy, Atomic Absorption Spectrometry. X-Ray Flourscene Spectrometry.
Mass Spectroscopy
Spark Source Mass Spectrometry, Gas Analysis by Mass Spectrometry.
Metallographic techniques
Optical Metallorgraphy, Image Analysis.
Diffraction Methods
X-Ray Powder Diffraction, X-Ray Diffraction Residual Stress Techniques. Serigraphic projection and relative determination.
Electron Optical Methods
Analytical transmission Electron Microscopy, Scanning Electron Microscopy, Electron Probe X-Ray Microanalysis, Low-Energy Electron Diffraction.
Chromatography

Gas Chromatography, Mass Chromatography, Ion Chromatography.

Recommended Books:

1. C.S. Barret and T.B. Massaiski, "Structure of Metals", Mc-Graw Hill, 1980.
2. J.W. Watchman, "Characterization of Materials", Butterworth-Heinemann, 1993.
3. D. Brandson and W.D.Kalplan, "Microstructural Characterization of Materials", 1999.

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. Chemistry/ B.Sc. Hons. Chemistry

M.Sc. Physics/ B.Sc. Hons. Physics

M.Sc. Bio Chemistry/ B.Sc. Hons. Bio Chemistry

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

Course Code	Course Title	Credit Hours		
		Theory	**Lab**	**Total**
PT 601	Fundamental of Polymer Sciences	3	0	3
PT 602	Polymer Synthesis and Characterization	3	0	3
PT 603	Polymer Rheology & Processing	3	1	4
PT 604	Materials Synthesis and Characterization Laboratory	0	1	1
Total		**9**	**2**	**11**

Second Semester

Course Code	Course Title	Credit Hours		
		Theory	**Lab**	**Total**
PT 605	Advanced Composite Materials	3	0	3
PT 606	Membrane Science and Application	2	0	2
PT 607	Advance Polymers	2	0	2
PT 608	Elastomeric Materials	2	0	2
Total		**9**	**0**	**9**

Third Semester

Course Code	Course Title	Credit Hours		
		Theory	**Lab**	**Total**
PT 609	Polymer Process Technologies	2	0	2
PT 610	Polymer Reaction Kinetics	2	0	2
PT 620	Research Thesis Part I	0	4	4
Total		**4**	**4**	**8**

Fourth Semester

Course Code	Course Title	Credit Hours		
		Theory	**Lab**	**Total**
PT 630	Research Thesis Part II	0	4	4
Total		**0**	**0**	**4**

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 relation.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; Rhelogical 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 SIENCE 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, Biodegradeable 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 elstomeric 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
(ii) Particulate Solids Technology
(iii) Unit Process
(iv) Applied Physics
(v) Unit Operations
(vi) Petroleum Engineering
(vii) Instrumentation and Process Control
(viii) Fuel Engineering
(ix) Metallography
(x) Engineering Drawing
(xi) Heat-Treatment
(xii) Composite Materials
(xiii) Mechanical Properties Testing
(xiv) Welding NDT Lab.
(xv) Plastic Technology
(xvi) Corrosion Engineering
(xvii) Chemical Process Technology
(xviii) Foundry Shop
(xix) Ceramics & Glasses

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

20. Microhardness Tester
21. Hardness Tester (Rockwell, Brinel, Vicker)
22. Universal Testing Machine
23. Differential Thermal Analysis (DTA)
24. Differential Scanning Chlorinator (DSC)
25. Size Reduction Lab.
26. Deep Drawing Cupping Machine
27. Joining End Quench Hardening Machine
28. Surface Toughness Meter
29. Mechanical Workshop
30. Gas Chromatograph
31. HPLC
32. UV/Vis Spectrophotometer
33. Atomic Absorptions Spectrometer
34. Catalyst Characterization Instrument
35. BET Nitrogen Adsorption Unit
36. Rheometer
37. Laser Size Analyser
38. Universal Testing Machine Floor Type
39. Dynamic Mechanical Analyzer with Accessories
40. Hardness Tester with different measuring ranges
41. Pendulum Impact Testing Machine
42. Lab Attritor
43. Lab Scale Reactor
44. Lab Mixing Extruder bench type
45. Solution Viscometer
46. High Temperature Press (Hydraulic)
47. Gas permeability tester
48. Ultrasonic Cleaner
49. Cylindrical Mandrel Bending Tester
50. Drying Time Recorder
51. Drying Time Recorder
52. Wet Abrasion Scrub Tester
53. Tubular Impact Tester
54. Gloss Master
55. Fineness Grind Gauge 0-100UMS wide
56. Adjustable Film Applicators
57. Hardness Tester
58 Pinhole Detector
59. Opacity Meter
60. Spindle Viscometer
61. Coating Thickness Tester
62. Research Microscope
63. Simultaneous Differential Scanning Calorimeter
64. Thermo Gravimetric Analyzer (SDT Q600)
65 Differential Scanning Calorimeter (DSC Q 200)
66. Thermo Mechanical Analyzer (TMA Q400)
67. Rheometer
68. Gel Permeation Chromatograph (GPC)
69. Fourier Transform Infrared Spectrophotometer (FTIR)

70. Polymer Synthesis Pilot Plant
71. Pervaporation Unit
72. Bench Scale Reactors
73. Polymer Synthesis Glass Assemblies
74. Dip Goods Synthesis Plant
75. Pipe Extruder
76. Film Extruder
77. Blow Moulding
78. Injection Moulding
79. Mechanical Stirrer
80. Oil Bath
81. Hot Plate Magnetic Stirrer
82. Rotamental
83. Orbital Shaker
84. Glove Box

University-Industry Interaction

The Institute is striving hard to establish strong liason with the industry. This link is needed to meet the challenges of Global Competion. 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

Sr. No.	Project Name
1	Fast Pyrolysis of Agricultural Residues for the production of Bio Oil
2	Development and Characterization of Promoted Iron Catalysts for Fischer Tropsch Synthesis to Study Gas to Liquid Technology
3	Comparative Study of Combustion of Various Solid Wastes in Combination with Coal in a Circulating Fluidized Bed Combustar (CFBC)
4	Identification and Mitigation of Internal Corrosion in Gas Transmission Pipelines due to CO_2, H_2S, Moisture and Bacteria
5	Catalytic Hydrodechlorination of Chlorophenol

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.