Materials Science and Engineering

Department of
Materials Science and Engineering

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Overview

Materials science and engineering (MSE) is a relatively new field of engineering. Up until 1970's, it was referred to as metallurgical engineering in technical universities and institutes of higher education. With the recognition of common features and similarities in the behaviour of engineering materials, most of these departments were renamed materials engineering, materials science, or similar titles.

Apart from courses on structural similarities between different engineering materials, the curricula of materials departments across the globe may include specialized courses on metals, ceramics, composites, polymers, and other materials. In a sense, materials science and engineering is itself a multidisciplinary field, incorporating physics, chemistry, and mechanical engineering. It can therefore cover a very wide spectrum of engineering subjects. As a result, the effects of this important engineering field are visible in more or less every civil / industrial application one can think of. These fields include mineral processing, metals extraction, corrosion, metals and materials processing, casting and joining, nanomaterials, electronic materials, biomaterials and renewable energy materials to name but a few.

Industries as diverse as metal forming and nano drug delivery are somehow or other related to materials science and engineering, and communities across the world benefit from its progress and contributions. This field is undoubtedly one of the major engineering disciplines of the 21st century.

Sharif University of Technology (SUT) was founded in 1965. Immediately after establishment, this institute became the top technical university in Iran. A favourite destination for the very best students in the country at both undergraduate and postgraduate levels, our graduates enjoy a worldwide recognition as successful and top rated professionals. SUT graduates are currently present at every level in the top academic / industrial institutes on the globe.

MSE department (formerly metallurgical engineering) was among the original departments established at SUT. Considering that SUT was initially founded to provide and train technical staff for Iran's iron and steel industry, it should come as no surprise that MSE department has always been one of the cornerstones of SUT.

Even now that the university has diversified to encompass other engineering and management fields, MSE department ranks 1st among engineering departments at SUT in the number of papers published in peer reviewed journals.

We offer a four year degree course in Materials Science and Engineering. Graduates may pursue a career in industrial centres as diverse as the field itself. Most of our graduates, however, opt to continue their education to higher degrees at SUT or other academic establishments.

MSE department offers MSc courses in a multiple of disciplines that more or less cover every aspect of the field. These areas include:

- Materials processing
- Corrosion engineering
- Materials characterization and analysis
- Metal forming
- Casting
- Welding
- Ceramics
- Nanomaterials
- Biomaterials

The normal duration of the course is two years.

PhD degrees are also offered to students who have been successful in the competitive entrance exam and the departmental interview. PhD candidates are expected to graduate within five years of commencing the course.

Faculty

Parvin ABACHI
Associate Professor (PhD, 1998, Germany)
Areas of interest: Mechanical Properties of Metals, Composites, Powder Metallurgy

Abdollah AFSHAR
Professor (PhD, 1985, Polytechnic of Lorraine, France)
Areas of interest: NDT, Corrosion, and Coating

Abbas AKBARZADEH CHANGIZ
Associate Professor (PhD, 1996, McGill University, Canada)
Areas of interest: Metals Deformation, Thermomechanical Processing and Texture of Materials

Reza ALIZADEH
Assistant Professor (PhD, 2015, University of Tehran, Iran)
Area of interest: Nano mechanics, Mg Alloys, Ultra Fine- and Nano-grained Materials

Masoud ASKARI
Assistant Professor (PhD, 1991, Manchester University, England)
Areas of interest: Chemical Metallurgy, Computer Simulation of Extractive Metallurgy Processes

Sirous ASGARI
Professor (PhD, 1997, Drexel University, USA)
Areas of interest: Electron Microscopy (SEM-TEM), High Temperature Materials, Physical and Mechanical Properties of Materials

Reza BAGHERI
Professor (PhD, 1995, Lehigh University, USA)
Areas of interest: Mechanical and Physical Properties of Polymers, Polymer Matrix composites

Abolghasem DOLATI
Professor (PhD, 2002, Sharif University of Technology, Iran)
Areas of interest: Corrosion and Protection of Materials

Mohammadali FAGHIHI SANI
Associate Professor (PhD, 2002, Nagoya Institute of Technology, Japan)
Areas of interest: Engineering Ceramics

Mohammad GHORBANI
Professor (PhD, 1991, Manchester University, England)
Areas of interest: Corrosion and Protection of Materials, Alloys Deposition, Nanomaterials

Mohammad HALALI
Associate Professor (PhD, 1993, Imperial College of Science, Technology, and Medicine, England)
Areas of interest: Extractive Metallurgy

Mohsen KAZEMINEZHAD
Professor (PhD, 2006, Sharif University of Technology, Iran)
Areas of interest: Metal Forming

Adrine Malek KHACHATOURIAN
Assistant Professor (PhD, 2016, Iran University of Science and Technology, Iran)
Areas of interest: Engineering Ceramics, Nanomaterials, Optical Properties of Materials, Transmission Electron Microscopy (TEM)

Amirhossein KOKABI
Professor (PhD, 1979, Strathclyde, England)
Areas of interest: Weld Technology and Welding Metallurgy

Hamid Reza MADAAH HOSSEINI
Professor (PhD, 2000, Sharif University of Technology, Iran)
Areas of interest: Advanced Materials

Mohammad Reza MOHAMMADI
Associate Professor (PhD, 2006, Sharif University of Technology, Iran)
Areas of interest: Nanomaterials

Mojtaba MOVAHEDI
Associate Professor (PhD, 2012, Sharif University of Technology, Iran)
Areas of interest: Welding, Brazing and Soldering

Ali NEMATI
Associate Professor (PhD, 1994, Case Western Reserve University, USA)
Areas of interest: Nanoceramics, Refractories, Ceramics

Majid POURANVARI
Assistant Professor (PhD, 2014, Sharif University of Technology, Iran)
Areas of interest: Welding Metallurgy

Gholamreza PIRCHERACHI
Assistant Professor (PhD, 2012, Amirkabir University of Technology, Iran)
Areas of interest: Polymer Sciences

Sayed Khatiboleslam SADRNEZHAAD
Professor (PhD, 1979, Massachusetts Institute of Technology, USA)
Areas of interest: Purification, Process Simulation, and Memory Alloys

Siamak SERAJZADEH
Professor (PhD, 2002, Sharif University of Technology, Iran)
Areas of interest: Metal Forming

Abdolreza SIMCHI
Professor (PhD, 2001, Sharif University of Technology, Iran)
Areas of interest: Nanostructured and Advanced Materials, Powder Metallurgy and Particular Materials, and Rapid Prototyping

Rouhollah TAVAKOLI
Associate Professor (PhD, 2009, Sharif University of Technology, Iran)
Areas of interest: Casting, Solidification, Simulation and Optimal Design

Emeritus Professors

- **Hossein ASHURI**
  Areas of interest: Casting, Solidification
- **Parviz DAVAMI**
  Areas of interest: Casting, Solidification, Simulation
- **Ali Akbar EKRAMI**
  Areas of interest: Mechanical Properties of Materials, Structure – Property Relations
- **Manoochehr HAKIM**
  Areas of interest: Extractive Metallurgy, Economics of Geology
- **Ali KARIMI TAHERI**
  Areas of interest: Mechanical – Thermomechanical Behaviour of Metals, Metal Forming , Simulation
- **Saeed NATEGH**
  Areas of interest: Microstructure and Transformation, Creep, Metal – Matrix Composites
- **Kazem PURAZARANG**
  Areas of interest: Physical and Mechanical Properties of Metals
- **Sayed Morteza SAYED REIHANI**
  Areas of interest: Mechanical Properties of Metals and Composites, Solid State Physics
- **Naser VARAHRAM**
  Areas of interest: Casting, Solidification, Simulation
- **Hossein YOOZBASHIZADEH**
  Areas of interest: Extractive Metallurgy, Advanced Materials

Majors

The academic curricula of higher education institutes in Iran are devised by a committee in the Science, Research, and Technology (SRT) ministry. However, due to her continuous achievements and reputation as a centre of excellence, SUT departments are allowed to set and practice their own curricula.

For the fulfillment of the degree course, students are required to pass a minimum of 140 credit units. Apart from some mathematics courses which count as 4 credit units, other subjects are valued as 3 or 2 credit units except for laboratory courses which count as 1.

A departmental committee at MSE is responsible for observing and monitoring the syllabi of undergraduate courses. Every ten years the subjects are thoroughly reviewed and syllabi are changed according to the advances made in different areas of the field and international research trends. The committee also keeps an eye on the future requirements of related industries in Iran.

It has been the aim of this committee to devise the academic programme at MSE in a manner that would benefit graduates and maintain the department's position in the country, while trying to keep up with advances in this branch of engineering. We aim to improve our international ranking by providing our students with high tuition standards and conducting research on science / industry based areas. Based on these assumptions, our graduates are expected to:

- Have a firm grasp and understanding of basic engineering theory and practice.
- Understand main concepts of materials science and engineering.
- Be able to enter postgraduate programmes at highest ranking universities in the world.
- Be able to start up science / engineering based ventures.
- Be able to compete successfully for career openings in materials related organizations or other engineering fields.
- Be able to manage industrial based projects and / or conduct research on areas of their expertise.

Based on these goals, our undergraduate entries together with students from other engineering departments at SUT, take courses in mathematics and basic science courses in their first couple of terms at university.

Over the next four terms, students follow a comprehensive programme based on materials chemistry, physics of materials, and mechanical engineering. They will become familiar with basic concepts of materials science. The curriculum ensures a balanced combination of courses that allows students to understand main foundations of materials science and engineering.

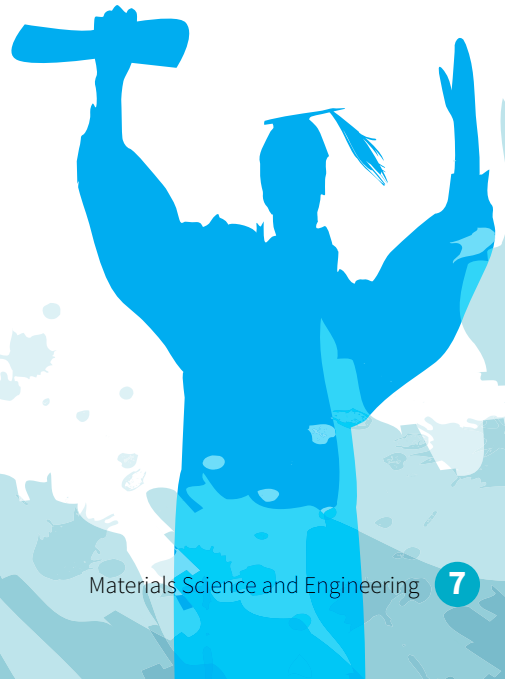
For their final year, students at this department may choose their subjects from a variety of courses. The optional subjects generally fall in one of the following categories:

- Materials production
- Materials processing
- Materials characterization and advanced materials

Materials production subjects are devised for students who seek their future career in areas such as minerals processing, extraction and refining of metals, and alloy making. Students interested in areas such as corrosion, welding, casting, and metal forming will take subjects from the materials processing category, while students who are interested in nanomaterials, biomaterials, ceramics and other novel / advanced materials will opt for courses in materials characterization group.

Each student is required to take a research project which counts as 3 credit units. These projects might be related to industrial practice, or be initiated by a research organization. Students tend to take the project unit towards the end of their third year or start of their fourth year.

All the students will be awarded the same degree irrespective of the optional courses they might have taken.



Admissions

Iranian students wishing to enter higher education at an Iranian institute must have completed secondary school education in Iran. A competitive university entrance exam is conducted annually on national level by the SRT ministry. The results of this exam determine which university each participant will eventually attend. SUT has traditionally been the focal point for the top students in the country. Out of the 100 top students in the national exam, on average 96 end up at SUT. The MSE department enjoys a favourable position among high school graduates. Our entries seldom have a national exam position higher than 2000. Considering over 400000 candidates sitting the maths and science category of the national exam every year, our entries rank is in the top 0.5%. This high caliber wealth of talent entering the department every year, together with the dedicated and hard working members of staff, are the main reasons for the high status the department has achieved.

MSE department will also consider applications from high school graduates abroad. The application will be processed via the International Affairs (IA) office at SUT.

Students already attending a reputable higher education institute may also apply for a place at MSE department. Upon receiving a request, their credentials will be assessed by a departmental committee. The applicant may be offered a place subject to the satisfaction of the committee and availability of places.

Requirements for a B.Sc. degree in Materials Science and Engineering

Course Number	Course Title	Condition	Credit Units
22-015	General Mathematics 1	mandatory	4
22-016	General Mathematics 2	mandatory	4
22-034	Differential Equations	mandatory	3
22-035	Engineering Mathematics	mandatory	3
40-151	Basic Computer Programming	mandatory	3
22-071	Numerical Calculations	mandatory	2
24-011	Physics 1	mandatory	3
24-001	Physics 1 (Laboratory)	mandatory	1
24-012	Physics 2	mandatory	3
24-002	Physics 2 (Laboratory)	mandatory	1
23-011	General Chemistry 1	mandatory	3
23-001	General Chemistry 1 (Laboratory)	mandatory	1
26-261	Statics	mandatory	3
25-091	Fundamentals of Electric Engineering	mandatory	3
35-311	Technical Drawing 1	mandatory	2
33-018	General workshop	mandatory	1
27-012	Principles of Materials Science and Engineering	mandatory	3
27-014	Mechanics of Material	mandatory	3
27-016	Crystallography and Diffraction	mandatory	3
27-018	Physical Chemistry of Materials	mandatory	3
27-024	Mechanical Properties of Materials 1	mandatory	3
27-026	Physical Metallurgy 1	mandatory	3
27-025	Physical Metallurgy 1 (Laboratory)	mandatory	1
27-028	Thermodynamics of Material 1	mandatory	3
27-022	Transport phenomena	mandatory	3
27-038	Principles of Production of Engineering Materials 1	mandatory	2
27-036	Physical Metallurgy 2	mandatory	3
27-037	Physical Metallurgy 2 (Laboratory)	mandatory	1
27-042	Electronic Properties of Materials	mandatory	2
27-048	Principles of Electrochemistry and Corrosion	mandatory	3
27-068	Principles of Production of Engineering Materials 2	mandatory	2
27-034	Principles of Polymer Engineering	mandatory	3
27-044	Principles of Metal Forming	mandatory	3
27-046	Principles of Solidification and Casting	mandatory	3
27-052	Principles of Ceramic Engineering	mandatory	3
27-058	Principles of Surface Engineering	mandatory	3
27-054	Scientific Communication Skills	mandatory	1
27-056	Principles of Welding Engineering	mandatory	3
27-010	Research Project	mandatory	3
27-110	Industrial Internship	mandatory	0
27-013	Kinetics in Material Engineering	optional	3
27-126	Mechanical Properties of Materials 2	optional	3
27-015	Quality Control and Non-Destructive Testing	optional	0
27-017	Selection of Engineering Materials	optional	3
27-019	Science and Engineering of Powder Metallurgy	optional	3
27-023	Material Characterization 1	optional	3

Course Number	Course Title	Condition	Credit Units
27-029	Iron and Steel Production	optional	3
27-031	Production of Non-Ferrous Metals	optional	3
27-033	Process Control in Material Engineering	optional	2
27-035	Material Production Calculations	optional	2
27-316	Refractory Materials	optional	2
27-236	Metal Casting 2	optional	3
27-828	Metal Shaping 2	optional	3
27-142	Processing of Ceramics	optional	2
27-057	Structure and Properties of Ceramics	optional	2
27-039	Composites	optional	3
27-296	Material Thermodynamics 2	optional	2
27-118	Mineralogy	optional	2
27-562	Industrial Furnaces	optional	2
27-129	Casting Die Design (Laboratory)	optional	3
27-041	Materials Processing (Laboratory)	optional	1
27-701	Metal Forming1 (Laboratory)	optional	1
27-702	Joining of Metals (Laboratory)	optional	1
27-043	Solidification and Casting (Laboratory)	optional	1
27-045	Corrosion and Coating of Metals (Laboratory)	optional	1
27-047	Ceramics (Laboratory)	optional	1
27-049	Advanced Materials	optional	3
27-055	Materials Characterization 2	optional	3
27-051	Novel Manufacturing Techniques	optional	2
27-581	Fuel and Energy + Laboratory	optional	3
27-053	Simulation in Materials Science and Engineering	optional	2
27-135	English for Materials Science Students	optional	2
21-131	Engineering Economics	optional	2
37-991	Persian Literature	mandatory	1
31-101	General English	mandatory	3
30-001	Physical Education 1	mandatory	1
30-002	Physical Education 2	mandatory	1
37-445	Islamic Ideology 1	mandatory	2
37-446	Islamic Ideology 2	mandatory	2
37-127	Islamic Life Style	mandatory	2
37-620	Analytical History of Islam	mandatory	2
37-489	Thematic Commentary of the Quran	mandatory	2
37-624	Islamic Revolution and its Roots	mandatory	2
37-510	Family Planning and Population Control	mandatory	1

Planning a programme of study

The following table is a proposed plan of study for the undergraduate course.

Term 1

1
- General Mathematics 1
- Physics 1
- Physics 1(Lab)
- General Chemistry 1
- General Chemistry 1(Lab)
- Technical Drawing 1
- Physical Education 1
- General English

Term 2

2
- General Mathematics 2
- Physics 2
- Physics 2(Lab)
- Statics
- Principles of Materials Science and Engineering
- General workshop
- Physical Education 2
- Islamic Ideology 1

Term 3

3
- Differential Equations
- Fundamentals of Electric Engineering
- Mechanics of Material
- Crystallography and Diffraction
- Physical chemistry of Materials
- Persian Literature
- Islamic Ideology 2

Term 4

4
- Engineering Mathematics
- Basiccomputer programming
- Mechanical properties of materials 1
- Physical Metallurgy 1
- Physical metallurgy 1(Lab)
- Thermodynamics of Material 1
- Islamic Life Style
- Mechanical properties of materials 1(Lab)

Term 5

5
- Transport phenomena
- Numerical calculations
- Electronic properties of materials
- Physical Metallurgy 2
- Physical metallurgy 2(Lab)
- Principles of Production of Engineering Materials 1
- Principles of Electrochemistry and Corrosion
- Analytical History of Islam

Term 6

6
- Principles of polymer engineering
- Principles of metal forming
- principles of solidification and casting
- Principles of Ceramic Engineering
- Principles of Production of Engineering Materials 2
- Principles of surface engineering
- Thematic Commentary of the Quran

Term 7

7
- Family Planning and Population Control
- Scientific Communication Skills
- Research Project
- Principles of welding engineering
- Islamic revolution and its roots
- Optional
- Optional
- Optional

Term 8

8
- Industrial Internship
- Optional
- Optional
- Optional
- Optional
- Optional
- Optional
- Optional

Graduate study in materials science and engineering

1. Master of science (M.Sc.) degree

A. Course description

The MSE department offers MSc programmes in 8 different areas of materials science and engineering. These fields are:

- Materials processing – extraction and refining of metals and alloys.
- Metal forming – different metal forming processes such as milling, forging, deep drawing.
- Welding – different joining practices such as TIG, friction welding, MIG.
- Corrosion engineering – protection of materials against corrosion.
- Casting – different casting practices such as sand casting, die casting, centrifuge casting.
- Nanotechnology and nanomaterials – production and applications of nanomaterials.
- Ceramics – production and application of ceramics.
- Materials characterization and selection – characterization, production and applications of advanced materials such as composites and magnetic materials.
- Biomaterials – Materials used in biotechnology

The course usually takes between four to five terms. Students will also take a research project. However, it is possible to opt for MSc degree by taught courses only.

MSc students are required to pass a total of 30 credit units. The research project counts as 6 credit units and normally takes two terms to complete. Students are expected to start their research projects upon the completion all the necessary taught courses. The annual intake of MSc students is 60 to 70.

B. Admission

Like the first degree course, students will need to take a competitive national exam for entering MSc courses nationwide. Top students normally choose SUT as their first choice. There are limited places available in each of our MSc programmes. Only the very best can therefore enter the MSE department. There are, however, other mechanisms to enter our MSc programme. These include:

- Students who have distinguished themselves as "outstanding talents" may enter our MSc programme without having to sit the national exam.
- Top students at other Iranian universities will be considered for places at SUT.
- Students who have won scholarships from awarding bodies may apply for our MSc programme. Most of these students will be offered a place.
- Foreign students who, through an agreement between their respective governments and Iranian SRT ministry are allowed to enter Iranian universities.
- Students who have received their first degrees from top universities abroad.

C. Course requirements

Due to the diverse nature of the MSc programmes, the subject areas required for each field might vary considerably from others. Each programme consists of mandatory and optional courses. The curricula of respective programmes are listed below.

- Materials processing

Course Number	Course Title	Condition	Credit Units
27-293	Advanced Thermodynamic of Materials	mandatory	3
27-781	Theoretical Pyrometallurgy	mandatory	3
27-751	Novel Materials Characterization Methods	mandatory	3
27-928	Advanced Kinetics of Materials	mandatory	2
27-787	Advanced Transport Phenomena	mandatory	2
27-785	Extraction of Rare Metals	mandatory	2
27-809	Metallurgical processes (lab)	mandatory	1
27-782	Hydroelectrometallurgical Processes	mandatory	3
27-810	Master's Research Project	mandatory	6
27-894	Special Topics on Metals Extraction	optional	2
27-759	Design of Material Production Processes	optional	3
27-784	Multi Component Systems	optional	2
27-974	Numerical Analysis	optional	1
27-783	Control IN Materials Processing	optional	2
27-847	Electrochemistry Instruments	optional	2
27-152	Nanomaterials production processes	optional	3
27-161	Design of experiment	optional	2

Metal forming

Course Number	Course Title	Condition	Credit Units
27-992	Advanced Engineering Mathematics	mandatory	3
27-869	Mechanics of Continuous Media	mandatory	3
27-868	Hot Shaping	mandatory	2
27-974	Numerical Analysis	mandatory	1
27-893	Theory of Plasticity	mandatory	3
27-323	Ductility of Metals	mandatory	3
27-878	Advanced Shaping (lab)	mandatory	1
27-892	Rolling	optional	2
27-896	Forging	optional	2
27-877	Shaping of Sheets	optional	2
27-870	Extrusion and Wire Drawing	optional	2
27-895	Rapid Forming	optional	2
27-858	Finite Element Method	optional	3
27-930	Superplasticity	optional	2
27-839	Special Topics in Metal Forming	optional	2
27-810	Master's Research Project	optional	6

Welding

Course Number	Course Title	Condition	Credit Units
27-832	Advanced Welding Methods	mandatory	3
27-973	Advanced Solidification	mandatory	3
27-974	Numerical Analysis	mandatory	1
27-835	Fracture Mechanics	mandatory	3
27-834	Advanced Welding Metallurgy	mandatory	3
27-751	Novel Materials Characterization Methods	mandatory	3
27-838	Weld Inspection	mandatory	3
27-837	Advanced Welding (lab)	mandatory	1
27-810	Master's Research Project	mandatory	6
27-879	Hard and Soft Soldering	optional	2
27-836	Adhesive and Bonding Non-Metallic Materials	optional	2
27-839	Special Topics in Welding	optional	2
27-858	Finite Element Method	optional	3
27-293	Advanced Thermodynamics	optional	3
27-507	Advanced Surface Engineering	optional	2
27-821	Weld Structures Analysis	optional	3

Corrosion engineering

Course Number	Course Title	Condition	Credit Units
27-941	Advanced Corrosion Theory	mandatory	2
27-939	Advanced Electrochemistry	mandatory	2
27-751	Novel Materials Characterization Methods	mandatory	3
27-297	Thermodynamics of Electrochemistry	mandatory	2
27-927	Gas Phase Oxidation	mandatory	2
27-932	Cathodic Protection	mandatory	2
27-847	Electrochemistry	mandatory	2
27-404	Principles of Protection (lab)	mandatory	1
27-989	Mechanical Aspects of Corrosion	mandatory	2
27-810	Master's Research Project	mandatory	6
27-942	Corrosion Inhibitors	optional	2
27-504	Failure Analysis (lab)	optional	1
27-937	Conversion and Organic Coatings	optional	2
27-507	Advance Surface Engineering	optional	2

Metal forming

Course Number	Course Title	Condition	Credit Units
27-973	Advance Solidification	mandatory	3
27-295	Advanced Thermodynamics	mandatory	2
27-853	Advanced Casting	mandatory	2
27-151	Advanced Diffusion and Transformations in Materials	mandatory	3
27-787	Advanced Transport Phenomena	mandatory	2
27-751	Novel Materials Characterization Methods	mandatory	3
27-810	Master's Research Project	mandatory	6
27-855	Engineering Design in Casting	optional	3
27-299	Physical Metallurgy of Cast Iron	optional	2
27-876	Simulation of Casting and Solidification Processes	optional	2
27-852	Ingot Casting	optional	2
27-974	Numerical Analysis	optional	1
27-858	Finite Element Method	optional	2
27-854	Advanced Powder Metallurgy	optional	2
27-992	Advanced Engineering Mathematics	optional	3
27-920	Rapid Prototyping	optional	2
27-298	Casting Design Workshop	optional	2
27-919	Composites	optional	2

Nanotechnology and nanomaterials

Course Number	Course Title	Condition	Credit Units
27-152	Fundamentals of Nanomaterials 1	mandatory	3
27-157	Fundamentals of Nanomaterials 2	mandatory	3
27-153	Nanomaterials Production Processes	mandatory	3
27-751	Principles of Nanomaterials Processing	mandatory	3
27-810	Master's Research Project	mandatory	6
27-155	Nanostructured Ceramics	optional	2
27-158	Thermodynamics of Nanomaterials	optional	2
27-156	Nanocoatings and Thin Films	optional	2
27-159	Nanocomposites	optional	2
27-160	Applications of Nanomaterials in Biomaterials	optional	2
27-507	Advanced Surface Engineering	optional	2
27-953	Advanced Polymer Engineering	optional	2
27-757	Advanced Engineering Ceramics	optional	2

Ceramics

Course Number	Course Title	Condition	Credit Units
27-295	Advanced Thermodynamics	mandatory	2
27-753	Modern Ceramic Processing Methods	mandatory	3
27-151	Advanced Diffusion and Transformation in Materials	mandatory	3
27-757	Advanced Engineering Ceramics	mandatory	3
27-751	Novel Materials Characterization Methods	mandatory	3
27-875	Advanced Materials Properties	mandatory	3
27-810	Master's Research Project	mandatory	6
27-856	Novel Refectory Materials	optional	2
27-885	Advanced Glass Theory	optional	2
27-910	Ceramic Pigments	optional	2
27-758	Magnetic and Electrical Ceramics	optional	2
27-155	Nanostructured Ceramics	optional	2

Materials characterization and selection

Course Number	Course Title	Condition	Credit Units
27-295	Advanced Thermodynamics	mandatory	2
27-955	Theory of Dislocations	mandatory	3
27-751	Novel Materials Characterization Methods	mandatory	3
27-974	Numerical Analysis	mandatory	1
27-151	Advanced Diffusion and Transformation in Materials	mandatory	3
27-810	Master's Research Project	optional	6
27-854	Advanced Powder Metallurgy	optional	2
27-976	Creep	optional	2
27-839	Special Topics	optional	2
27-835	Mechanics of Failure	optional	3
27-899	Electron Theory of Materials	optional	2
27-858	Finite Element Method	optional	3
27-507	Advance Surface Engineering	optional	2
27-953	Advanced Polymer	optional	2
27-840	Simulation in Material Engineering	optional	2
27-919	Composites	optional	2
27-992	Engineering Mathematics	optional	3
27-920	Rapid Prototyping	optional	2
27-833	Advanced Solidification	optional	2
27-987	Strengthening Mechanism	optional	2
27-159	Nanocomposites	optional	2

Biomaterials

Course Number	Course Title	Condition	Credit Units
27-754	Application of Metals in medical engineering	mandatory	3
27-005	Application of Ceramics in medical engineering	mandatory	3
27-517	Application of Polymers in medical engineering	mandatory	3
27-761	Biocompatibility	mandatory	3
27-810	Master's Research Project	mandatory	6
27-751	Novel Materials Characterization Methods	optional	3
27-003	Design of Materials in Medical Engineering	optional	2
27-009	Prosthesis Materials	optional	3
27-004	Nano Drug Delivery	optional	2
27-526	Destructive Biomass	optional	3
27-519	Bio Instruments	optional	3
27-518	Application of Gel in Medical Engineering	optional	3
27-522	Application of Composites in Medical Engineering	optional	3
27-523	Application of Laser in Medical Engineering	optional	2
27-524	Special topics in Medical Engineering - Biomaterial	optional	3

2. Doctor of philosophy (PhD) degree

A. Course description

The MSE department takes a maximum of 15 PhD students each year. The course consists of taught courses and a research programme. Students are initially required to pass a minimum of 15 credit units of taught courses. They would then need to pass a written transfer exam before they can start working on their research project. Within two terms after passing the transfer exam, students are required to give a presentation explaining their research work and clearly express their objectives to the examiners. They should convince the referees of their capability to conduct scientific research in the proposed area.

The research work takes on average five to six terms to complete and counts as 24 credit units. Before their final viva, students must publish a minimum of one paper in a Q1 peer reviewed journal. The final viva is conducted before a panel consisting of two internal and two external examiners from a list suggested by supervisor(s) and confirmed by the departmental post graduate affairs council.

B. Admission

Candidates should sit a competitive national exam to enter the PhD programmes offered by various universities in the country. As in the degree course, PhD positions at SUT are in high demand since many universities in Iran would favour SUT graduates when openings for academic members of staff become available. Many of our graduates are currently employed as academic members of staff / research personnel at top brass institutes across the world.

C.Course requirements

A multitude of courses are available to PhD candidates. Students may also take courses offered by other universities subject to approval by their supervisors.

Departmental Facilities

Department of Materials benefits from a number of high profile research and service labs. As a consequence of the diversity of subjects and fields in the department, many research labs have been established over the years to meet the demands of different research groups. These labs not only form the basis of research activity in the department, they also serve as teaching labs for undergraduate and postgraduates alike. Our labs can also provide specific services for industrial customers thus creating income for the department. Some of these labs and research centres are listed below:

- RCNAM (research centre for nanostructure and advanced materials). Incorporating centres for electronic materials, nanostructures, and nanobiomaterials research.
- Nanomaterials lab. - Nanomaterials laboratory was established in 2010 for synthesis and characterization of advanced nanomaterials. Currently, most of the research work is focused on synthesis of nanomaterials for solar cells applications. Equipment such as Ultraviolet–visible (UV-vis) spectroscopy, solar simulator and electrochemical impedance spectroscopy (EIS) are available in the lab. Various nanostructures (i.e., zero-, one- and two-dimensional nanostructures) with different morphologies have been synthesized using wet chemistry (chemical) routes. These include but not limited to sol-gel, hydrothermal, solvothermal, chemical bath deposition, electrochemical and electrophoretic depositions. Moreover, nanocoatings, thin films and thick films have been prepared by dip- and spin-coating techniques. Titanium dioxide (TiO2), with various morphologies such as nanoparticles, nanowires, corn-like nanowires, nanotubes, skein-like nanotubes, dandelion-like particles, hierarchical rparticles, hollow spheres and CNT-TiO2 hybrid has been widely studied. In addition, synthesis of graphene and its derivatives has been

carried out.

- Solidification and casting lab.
- Corrosion lab. - Corrosion Laboratory was established in 1970, as a part of corrosion course for BSc degree in metallurgical engineering. The lab contains the following apparatus:

★ Salt Spray and Humidity cabinets
★ Thickness measurement instrument
★ Polarization, EIS and Voltammetry Systems
★ Electrochemical Accelerated Testing Systems
★ Concrete Corrosion Testing and Tracing Instruments
★ Production and Characterization of Nanostructure Coatings
★ Plasma Electrolytic Oxidation coating System
★ Roughness measurement instrument
★ Cathodic Protection Systems
★ Pull off and Impact Test Instrument for study of paint coating
★ Immersion Corrosion Test at Low and high Temperatures

- Stress Corrosion Cracking Studies(SCC,HIC,SSC,etx)
- Polymers lab.
- Powder and nanoparticles lab.
- Welding lab.
- Mechanical properties lab.
- Surface and coating lab.
- Ceramics lab.
- Metal forming lab.
- Chemical metallurgy lab.
- Heat treatment lab.
- Materials production lab. – This lab was established at the same time as the department herself. Materials production covers a wide spectrum of materials science and engineering. The lab is subdivided into two areas: minerals processing and extractive metallurgy. Standard laboratory equipment such as jaw crusher, jig, floatation cells, classifier and heavy media separation units are located in the min. proc. section. The extractive metallurgy section contains facilities such as muffle furnaces, VIM, pelletizing disc, and GC. This area is also equipped with two induction furnaces, one working at medium frequency (450 khz), and the other operating at industrial frequency. A fluidized bed furnace, designed and assembled at this department is at students' / researchers' disposal. The extractive metallurgy area also houses a large chemistry section for the benefit of those working in the field of hydrometallurgy.
- Metallography lab. - The metallography lab provides full facilities for cutting, mounting, grinding, mechanical / electrolytic polishing and etching of specimens. The examination of specimens can be performed using various upright and inverted optical microscopes. The observed micro and /or macrostructure could be also recorded photographically. In addition, quantitative metallography plus image analyzing facilities are accessible. Micro hardness measurements can be also performed using the proper apparatus. All facilities are available to industry, students, department personnel for academic and service works or long-term development projects.
- Materials analysis lab. – Materials analysis lab is established for characterization of different types of materials (ceramics, metals, polymers and composites). Equipment such as X-ray Diffraction (XRD) and X-ray Fluorescence (XRF) are available for phase analysis and elemental analysis respectively. Microstructure analysis of samples can be done by Transmission Electron Microscopy (TEM). Moreover, standard SEM/TEM samples preparation equipment such as coater, ion-miller and jet polisher are available on site.
- Magnetic materials lab.
- Non-destructive testing (NDT) lab. - NDT Lab was established in 2014 in order to inspect, testand evaluate the components or assemblies for defects or differences in the materials characteristics without destroying the part. The following NDT techniques are currently used in the NDT labfor educational and research purposes as well as the industrial services:

★ Visual testing (VT)
★ Liquid penetrant Testing (PT)
★ Ultrasonic testing (UT)
★ Electromagnetic testing (ET)
★ Magnetic Particle testing (MT)
★ Ferritescope testing

- Advanced bionanomaterials lab. The «advanced bioanomaterials» laboratory aims the study, research, and developments of methods for synthesizing and producing new materials having application in health, industry, environment, water and energy fields, focusing on nanotechnology and utilizing the latest scientific achievements. This lab. which was launched in 2017, has provided the following equipment to help the students in their scientific and research activities:

★ Heater stirrer
★ Oven
★ Electric furnace (Muffle and Tunnel)
★ Centrifuge
★ Ultrasonic (Bath and Prob.)
★ pH meter
★ Glove box
★ Medium and high precision digital scales
★ Electrospinning device
★ Chemical vapor deposition unit (CVD)
★ Anodizing DC and pulse power supply
★ Spark cutting machine for production of nanopowder
★ Microwave oven
★ Ultraviolet-visible spectrometer
★ Surface properties measurement device (TPD-TPR-BET)
★ Ball mills
★ CNC machine
★ Gas chromatography unit
- General workshop

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