

CURRICULUM
OF
Metallurgy and Materials Engineering
B.E/B.S

2008



HIGHER EDUCATION COMMISSION
ISLAMABAD.

CURRICULUM DIVISION, HEC

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PREFACE

Curriculum development is a highly organized and systematic process and involves a number of procedures. Many of these procedures include incorporating the results from international research studies and reforms made in other countries. These studies and reforms are then related to the particular subject and the position in Pakistan so that the proposed curriculum may have its roots in the socio-economics setup in which it is to be introduced. Hence, unlike a machine, it is not possible to accept any curriculum in its entirety. It has to be studied thoroughly and all aspects are to be critically examined before any component is recommended for adoption.

In exercise of the powers conferred by sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide notification No. D773/76-JEA (cur.), dated December 4th 1976, appointed the University Grants Commission as the competent authority to look after the curriculum revision work beyond class XII at the bachelor level and onwards to all degrees, certificates and diplomas awarded by degree colleges, universities and other institutions of higher education.

In pursuance of the above decisions and directives, the Higher Education Commission (HEC) is continually performing curriculum revision in collaboration with universities. According to the decision of the special meeting of Vice-Chancellor's Committee, the curriculum of a subject must be reviewed after every 3 years.

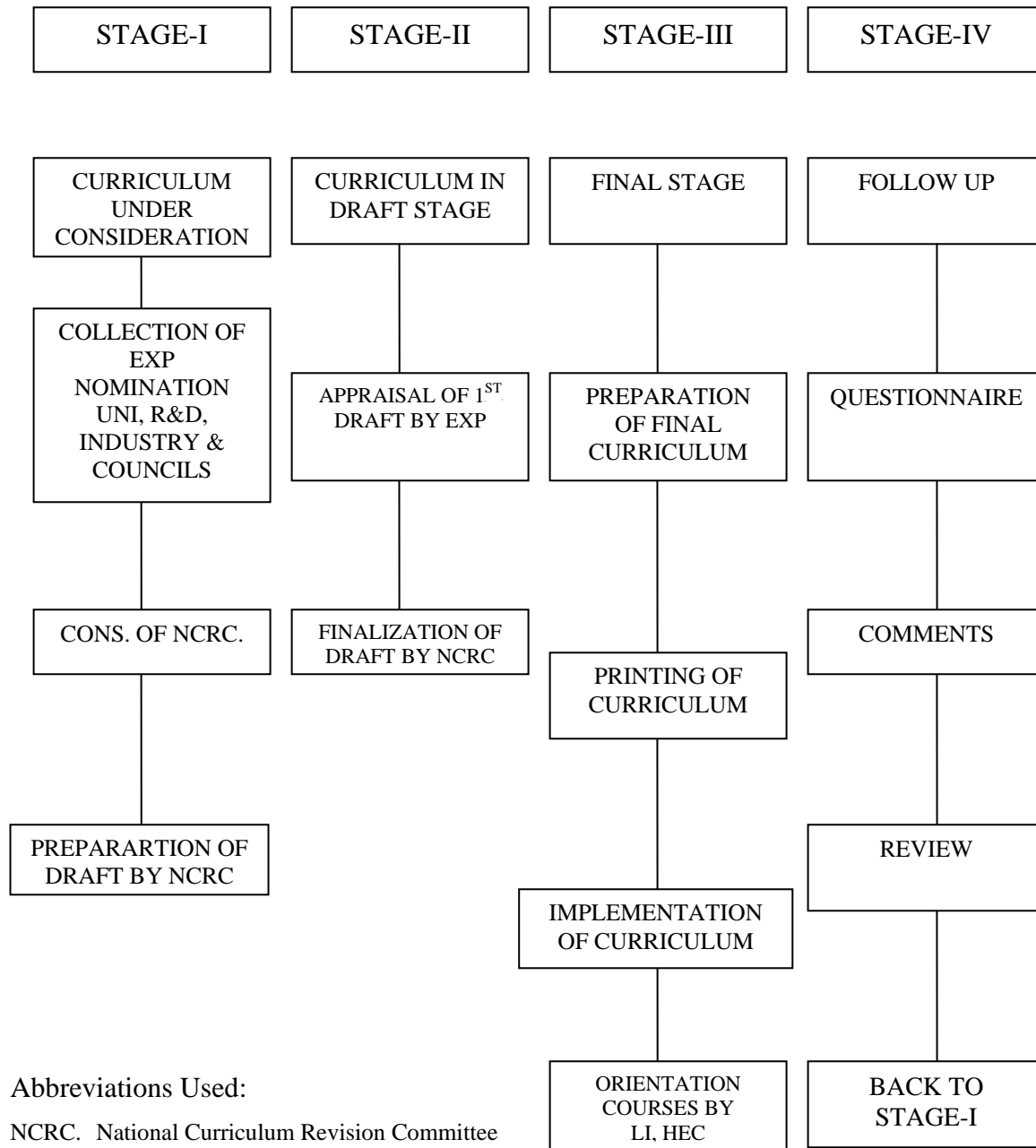
A committee of experts comprising of conveners from the National Curriculum Revision of HEC in Basic, Applied Social Sciences and Engineering disciplines met in April 2007 and developed a unified template to standardize degree programs in the country to bring the national curriculum at par with international standards, and to fulfill the needs of the local industries. It also aimed to give a basic, broad based knowledge to the students to ensure the quality of education. The new BS degree shall be of 4 years duration, and will require the completion of 130-136 credit hours. The engineering degree will devote 65-70% of the curriculum towards engineering courses, and 35--30% to non Engineering courses.

For the purpose of curriculum revision various committees are constituted at the national level, comprising of senior teachers nominated by universities, degree awarding institutions, R&D organizations and respective accreditation councils. The National Curriculum Revision Committee for Metallurgy and Materials Engineering in a meeting held on March 11-13, 2008 at HEC Regional Centre, Karachi in continuation of its earlier meetings held on July 31 – August 2, 2007 revised the curriculum in light of the unified template. The final draft prepared by the National Curriculum Revision Special Committee, duly approved by the competent authority, is being circulated for implementation in the concerned institutions.

DR. RIAZ-UL-HAQ TARIQ
Member Academics

April 2008

CURRICULUM DEVELOPMENT



Abbreviations Used:

- NCRC. National Curriculum Revision Committee
- VCC. Vice-Chancellor’s Committee
- EXP. Experts
- COL. Colleges
- UNI. Universities
- PREP. Preparation
- REC. Recommendations
- LI Learning Innovation
- R&D Research & Development Organization
- HEC Higher Education Commission

Introduction

The final meeting of National Curriculum Revision Committee (NCRC) of Metallurgy and Materials Engineering was held at Higher Education Commission Regional Centre, Karachi from March 11-13, 2008 to finalize the draft curriculum for B.E./B.S. degree programme. The committee consisted of the following members:

1. Prof. Dr. M. Saleem Shuja, Convener
Rector,
The University of Lahore,
1 Km Raiwind Road,
Lahore
2. Prof. Dr. M. Moazam Baloch Member
Department of Metallurgy & Material Engineering,
Mehran University of Engineering & Technology,
Jamshoro
3. Dr. Ejaz Ahmad, Member
Principal Engineer, Materials Division,
PINSTECH, PO Nilore,
Islamabad
4. Prof. Dr. Yaseen Iqbal Member
Department of Physics
University of Peshawar,
Peshawar
5. Prof. Dr. Muhammad Nasim Member
Principal
Dawood College of Engineering & Technology,
Karachi
6. Prof. Dr. Amir Azam Khan Member
Head of Materials Engineering Department
National University of Sciences and Technology (NUST),
Sector H-12,
Islamabad
7. Eng. Muhammad Moinuddin Ali Khan Member
General Manager (Quality Assurance),
Peoples Steel Mills Ltd.,
Karachi

- | | | |
|-----|---|------------------|
| 8. | Prof. Dr. Muhammad Iqbal Qureshi
Sarhad University NWFP
Peshawar | Member |
| 9 | Prof. Dr. Tahir Abbas
Director,
Institute of Advance Material Science,
Bahauddin Zakariya University,
Multan | Member |
| 10. | Prof. Dr. Javed Iqbal,
Department of Metallurgy & Material Engineering,
University of Engineering & Technology,
Lahore | Member |
| 11. | Prof. Dr. Shahid H. Zaidi
Chairman
Department of Applied Physics
University of Karachi,
Karachi | Member |
| 12. | Prof. Dr. Ashraf Ali,
Chairman,
Department of Materials & Metallurgical Engineering,
NED, University of Engineering & Technology,
Karachi | Secretary/Member |

The meeting started at 9:00 AM on March 11th 2008, with the recitation of Holy Quran by Mr. Tahir Ali Shah, Assistant Director (Curriculum), Higher Education Commission, Islamabad. He briefed the committee about the aims of the meeting regarding the revision of the present curriculum.

Mr. Muhammad Rafiq Rai, Regional Director, HEC, Karachi, welcomed the participants of the meeting on behalf of the Chairman, Higher Education Commission. He assured the participants for providing all possible assistance and secretarial support to enable the committee in finalizing the draft curriculum of the subject at the undergraduate level.

Prof. Dr. M. Saleem Shuja, Convener of the committee, welcomed the participants and thanked them for their continuous contribution in reviewing and finalizing the curriculum. He also thanked all the following participating universities/organizations for sending their representatives to participate in the meetings:

1. Bahauddin Zakariya University, Multan
2. Dawood College of Engineering and Technology, Karachi
3. Mehran University of Engineering and Technology, Jamshoro
4. National University of Sciences & Technology (NUST)
5. NED University of Engineering and Technology, Karachi

6. Peoples Steel Mills Ltd. Karachi
7. PINSTECH, Islamabad.
8. The University of Lahore, Lahore
9. University of Engineering and Technology, Lahore
10. University of Karachi, Karachi
11. University of Peshawar, Peshawar

The committee reviewed and finalized the draft curriculum in the light of suggestions of the participants and the recent developments in the field of Metallurgy and Materials Engineering. Emphasis was given to the suggestions put forward by the participants from different universities, industries and R&D organizations to finalise the curriculum of Metallurgy and Materials Engineering at the undergraduate level.

OBJECTIVES

The main objective of the undergraduate program in Metallurgy and Materials Engineering is to produce engineers with the following attributes:

- a. Dynamic leadership and effective communication skills.
- b. High moral values and good engineering ethics.
- c. Broad based engineering knowledge
- d. Problem solving approach.
- e. Creative and innovative thinking for research and development.
- f. Sufficient skills to optimise human, technological and natural resources.
- g. Suitable to work successfully in the industry

GOAL

The curriculum has been reviewed in order to prepare academically sound graduates for being successful teachers, research workers and engineers in the practical field. Apart from the engineering courses a sufficient number of courses in language, communication skills, ethics, social and management sciences have been incorporated into the curriculum to enhance the quality and performance of the graduates.

It is also expected that having followed this curriculum the graduates would be sufficiently equipped to successfully pursue post graduate studies.

RATIONALE

Metallurgy and Materials Engineering is the *avant garde* of engineering in the modern world. New materials starting from atomic and nano level to the macro level are being developed each day to improve the life of a common man. The purpose of this undergraduate engineering program is to produce engineers to face these challenges in a way to bring Pakistan among the top countries in the world.

SALIENT FEATURES

The curriculum revision is based on following considerations:

The curriculum for the undergraduate program has been revised on the basis of HEC and PEC directives. The salient features of the revised curriculum are given below:

Duration:	4 years
Number of Semesters	8
Number of weeks per semester:	18 (16 for teaching and 2 for examinations)
Total number of credit hours:	134
Number of credit hours per semester:	15 – 18
Engineering Course:	67.9 %
Non-Engineering Course (Maximum):	32.1 %

The entire curriculum of Metallurgy and Materials Engineering at undergraduate level has been designed on the following lines:

- The curriculum design is based on the concept of foundation, breadth and depth courses so that streams for different specializations can be created within each discipline.
- Foundation courses: the foundation courses are the courses that all students in a given discipline of engineering must take. These courses provide students with the fundamental concepts and tools to pursue their studies at the higher level.
- Breadth Courses: the breadth courses introduce students to different specialties in the given discipline of engineering early in their studies. Before taking the breadth courses, the students should be advised that their choices will affect taking follow up courses because of pre-requisite requirement.
- Depth Courses: The depth courses offer specialization within each engineering discipline. All depth courses must integrate a substantial design component.
- The students may select electives from any of the areas of specialization with some guidelines from their respective advisors.
- All courses are also identified as engineering or non-engineering.
- A university can offer a degree programme in Metallurgy and Materials Engineering at undergraduate level by selecting all the prescribed foundation, breadth and the depth courses and the elective courses of the disciplines in which the university has the requisite faculty and lab facilities.
- This design of the curriculum will facilitate the universities to optimize the utilization of faculty and resources and produce engineers with greater in- depth knowledge in the selected areas.

**FRAME WORK TEMPLATE FOR BE/BSc/BS
METALLURGY AND MATERIALS ENGINEERING**

Non-Engineering Domain								% Area	% Overall
Knowledge Area	Subject Area	Name of Course	Lec CH	Lab CH	CR	Total Courses	Total Credits		
Humanities	English	English-I (Functional English)	3	0	3	3	9	21	6.87
		English-II (Communication Skills)	3	0	3				
		English-III (Technical Report Writing and Presentation Skills)	3	0	3				
	Culture	Pakistan Studies	2	0	2	2	4	9.3	3.05
		Islamic Studies/Ethics	2	0	2				
	Social Sciences	Social Science I	3	0	3	2	6	13.95	4.58
Social Science II		3	0	3					
Management Sciences (MS)	Select Any Two Courses					2	6	13.95	4.58
		Elective-I: Industrial Safety and Environmental Engineering	3	0	3				
		Elective-II: Production Operations Management	3	0	3				
		Elective-III: Environmental Management and Control	3	0	3				
		Elective-IV: Solid Waste Management	3	0	3				
		Elective-V: Metallurgical Plants and Quality Control	3	0	3				
Natural Sciences (NS)	Physics	Applied Physics	2	1	3	1	3	6.9	2.29
	Mathematics	Calculus	3	0	3	4	12	27.9	9.16
		Differential Equations	3	0	3				
		Statistical Methods and Estimation	3	0	3				
		Mathematical Methods	3	0	3				
	Chemistry	Applied Chemistry	2	1	3	1	3	6.97	2.29
SUB TOTAL						15	43	100	32.08

Engineering Domain									
Knowledge Area	Subject Area	Name of Course	Lec CH	Lab CH	CR	Total Courses	Total Credits		
Computing	Fundamentals	Introduction to Computer Systems	2	1	3	3	9	9.89	6.71
	Programming	Numerical Analysis and Computer Programming	3	1	4				
	Design	Computer Applications in Materials Engineering	1	1	2				
Engineering Foundation (EF)		Engineering Drawing and Graphics	2	1	3	8	26	28.58	19.4
		Workshop Practice	1	1	2				
		Introduction to Engineering Materials	3	0	3				
		Mechanics of Materials	3	0	3				
		Physical Metallurgy	3	1	4				
		Materials Thermodynamics	3	0	3				
		Inspection and Testing of Materials	3	1	4				
		Instrumentation and Control	3	1	4				
Major Based Core Breadth (MBCB)		Heat Treatment & Phase Transformations 3	3	1	4	6	24	26.3	17.9
		Ferrous Metallurgy	3	1	4				
		Engineering Ceramics and Glasses	3	1	4				
		Manufacturing Technologies	3	1	4				
		Composites and Polymeric Materials	3	1	4				
		Production and Refining of Materials	3	1	4				
Major Based Core Depth (MBCD)		Select Any Five Courses (Subject to the availability of Laboratories)							
		Elective-I: Advanced Materials	3	1					4

		Elective-II: Welding and Joining Processes	3	1	4	5	20	21.9	14.9
		Elective-III: Foundry Engineering	3	1	4				
		Elective-IV: Corrosion, Protection and Prevention	3	1	4				
		Elective-V: Materials Characterization	3	1	4				
		Elective-VI: Powder Metallurgy	3	1	4				
		Elective-VII: Surface Engineering and Coatings	3	1	4				
		Elective-VIII: Advanced Steels	3	1	4				
		Elective-IX: Selection and Application of Materials	3	1	4				
		Elective-X: Fracture Mechanics and Failure Analysis	3	1	4				
Inter- disciplinary Engineering Breadth (IDEB)	Select Any Two Courses								
		Elective-I: Fuel and Furnaces	3	0	3				
		Elective-II: Mineral Processing	3	0	3				
		Elective-III: Nuclear Materials	3	0	3				
		Elective-IV: Vacuum Technology	3	0	3				
Senior Design Project		Senior Design Project Part-I	0	3	3	2	6	6.5	4.47
		Senior Design Project Part-II	0	3	3				
Industrial Training			0	0	0	0	0	0	0
SUB TOTAL						26	91	100	67.92
GRAND TOTAL						41	134		

Summary				
Domain	Knowledge Area	Total Courses	Total Credits	% Overall
Non-Engineering	Humanities	7	19	32.1
	Management Sciences	2	6	
	Natural Sciences	6	18	
	Sub Total	15	43	
Engineering	Computing	3	9	67.9
	Engineering Foundation	8	26	
	Major Based Core (Breadth)	6	24	
	Major Based Core (Depth)	5	20	
	Inter-Disciplinary Engineering Breadth (Electives)	2	6	
	Senior Design Project	2	6	
	Industrial Training	0	0	
	Sub Total	26	91	
Grand Total				
		41	134	100

Scheme of Study for BE/BSc/BS Metallurgy and Materials Engineering

Course Title	Lec	Lab	CR	Course Title	Lec	Lab	CR
First Year							
English-I (Functional English)	3	0	3	Engineering Drawing and Graphics	2	1	3
Applied Physics	2	1	3	Workshop Practice	1	1	2
Calculus	3	0	3	Introduction to Engineering Materials	3	0	3
Introduction to Computer Systems	2	1	3	Mechanics of Materials	3	0	3
Applied Chemistry	2	1	3	Pakistan Studies	2	0	2
				Instrumentation and Control	3	1	4
Total	12	3	15	Total	14	3	17
First year Credit Hours		32					

Course Title	Lec	Lab	CR	Course Title	Lec	Lab	CR
Second Year							
English-II (Communication Skills)	3	0	3	Materials Thermodynamics	3	0	3
Islamic Studies/Ethics	2	0	2	Engineering Ceramics and Glasses	3	1	4
Numerical Analysis and Computer Programming	3	1	4	Ferrous Metallurgy	3	1	4
Differential Equations	3	0	3	Heat Treatment & Phase Transformations	3	1	4
Physical Metallurgy	3	1	4	Social Science I	3	0	3
Total	14	2	16	Total	15	3	18
Second year Credit Hours		34					

Course Title	Lec	Lab	CR	Course Title	Lec	Lab	CR
Third Year							
Composites and Polymeric Materials	3	1	4	Manufacturing Technology	3	1	4
MBCD-Elective-I	3	1	4	Inspection and Testing of Materials	3	1	4
Management Science Elective I	3	0	3	Inter Disciplinary Elective I	3	0	3
Mathematical Methods	3	0	3	MBCD Elective-II	3	1	4
Production and Refining of Materials	3	1	4	Computer Applications in Materials Engineering	1	1	2
Total	15	3	18	Total	13	4	17
Third year Credit Hours		35					

Course Title	Lec	Lab	CR	Course Title	Lec	Lab	CR
Final Year							
English-III (Technical Report Writing and Presentation Skills)	3	0	3	Inter Disciplinary Elective II	3	0	3
Social Science II	3	0	3	Management Science Elective II	3	0	3
Statistical Methods and Estimation	3	0	3	MBCD Elective-IV	3	1	4
MBCD-Elective-III	3	1	4	MBCD Elective-V	3	1	4
Senior Design Project Part-I	0	3	3	Senior Design Project Part-II	0	3	3
Total	12	4	16	Total	12	5	17
Final year Credit Hours	33						

Total Credit Hours	134
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Detail of Course

BE/B.Sc/BS Level

Title of the Course: **English-I (Functional English)**
Credit Hours: 3-0-3
Course Outline: **Annex-A**

Title of the Course: **English-II (Communication Skills)**
Credit Hours: 3-0-3
Course Outline: **Annex-A**

Title of the Course: **English-III (Technical Report Writing and Presentation Skills)**
Credit Hours: 3-0-3
Course Outline: **Annex-A**

Title of the Course: **Pakistan Studies**
Credit Hours: 2-0-2
Course Outline: **Annex-B**

Title of the Course: **Islamic Studies/ Ethics**
Credit Hours: 2-0-2
Course Outline: **Annex-C**
Lab Outline: N/A
Recommended Books:

Title of the Course: **Social Science-I (Social Psychology)**
Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: The impart knowledge of social psychology of attraction; attitudes and prejudice; altruism and aggression; personal and social identities; conformity; group influence and their applications in the real world.

Course Outline:

Principles of sociology and psychology with emphasis on the individual and his/her reciprocal interaction with groups, basic psychological factors, attribution and perception of others, attitudes and attitudinal change, social attitudes, altruism, helping others, aggression, hurting others, prejudice, disliking others, discrimination and stereotypes, language and communication, society and cultures, culture and personality, small groups and their relation to the individual, leadership and group dynamics. Attraction, attitudes and prejudice; altruism and aggression; personal and social identities, conformity, group influence.

Lab Outline: N/A

Recommended Books:

- Edward Alsworth Ross, “Social Psychology”, Macmillan, 2006
- Emory Stephen Bogardus, “Essentials of Social Psychology”, Univ. of Southern California Press, 2006
- Hewstone, M., & Stroebe, W. (Eds.), “Introduction to Social Psychology”, 3rd ed., Oxford: Blackwell Publishers, 2006
- Lesko, W.A. “Readings in social psychology General, classic, and contemporary selections, 6th ed., 2006

Title of the Course: Social Science-II (Engineering Economics)

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: To impart knowledge of engineering economy.

Course Outline:

Introduction of engineering economy and the economic environment. Consumer and producer goods, measures of economic worth, Price, Supply, & Demand relationship; Production; Factors of production; Laws of return. Cost Concepts & Analysis: Sunk & opportunity costs; Fixed, variable, and incremental costs; Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Unit cost of production. Time Value of Money: Simple interest; Compound Interest; Cash flow diagrams; Interest formulas; Nominal versus effective, interest rates; Depreciation and Depletion: Purpose of depreciation; Types of depreciation; Production Concepts & Mathematical Models: Manufacturing lead time, Production rate; Capacity; Utilization; Availability; Work in process; Linear Programming: Mathematical statement of linear programming problems; Graphic solution; Simplex method; Duality problems. Capital Financing and Budgeting: Types of ownership; types of stock; partnership & joint stock companies; Banking & specialized credit institutions. Industrial Relations: Labour problems; Labour organizations; Prevention & Settlement of disputes.

Lab Outline: N/A

Recommended Books.

- George Owen Hoskins and Thomas Hall Burnham, “Engineering Economy”, Pitman, 2007
- William Thomas Morris, “Engineering Economy”, University of Michigan Jan, 2007
- Paul, E. Degarmo, “Engineering Economy”, OUP, 2005
- John Charles and Lounsbury Fish, “Engineering Economics”, McGraw-Hill, 2005

Title of the Course: Industrial Safety and Environmental Engineering

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: To provide thorough knowledge of industrial safety and engineering environment.

Course Outline:

Industrial safety management, Understanding accident and hazard, Hazard control and loss control. Accident Prevention and Control, Accident reporting and investigation, Fire safety, Electrical Safety, Safety in boilers, Safety in material handling and storage, Safety in production operations. Process Safety Management: Development of facility operation and procedures, Analysis of process hazard. Hazard communication, Chemical inventory record. Industrial Hygiene and Workers Protection, Various hazards encountered in workplace, Types of personal protective equipment (PPE), Availability in market their design standards and selection criteria. Environment Management: Environment pollution, Air emission management, Waste management, Waste water treatment and control, Soil and ground water protection, Introduction to Pakistan Environment Protection Act 1997 and National Environmental Quality Standards, Key elements of ISO 14000.

Lab Outline: N/A

Recommended Books:

- Thomas J. Anton, "Occupational Safety & Health Management", 2nd ed., McGraw Hill, 2006
- Daniel E. Della-Giustina, "Safety and Environmental Management", 2001
- Ronald Packman, "A Guide to Industrial Safety and Health" Longmans, 2007
- James S. Angle, "Occupational Safety", Thomson Delmar Learning, 2004, ISBN 1401859038

Title of the Course: Production Operations Management

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: To provide insight in the management skills to the engineers working in the production industry.

Course Outline:

Production /operation functions and the organization. Basic concepts of five Ps .Production strategies, guides and unities. Decision making in operations. Planning and controlling operations. Operational budget making and controlling. Variety management. Quality control and quality management.TQM.

Location, design and layout of plant and equipment. Maintenance of equipment.

Methods study and work measurement. The importance of forecasting in

production and operations control. Project management techniques. Personnel management. Health and safety management in industry

Lab Outline: N/A

Recommended Books:

- Keith Lockyer, "Production and Operations Management", Pitman, ELBS ed., 2000.
- Lockyer, K.G., "Production Control in Practice", Pitman, 2007
- Norman Gaither, "Production and Operation Management", Dryden Press, 2007
- William Gavett Harcourt, "Production and Operation Management", Brace & World, 2006
- John F. and Muth, Gene K. Groff, "Operation Management", Irwin, 2007
- Buffa, Elwood Spencer, "Modern Production Management" Wiley, 2006, ISBN 0471118230
- Nicholas J. Aquilano, Richard B. Chase, "Production and Operation Management", Irwin, 2007, ISBN 0256019193

Title of the Course: Environmental Management and Control

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: To provide thorough understanding of environmental management and its control.

Course Outline:

Environmental Organization, Legislation, Standards, Monitoring and Compliance assurance, Environmental Economics, Regional Development Planning, Environmental Decision-Making for industries. NEQA, ISO-14000 and Occupational Safety and Hazards Regulations. Risk Analysis. Atmospheric Dispersion of Pollutants. Analysis of Control Systems for Gaseous and Particulate Emissions. Discussion of Source Control and Air Quality Standards, Environmental Quality Objectives, Environmental Legislation, Standards, and Technologies. Interrelations of Air, Water Pollutions Environmental Pollution Control.

Lab Outline: N/A

Recommended Books:

- Christopher J. Barrow, "Environmental Management & Control" Rutledge, 2006
- Stephen. Tinsley, "Environment Management", Taylor & Francis, 2001, ISBN 0415246636
- Bhaskar Nath, "Environment Management in Practice", Rutledge, 1999, ISBN 041514907X
- Frank B. Friedman, "Practical Guide to Environmental Management", Environmental Law Institute, 2003, ISBN 1585760471

Title of the Course: Solid Waste Management**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To provide knowledge of solid waste management produced by materials industry.**Course Outline:**

Solid wastes definitions, characteristics and perspectives. Types of solid wastes, sources of solid waste management. Engineered systems for solid waste management Solid waste generation, on site handling, storage and processing. Collection of solid wastes, Transfer and transportation, processing techniques, ultimate disposal. Engineered systems for resource and energy recovery, processing techniques, materials recovery of biological conversion products, recovery of energy from conversion products and energy recovery systems. Plastic waste, composition quantities and disposal alternatives. Recycling of wastes, recycling of plastics, metals and glasses.

Lab Outline: N/A**Recommended Books:**

- Johan Post "Solid Waste Management", Springer, 2004, ISBN 1402019750
- Elizabeth M. Thomas-Hope, "Solid Waste Management", Canoe Press University of the West Indies, 1998, ISBN 9768125438
- Elizebeth, M Thomas-Hope "Solid Waste Management" 1998
- Forbes, R. McDougall, "Integrated Solid Waste Management" Black Well Publishing, 2001, ISBN 9780632058891

Title of the Course: Metallurgical Plants and Quality Control**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To provide knowledge of metallurgical plants and the quality control procedures used.**Course Outline:**

Metallurgical plant location, Factors affecting location; Multiplant location; Plant layout; product and process layout analysis; Layout comparison. Type of Pollutants and their treatment, Overview of Environmental impacts of Iron and Steel making, Hot rolling, Forging, Cold rolling, Annealing and Tempering, Coating and Plating plants. Environmentally friendly metallurgical plants. Occupational Health and Safety Impacts of Metallurgical plants. Basic procedures and remedies. Applications of computers for environmental and Pollution Control and Waste management in metallurgical plants. Fundamentals of statistics and analysis techniques. Probability distributions. AQL, AOQL, L TPD, attributes sampling, variable sampling, selection of proper sampling plan. Reliability and maintainability, inspection of different types of materials and products for evaluation of quality reliability of flaw detection by non-destructive inspection, quality control applications of non-destructive inspection. Introduction to standards. Familiarization of standards for testing of materials, ASTM, BS,

JIS GOST and ISO. Pakistan Standards, Quality assurance for final products, Measures for quality control.

Lab Outline: N/A

Recommended Books:

- Tim Jones, “Steel Industry and the Environment: Technical and Management issues”, International Iron, Steel Institute, ISBN: 9280716514, 2000
- Mular Andrew L, Barrett, Derek J., and Halbe Doug N., “Mineral Processing Plant Design, Practice, and Control,” Society for Mining Metallurgy & Exploration, 2002
- Kasatkin, N. L, “Erection and Operation of Metallurgical Plant” Mir, 1975
- Nurse M. C, Brown Sharon, “Metallurgical Plant Makers of the World”, Metal Bulletin Books; 4th ed., 1997
- Coppa & Avery Consultants, “Metallurgical Plant Design”, Vance Bibliographies 1985
- Metals Handbook Vol. 17th, “Non-destructive Testing and Quality Control”, American Society for Metals USA, 2005

Title of the Course: Applied Physics

Credit Hours: 2-3-3

Pre-requisites:

Specific Objectives of Course: To provide in-depth knowledge of the subject.

Course Outline:

Thermometry, heat transfer, heat insulation, properties of materials for use in building geometrical optics, the focal length of a lens, magnification, compound lenses, resolving power, laws of illumination and photometry, sextant spectrometer. Principles of refracting telescope, polarization of light. Waves and oscillation, sound waves, resultant to two simple harmonic motions, response and beats, acoustics and its application, interference, wave length and frequency, units and measurement of intensity, reflection and refraction of sound, reverberation time. Magnetic effect of current, CGS and practical units, relation between magnetism and electricity, magnetic field due to current in a long wire, force on a current carrying conductor in magnetic field, laws of electromagnetic induction, galvanometer, ammeter, voltmeter, avometer, condensers and dielectrics, Magnetic materials, B-H curves, hysteresis, magnetic circuits calculations, solenoids, pull of an electromagnet, principles of diode & triode, cathode ray tube and photo-multiplier tube. Atomic & nuclear physics, atomic structure, nuclear structure, radioactivity, nuclear theory, fission & fusion.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Stan Gibilisco, “Applied Physics”, McGraw-Hill, 2002, ISBN 0071382011

- Kittle C, “ Introduction to Solid State Physics”, Willey New York, 2000
- Arthur Beiser, “Applied Physics”, McGraw-Hill, 4th ed., 2004 ISBN-10: 0071426116
- John. D Cutnel, “Physics” Wiley; 7th ed., 2006, ISBN-10: 0471663158
- Douglas, C., Giancoli, “Physics Principles and Applications”, Pearson Education, 2004, ISBN-10: 0131846612

Journals/Periodicals

World Wide Web

Title of the Course: Calculus

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: To build the basic calculus and analytical geometry background

Course Outline:

Basic Operations of complex numbers, De’Moivre’s Theorem with applications, Circular, Hyperbolic, Exponential Functions of complex numbers and their inverse functions.

Limits-Indeterminate forms, Continuity, differentiability, Total differential with applications to errors, Newton’s method of approximating roots of non-linear equations. Tracing of simple curves in Cartesian and Polar Coordinates, Curvature and radius of curvature. Partial differentiation with applications. Homogeneous functions. Tangent and normal. Review of basic integration methods. Application to Area, Arc Length, Volume and Surface of Revolution. Reduction formulae. Elementary Beta and Gamma integrals. Rectification and Quadrate. Centre of gravity. Centre of pressure. Moment of inertia of plane areas. Approximate integration. Scalar and Vector quantities, physical and geometrical meanings. Algebra of vectors. Scalar and vector triple products.

Lab Outline: N/A

Recommended Books:

- William, E., Boyce Richard, and Diprima, C., “Calculus”, John Wiley, 2006 ISBN: 0471093335
- Richard Courant and Fritz John, “Introduction to Calculus and Analysis” Springer, 2000, ISBN 3540665706
- Steven George Krantz, “Calculus Demestified” , McGraw-Hill, 2002, ISBN 0071393080
- Edmund Landau, “Differential and Mathematical Calculus”, American Mathematical Society, 2001, ISBN 0821828304
- Douglas D. Downing, “Calculus”, Barron’s Educational Series, 1996, ISBN 0812091418

Title of the Course: Differential Equations**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** Develop fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems**Course Outline:**

Applications of simple convergence tests such as comparison, root, ratio, Raabe's and Gauss' tests on the behaviour of series. Definitions, formation and solution. Boundary conditions. Homogeneous and Non-homogeneous linear differential equations with constant coefficients, linear equations with variable coefficients. Cauchy's and Legendre's equations. Equations of second order. System of simultaneous linear equations with constant coefficients. Numerical approximation to solutions. Solution in Series. Simple applications in Engineering. Orthogonal trajectories. Formation of partial differential equations. Solution of first order linear and special types of second and higher order differential equations used in Engineering problems. Various standard forms. Elementary transformations. Shifting Theorems. Heaveside's expansion formula. Simple applications. Limit, continuity, zeros and poles, Cauchy-Reimann Equations, conformal transformations, contour integration

Lab Outline: N/A**Recommended Books:**

- Richard Bronson, "Differential Equations", McGraw-Hill, 2003, ISBN 007140967X
- Van Groesen, E. W. C. and Soewono, E. "Differential Equations" Springer, 2003, ISBN 0792348311
- Zill, Prindle, "A First Course in Differential Equations", Cole Publishing, 2001. ISBN: 0534955746.
- Edwards, C. H. and David, E., "Penney Elementary Differential Equations With Applications", Prentice Hall, 1993. ISBN: 0132534282.
- Constantine M. Dafermos, C. M., "Differential Equations", CRC Press, 2000, ISBN 0824780779

Title of the Course: Mathematical Methods**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To provide in-depth knowledge of mathematical methods.**Course Outline:**

Rectangular Coordinate Systems in three dimension, direction cosines, plane (straight line) and sphere. Taylor's Theorem for functions of two variables without proof. Maxima and minima of functions of two variables. Lagrange's method of multipliers. Double integration, change of order,

conversion to polar form. Applications in finding areas, volumes, centroids, centre of pressure. Movement of inertia and principal axes. Theorems of Pappus and Guldinus. Surface area and volumes of revolution. Differentiation of vectors, gradient, divergence and curl. Laplacian and spherical harmonies. Vector integration. Theorems of Gauss, Green and Stokes. Simple applications. Linearity, dependent and independent vectors, bases and dimension, vector spaces, fields, linear transformations, matrix of a linear transformation. Basic definitions and matrix operations, adjoint and inverse of a 3 x 3 matrix. Rank of a matrix. Cayley-Hamilton Theorem, eigen values. Applications in solving linear homogeneous and non-homogeneous equations in three unknowns. Cases of existence of solution, no solution, infinite and unique solutions.

Cartesian Tensors, understanding

Lab Outline: N/A

Recommended Books:

- Peter B. Kahn, "Mathematical Methods" Courier Dover Publications, 2004, ISBN 0486435164
- Howard Anton, "Elementary Linear Algebra" 7th ed., John Wiley, 1993
- Sadri Hassani, "Mathematical Methods", Springer, 2000, ISBN 0387989587
- Carl M. Bender, Steven A. Orszag "Advanced Mathematical Methods for Engineers", Springer, 1999 ISBN 0387989315

Title of the Course: Applied Chemistry

Credit Hours: 2-3-3

Pre-requisites:

Specific Objectives of Course: To provide thorough understanding of chemistry which is essential for Materials/Metallurgical engineers.

Course Outline:

Introduction to chemistry, its scope and importance in Metallurgy and Materials Engineering. Classification of elements, periodic table and electronic configuration. State of matter (gas, liquid, solid) kinetic theory of gases, solutions. Basic laws: Rault's law, Henry's law, Sievert's law, Law of diffusion. Theory of crystallization, atomic bonding, crystal systems, properties of solid, liquid and gases. Chemical equilibrium: Chemical reaction and equilibrium, chemical kinetics, theory of electro-chemistry, heterogeneous equilibrium, phase-rule, quantum theory. Introduction to oxidation and reduction reactions in iron and steel making Oxygen potential diagrams. Organic chemistry: Introduction, nature and sources of compounds, hydrocarbon compounds, chemistry of hydrocarbon compound cracking. Analytical chemistry: Introduction, qualitative and quantitative analysis of ferrous and non ferrous metals, analysis of various ores, coals, liquid solution.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Hyman D. Gasser, "Applied Chemistry", Springer 2002, ISBN 0306465531
- Edward Andrew Parnell, "Applied Chemistry", D. Appleton & Co., 2007
- Thodore E Brown, "Chemistry", Prentice Hall, 2005 ISBN 0131096869
- M. Farhat, "Industrial Chemistry", McGraw Hill 2004 ISBN-10: 0071410376

Journals/Periodicals

World Wide Web

Title of the Course: Statistical Methods & Estimation**Credit Hours: 3-0-3****Pre-requisites:**

Specific Objectives of Course: To introduce the concept of statistics, randomness and probability and build on these concepts to develop tools and techniques to work with random variables

Course Outline:

Statistical treatment of data, frequency distribution and graphs, measures of central tendency, measures of variation. Probability, samples, spaces and events, counting probability, the axioms of probability, some elementary theorems, conditional probability, Bay's theorem, mathematical expectation and decision making. Probability distribution, random variables, the binomial distribution, Poisson approximation to the binomial distribution, Poisson processes, probability densities, normal distribution, statements "T" distribution. Sampling distribution, populations and samples. Curve fitting regression analysis by least square method, correlation, linear, polynomial, power, regression analysis by least square method, incorporation of linear polynomial, exponential or power function. Correlation coefficient of determination. Application and exponential model of reliability and life testing.

Lab Outline: N/A**Recommended Books:**

- Jyotiprasad Medhi "Statical Methods", New Age Publishers, 2005, ISBN 8122404197
- Kenneth. Lange, "Statical Methods", Springer, 2002, ISBN 0387953892
- Montgomery, D.C., and Runger, G.C., "Applied Statistics and Probability for Engineers", John Wiley & Sons, 2001
- N. A. Weiss, "Introductory Statistics", Addison Wesley, 1995

Journals/Periodicals

World Wide Web

Title of the Course: Introduction to Computer Systems**Credit Hours: 2-3-3****Pre-requisites:****Specific Objectives of Course:** This course focuses on a breadth-first coverage of computer: introducing software engineering and information technology.**Course Outline:**

Number Systems, Binary numbers, Boolean logic, History and basic components of computer system, approaches to solving problems using computers, Von Neumann Architecture, Algorithm definition, design, and implementation, Programming paradigms and languages, basic elements of C++ language, programming practice and case studies Graphical programming, Overview of Software Engineering and Information Technology, Operating system, Compiler, Computer networks and internet, Computer graphics, AI, Social and legal issues.

Lab Outline: Lab Manuals will be available in the concerned laboratory**Recommended Books:**

- Andrew J. Herbert, Roger Michael Needham, "Computer Systems", Springer, 2004, ISBN 038720170X
- Glenn, H. MacEwen, "Introduction to Computer Systems", McGraw-Hill, 2007, ISBN 0070443505
- John A. Aseltine, "Introduction to Computer Systems", Wiley, 2007, ISBN 0471637041
- Neil A. B. Gray "Introduction to Computer Systems" Prentice-Hall 1987 ISBN 0134803868

Journals/Periodicals

World Wide Web

Title of the Course: Numerical Analysis and Computer Programming**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To enable students using structured programming techniques in suitable programming languages and implement numerical solutions using computer-based techniques.**Course Outline:**

Numerical Analysis: Finite difference and theory of interpolation, iterative methods for collocation polynomials, Approximate zeros (roots) Numerical integration and differentiation. Interactive methods for solution of linear systems, Design value problems, Numerical solutions of ordinary differential equations. Basic Computer Concepts: Computer history, main types of computer, Number Systems, Field of Computer applications, Input/Output and Control processing units. Flow Chart Techniques: Main features of an efficient programming, How to organize the problem, Representation of various operations in flow-charts, Computer Programming: Kinds of computer languages, Arithmetic operators and priorities constants and types of their expressions.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Zhilin Li, Lubin and Vulkov, Jerzy Waśniewski, “Numerical Analysis and its Applications”, Springer, 2005, ISBN 3540249370
- Michelle Schatzman, “Numerical Analysis” Oxford University Press, 2002, ISBN 0198508522
- Steven T. Karris, “Numerical Analysis” Orchard Publications, 2004, ISBN 0974423912

Journals/Periodicals

World Wide Web

Title of the Course: Computer Application in Materials Engineering

Credit Hours: 1-3-2

Pre-requisites:

Specific Objectives of Course: To provide knowledge of applications of computer in Materials engineering.

Course Outline:

Basic computer modeling and simulation techniques, Computer modelling and simulation of blast furnace and basic oxygen converter operations. Computer modeling for microstructures, Phase transformation, mechanical properties and materials processing including rolling, forging, casting, extrusion and machining operations.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- ASTM Series “Computer Application in Materials Engineering”, 2000
- National Research Council (U.S.), Natl ACA Press, Joyce L. Vedral “Expert Systems to Materials Selection During Structural Design”, 2004
- Celyustkin, A.B., “The Application of computing Technique to Automatic Control Systems in Metallurgical Plant”, Mac Milan, 2004
- National Research Council (U.S.A) “Computer Aided Materials Selection” National Academies Press 1995
- ASTM Series “Computer Application in Materials Engineering”, ASTM, 1990

Journals/Periodicals

World Wide Web

Title of the Course: Engineering Drawing and Graphics

Credit Hours: 2-3-3

Pre-requisites:

Specific Objectives of Course: To provide in-depth knowledge of engineering drawings and graphics.

Course Outline:

Introduction to subject, use of instruments, Planning of drawing sheets, the projection of simple solids in simple position, the oblique and auxiliary

plans, lettering, dimensioning, the principle requirement of working drawing. Geometrical drawing & graphics: Isometric and pictorial of solid figures, making of free hand sketches from solid project and from orthographic projections. Section of solid, tangent planes, two surface in contact, intersection of surface and interpretation of solids development of surfaces.

Machine drawing: Screw thread systems, keys and cutters, coupling and simple bearings, hanger, wall bracket, pipes and pipes fittings, shafts, connecting rods, piston and piston rod, valves stuffing boxes, pulling thread gearing.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Thomas Ewing French “Engineering Drawing” McGraw-Hill 2006
- Henry Loren Thompson, “Engineering Drawing Practice and Theory and Practice”, International textbook company, 2007
- Charles William Weick “Elementary Mechanical Drawing” McGraw-Hill, 2006
- Frederick Ernest Giesecke, “Engineering Graphics”, Prentice Hall, 2003 ISBN 0131415212

Journals/Periodicals

World Wide Web

Title of the Course: Workshop Practice

Credit Hours: 1-3-2

Pre-requisites:

Specific Objectives of Course: To impart knowledge of workshop techniques.

Course Outline:

Bench fitting: Description, proper use and maintenance of the fitting tools: use and care of measuring instruments, Preparation of some specific jobs. Forging: Hand forging, Use and maintenance of forging tools, the fore anvils, hammers, chisels, fullers, swages, punches, drifts, tongs, Prepare some specific jobs using forging methods. Use of power hammer, drop and press forging, riveting. Wood working: Use & care of wood working tools, clamps, saws, planes, files, rasps, chisels, drills, bits, planning, nailing, screwing, jointing, doweling. Use and care of natural wood, chipboard, plywood, hardboard etc. Metal forming: Cold working processes for sheet metals; e.g. pressing stamping, embossing, drawing, bending, piercing etc. Use of common presses and dies. Foundry practice: Bench and floor sand casting; sand and binders, sand conditioning, moulding tools, flasks, boards, spurs, cutters, reamers, bellows, brushes, vent pins, trowels, spoons, etc., Preparation and care of patterns, metal melting and pouring. Safety and care: Precautions necessary in many shops machine accidents, general cleanliness of shop, proper appraisal, accident alarms and evacuation.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Alfred Parr Longmans, “Workshop Practice”, Green, and co, 2007
- Henry Wright Baker, “Modern Workshop Technology”, Cleaver-Hume Press, 2006
- Alfred Parr Longmans, “Machine Tools and Workshop Practice” Green & Co. 2007
- Raymond Francis Yates “Model Making Including Workshop Practice” The Norman W. Henley publishing company, 2007
- S.K. Garg, “Workshop Technology”, Laxmi Publication,s 2005, ISBN 8170086353

Journals/Periodicals

World Wide Web

Title of the Course: Introduction to Engineering Materials

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course: To introduce type of materials used in engineering.

Course Outline:

Introduction to engineering materials, their scope and role in industrial development, raw materials for engineering materials: their availability and demand, Atomic bonding, Crystal structures of metals, Introduction to polymers, ceramics and composite materials. Processing, properties and applications of metallic, polymeric, ceramic and composite materials. An introduction to new breeds of engineering materials e.g., shape memory materials, smart materials, electrical, magnetic and optical materials. Materials of aerospace and transportation industries.

Lab Outline: N/A

Recommended Books:

- Ashby, M.F. and Jones, D.R.H., “Engineering Materials -I & -II”, Butterworths- Heinemann, 2005
- Charles, J.A., “Selection and Use of Engineering Materials”, Butterworth- Heinemann, 2001
- Smith, W.F., “Structure and Properties of Engineering Alloys”, McGraw-Hill, 2001
- Flinn, R. A. and Trojan, P.K., “Engineering Materials & Their Applications”, Houghton Mifflin, 2002
- Lewis, G., “Selection of Engineering Materials”, Prentice Hall, 2000

Journals/Periodicals

World Wide Web

Title of the Course: Mechanics of Materials**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To develop knowledge of mechanics of materials.**Course Outline:**

Theory of elasticity, brittle fracture. Unsymmetrical bending and shearing. Horizontal shearing stresses, shear flow, flow deflection due to shear, photoelastic method. Plasticity, relationship between stress and deformation, moment of inertia along different axes. Ellipse of inertia, determination of principal axes. Fault plate, rectangular and circular plates sample supported and clamped at the ends, general theory of bending. Introduction to stress strain diagram, working stresses, unit design, strain energy in tension and compression. Analysis of bi-axial stresses, principal planes, principal of stress-strain curves, stresses in thin walled pressure vessels. Mohr's circles of bi-axial stress. Torsion of circular shafts, coiled helical spring, strain energy in shear and torsion of thin walled tubes, torsion of non-circular sections. General case of plane stresses, principal stress in shear stresses due to combined bending and torsion plane strain. Thermal stresses, buckling.

Lab Outline: N/A**Recommended Books:**

- Benham, P.P., Crawford, R.J. and Armstrong, J.P., "Mechanics of Engineering Materials", Pitman, 2000 or latest edition
- Ferdinand Beer, "Mechanics of Materials", McGraw Hill, 2005.
- Ashby, M.F. and Jones, D.R.H., "Engineering Materials 1- An Introduction to Their Properties and Applications", Butterworths-Heinemann, 2005.
- Madhukar Vable, "Mechanics of Materials", OUP, 2002.
- Gere, J.M. and Timoshenko, S.P., "Mechanics of Materials", 5th ed., PWS Kent, 1997.

Journals/Periodicals

World Wide Web

Title of the Course: Physical Metallurgy**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To develop understanding of physical metallurgy of materials.**Course Outline:**

Crystallography; Space lattice, Crystal system, Unit cell, Packing density, Coordination number, Allotropy, Rotational and Reflection Symmetries, Crystal planes and direction, Crystalline defects, Twinning, Ordered and Disordered solutions. Crystallization; Solidification, Grain boundaries, Grain size, Cast structure, Segregation, Shrinkage defects, Phase diagrams; Phase rule, Binary system, Ternary system, Solid Solution, Interstitial solid solution and Substitutional solid solution, Factor affecting

the limit of solubility, Intermediate compound, Mixture, Iron -Carbon Diagram, Microstructure and properties of steel and Cast Iron, Microstructure of Copper based and Aluminum based alloys and their relationship to the properties, Metallurgical Microscope, Objective lenses and their short comings, Polarized light microscopy.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Reed Hill, R.E. and Abbaschian, R., "Physical Metallurgy Principles", 3rd ed., PWS, 2000 or latest edition.
- Sydney, H. Avener, "Introduction to Physical Metallurgy", McGraw-Hill, 2001.
- Cahn, R. W. and Haasen, P., "Physical Metallurgy", North-Holland, 2001.
- Porter, D.A and Easterling, K.E, "Phase Transformations in Metals and Alloys", Chapman & Hall, 2001.
- Honeycombe, R.W.K., and Bhadeshia, H.K.D.H., "Steels, Microstructures and Properties", Edward Arnold, 2005.
- Smallman, R.E. and Bishop, R.J., "Modern Physical Metallurgy and Materials Engineering", Butterworth-Heinemann, 1999.
- Polmear, L.J., "Light alloys- Metallurgy of the Light Metals", 3rd ed., Arnold, 1999.

Journals/Periodicals

World Wide Web

Title of the Course: Materials Thermodynamics

Credit Hours: 3-0-3

Pre-requisites:

Specific Objectives of Course:

Course Outline:

First law of thermodynamics, enthalpy, internal energy. Second law, entropy, Third law Gibbs and Helmholtz free energies. Use of thermodynamic data. Equilibrium, quasi-static equilibrium. Relationship between heat and work. Reversible and irreversible processes. Measurement of heat reactions, Phase equilibria in single and multicomponent systems. Behaviour of solutions, non-ideal solutions, thermodynamics of phase diagrams. Experimental methods of evaluating thermodynamics functions, estimation and calculation of the values of thermodynamic functions, free energy of formation, free energy diagrams. The Arrhenius equation, the activated complex theory, collision theory, calculation of reaction rates. Heterogeneous reactions, gas-solid reactions, liquid-solid reactions, liquid-liquid reactions at slag-metal interface, gas-liquid reactions.

Lab Outline:N/A

Recommended Books:

- Gaskell, D.R , “Introduction to the Thermodynamics of Materials”, Taylor and Francis, 4th ed., 2003
- Kaufman. M., “Principles of Thermodynamics”, CRC, 2002
- David Ragone, “Materials Thermodynamics” MIT Press, 2002
- Machlin E. S., “An Introduction to Aspects of Thermodynamics & Kinetics”, Giro Pr; 2nd ed., Dec 2001
- Gaskell, D. R., “Introduction to Thermodynamics of Materials”, Taylor and Francis, 1995.
- Hudson, J. B, “Thermodynamics, An Advanced Text for Materials Scientists”, John Wiley, 1996

Journals/Periodicals

World Wide Web

Title of the Course: Inspection and Testing of Materials**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To provide thorough understanding of inspection and testing of materials**Course Outline:**

Introduction to inspection and testing of materials, its scope and importance, The Brinell test, the Vicker test, the Rockwell test, the Knoop test, the Scleroscope test, conversion tables for various scales of hardness, Stress and strain, load extension diagrams, modulus of elasticity, elastic limit, yield stress, proof stress, work hardening, tensile testing, (equipment and specimens). Compression testing, bend testing, torsion testing. impact testing. Toughness, brittleness and ductility, notched bar impact testing, the Charpy and Izod impact tests, brittle and ductile fractures, The fatigue test, different types of fatigue fractures, Goodman diagram, endurance limit-ultimate tensile strength, The Creep Test. Non destructive testing of materials, Liquid Penetrant, Eddy Current, X ray, Magnaflux, Ultrasonic etc.

Lab Outline: Lab Manuals will be available in the concerned laboratory.**Recommended Books:**

- Dieter G. E., “Mechanical Metallurgy”, McGraw-Hill, 2002.
- Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering Materials”, John Wiley, 2000
- Collins J.A., “Failure of Materials in Mechanical Design”, John-Wiley, 2000
- Halmshaw R., “Non- Destructive Testing”, 2nd ed., Edward Arnold, 2000.
- Felbeck D.K. and Atkins, A.G., “Strength and Fracture of Engineering Solids”, Prentice-Hall, 2000.
- Hull J.B. and V.B. John, “Non-Destructive Testing”, Macmillan, 1988.

Journals/Periodicals
World Wide Web

Title of the Course: Instrumentation and Control

Credit Hours: 3-3-4

Pre-requisites: -

Specific Objectives of Course: To provide knowledge about the instrumentation and control systems used in materials and metallurgical engineering

Course Outline:

The functional elements of instruments, Pyrometry, Active and passive transducers, Calibration, Accuracy, Sensitivity, Threshold, Resolution, Hysteresis and Dead Space, Linearity, Permanent Magnet Moving coil instrument, Pen recorder, Cathode ray Oscilloscope, Transistor as Amplifier, Measuring instruments for motion, pressure, level, temperature and heat flux, Optical pyrometers, rheotubes, temperature recorders, digital portable temperature indicators, analog temperature controllers, types of thermocouples, pressure gauges, flow meter and flow gauges, Introduction to open loop and closed loop control systems, Dynamics of first and second order system. Lapalace Transform, Transfer Function, Stability, steady State error and its elimination, Introduction to frequency response techniques. Electromechanical relay, Silicon controlled rectifier, Servo Motor, Logic Gates (NOR AND NAND).

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Clair Bayne “Applied Electricity and Electronics” Goodheart-Willcox Pub, 2004, ISBN: 9781566377089
- Stan Gibilisco “Teach Yourself Electrical and Electronics” McGraw-Hill 2001 ISBN 0071377301
- Randy Slone, G., “Electricity and Electronics” McGraw-Hill ,2000, ISBN 0071360573
- John Park, Steve Mackay, “Instrumentation and Control System”, Newness, 2003 ISBN 0750657960
- Walt Boyes, “Instrumentation Reference Book”, Elsevier, 2003, ISBN 0750671238

Journals/Periodicals
World Wide Web

Title of the Course: Heat Treatment and Phase Transformations

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course:

Course Outline:

Driving force for phase transformation, Diffusional studies, self-diffusion, Volume and grain boundary diffusion. Free energy changes during phase transformation, Concept of Gibbs’s free energy, Critical radius. Liquid-solid

and solid-solid transformation. Nucleation & growth, homogeneous and heterogeneous nucleation, nucleation on crystalline defects and on grain boundaries. Precipitation reactions, GP zones, Intermediate and stable precipitate, Coherency strain, Volume free energy, strain free energy, Spinodal decomposition, diffusional and diffusionless transformation, iron carbon phase diagram, Effect of common alloying additions on the equilibrium diagram. Annealing, normalizing, oxidation and decarburization during heat treatment, quenching rates and quenching media, martensitic transformation, TTT diagrams, effects of austenizing, grain size and alloying element on the transformation diagram, CCT diagrams. Hardenability, austempering, martempering. Induction and Flame hardening, heat treatment of cast iron, heat treatment of non ferrous metal and alloys, age hardening/precipitation hardening, defects caused during heat treatment and their remedies and subzero treatment.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Porter, D. A. and Easterling, K. E., “Phase Transformations in Metals and Alloys”, Chapman and Hall, 2001
- Reed-Hill, R. E. and Abbaschian, R., “Physical Metallurgy Principles”, PWS Publishing, 2000
- Smallman, R.E., “Modern Physical Metallurgy”, 4th ed., Butterworths, 1999
- Honeycombe, R.W.K., and Bhadeshia, H.K.D.H., “Steels, Microstructures and Properties”, Edward Arnold, 2005.
- Christian, J. W., “Transformations in Metals and Alloys”, Pergamon Press, 1975
- Totten, G.E., “Steel Heat Treatment”, CRC, 2007
- Krauss, G., “Steels Heat Treatment & Processing”, ASM, 2000
- Reed Hill, R. and Abbaschian, R., “Physical Metallurgy Principles”, PWS-Kent, 2001
- Martin, J. W., “Precipitation Hardening”, IoM, 1996

Journals/Periodicals

World Wide Web

Title of the Course: Engineering Ceramics and Glasses

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: to understand processing, design composition, learn about microstructure-property relationship of ceramic materials

Course Outline:

History and classification of ceramic materials, traditional Ceramics, Glass-ceramics, Electro-ceramics, Ceramics Microstructure, Review of Bonding and Structural Principles, Phase Equilibria, Batch Calculations, Raw Materials & Powder Processing, Forming, Densification, Physical, Thermal, electrical and Mechanical Behaviour of ceramics, , Introduction to Binary

Phase Equilibria, Microstructure Development and Properties, Ceramics Industry in Pakistan, refractories and their applications. Special ceramics, electro ceramics. Types of Glasses, Glass transition, viscoelastic behaviour, glass transition and second order transformation, heat treatment of glasses, glass formability, glass production techniques.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Rice, R.W., "Ceramic Fabrication Technology", Marcel Dekker, 2003
- Bengisu, M., "Engineering Ceramics", Springer, 2001
- Richerson, D.W., "Modern Ceramic Engineering", Marcel Dekker, 2000
- Terpstra, R. A., Pex, P. P. A. C. and de Vries, A. H., "Ceramic Processing", Chapman & Hall, 1995
- Lee, W.E. and Rainforth, W.M., "Ceramic Microstructures: Property Control by Processing", Chapman and Hall, 1994
- Rawson H "Glasses and their Applications", Royal Institute of Metals, London 1991

Journals/Periodicals

World Wide Web

Title of the Course: Manufacturing Technology

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To understand manufacturing processes available for materials.

Course Outline:

Scope and importance of manufacturing technology in Pakistan, Classification of mechanical working processes, Mechanism of plastic deformation, Theory of dislocations, Stamping and Deep Drawing, Weldability, work hardening, forging, tube drawing, sheet metal forming process, machining, rolling principles, rolling of ingot, bloom, billets, sheet and structural components, rolling of bars and rods, thermo-mechanical Treatment, rolling mills design and calculations, manufacturing process and system design, manufacturing defects causes and remedies, quality control in manufacturing processes, CAD/CAM technology. Introduction to Non-conventional manufacturing processes such as water jet cutting, and plasma cutting. Tool design. Surface Measurement and inspection, telesurf tolerances and specification. Material Selection and design, overview, the selection of materials, service conditions materials and primary processes, Secondary process, welding, machining, thermal treatment, finishing Operations.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Creese, R.C., "Introduction to Manufacturing Processes and Materials", Taylor and Francis, 1999
- Ashby, M.F. and Jones, D.R.H., "Engineering Materials-2", Pergamon, 2005

- Hwaiyu Geng, “Manufacturing Engineering Handbook”, McGraw-Hill, 2004
- Dieter, G.E., “Mechanical Metallurgy”, McGraw-Hill, 2000
- Paul De Garmo, Mlack, and Kohsar, “Processing Methods in Manufacturing”, Prentice Hall, USA, 2000

Journals/Periodicals

World Wide Web

Title of the Course: Ferrous Metallurgy

Credit Hours: 3-3-4

Pre-requisites: -

Specific Objectives of Course: To provide in-depth knowledge of iron and steel making technology.

Course Outline:

Iron ores and Iron bearing minerals. Iron making and its importance. Fluxes and slags, their sources chemistry and uses. Agglomeration and testing of blast furnace burden. Sintering and roasting, blast furnace theory, construction, chemistry and the process. Factors affecting the reducibility and other metallurgical properties of burden. Wrought Iron and sponge Iron. Direct reduction processes of iron making. Description of steel making processes, chemistry of steel making, rate of slag removal during refining, reaction of carbon, oxygen, deoxidation of steel, removal of impurities and killing of steels. Alternative routes of steel making, Bessemer, open hearth, top-blown and bottom-blown processes, acid and basic processes. Secondary steel making process, e.g., AOD, VOD, ESR, VAR.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Douglas Alan Fisher’ “Steel Making in America” United States Steel Corporation’ 2006
- Bradley Stoughton, “Metallurgy of Iron and Steel”, McGraw-Hill, 2006
- Ahindra Ghosh, “Secondary Steel Making”, CRC Press, 2001, ISBN 0849302641
- James McIntyre Camp, Charles Blaine Francis ”The Making Shaping and Treating of Steels” Carnegie-Illinois steel corporation, 2006
- Tretyakov, E., “Iron and Steel Production”, Minerva, 2001.

Journals/Periodicals

World Wide Web

Title of the Course: Production and Refining of Materials

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide students in-depth knowledge of production and refining of materials.

Course Outline:

Introduction to Non Ferrous metals and its ore deposits in Pakistan, Introduction to Non- Ferrous Extractive Metallurgy its scope and

importance in Pakistan, Aluminum and its ores, Preparation of Alumina, Preparation of Cryolite, Production of metallic Aluminum, Thermal process of Aluminum, Alloys production, Recovery of other values from Aluminum ores, Aluminum and its alloys, Properties, Microstructure and application. Copper and its ores, Preparation of concentrate, Extraction of Copper ores by pyrometallurgical methods, Matte smelting, Pier Smith converter, Top Blown Rotary Converter, Electrolyte and fire refining of Copper, Recovery of values such as Gold and Silver from Copper ores, Copper and its alloys, Properties and applications. Zinc and Zinc ores, General Preparation of extraction of Zinc, Roasting of Zinc concentrate, Leaching of roasted Zinc concentrate, Electrolysis of Zinc Sulphate solution, Melting of Cathodic Zinc, Production of Zinc retort and blast furnace method, Refining of Zinc, Zinc and its alloys, Properties and application. Lead and its ores, Extraction of lead, Blast roasting of lead concentrate, Blast furnace smelting of lead bullion, Recovery of aluminum and other metals from lead concentrate, Lead and its alloys, Properties microstructure and applications. Magnesium and its ores, Chromium and its ores, Extraction of magnesium and Chromium by Alumino-thermic and silico-thermic method, Refining of Magnesium and Chromium and its alloys, properties microstructure and application. Titanium and its ores, treatment of its ores concentrate, production of titanium metal by reduction with sodium and magnesium. Titanium and its alloys, properties, microstructure and applications. Refining of silicon and other semiconductor materials.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Gill, C.B., “ Non-Ferrous Extractive Metallurgy”, Krieger, 2000
- Polmear, I.J., “Light Alloys”, Edward Arnold, 2000
- Balá and Zcaron. P “Extractive Metallurgy of Activated Minerals” Elsevier Science, 2000
- Roundhill, Max D., “Extraction of Metals from Soils and Waters”, Springer; 1 Springer, 2001

Title of the Course: Selection and Application of Materials

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide in-depth knowledge of selection and applications of materials.

Course Outline:

Selection and applications of materials, service conditions, materials and primary processes, secondary processes, welding, machining, thermal treatment, finishing operations, strength-to-density and modules-to-density ratios, reading and using specifications, safety and reliability, quality control and quality assurance, help from the computer, prototypes and experimentation, cost analysis for a component, the recycling and reuse of materials. Computer applications in materials selection.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Lawrence W. Fisher, P.E, "Selection of Engineering Materials and Adhesives", Volume: 186, CRC Press, 2005, ISBN: 9780824740474
- Hummel, Rolf E. "Understanding Materials Science: History, Properties, Applications", 2nd Ed, Springer, 2005, ISBN: 9780387209395
- Joseph Datsko, "Materials Selection for Design and Manufacturing: Theory and Practice", CRC Press, 1997, ISBN: 9780824798444
- M. F. Ashby, Kara Johnson, "Materials and Design: The Art and Science of Material Selection in Product Design", Elsevier Science, 2002, ISBN 10: 0750655542

Journals/Periodicals

World Wide Web

Title of the Course: Advanced Materials

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide students thorough understanding of advanced materials.

Course Outline:

Development of new breeds of engineering materials, smart materials and functionally gradient materials, biomaterials. Semiconductors, superconductors, optical and magnetic materials. Basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses. Overview of elevated-temperature characteristics of materials, mechanical properties at elevated temperatures. Processing and properties of superalloys. Directionally solidified and single-crystal superalloys. Microstructural instabilities. Heat-resistant materials, titanium alloys, refractory metals and alloys. Intermetallics, ceramics, carbon-carbon composites. Nanomaterials and their classification. Mechanically alloyed metals, ODS alloys, Nanostructured materials, Fuel cell materials, materials for hydrogen storage. Shape memory alloys.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Scott A Guelcher and Hollinger, Jeffrey O., "An Introduction to Biomaterials", Taylor and Francis, 2005
- Charles P. Poole Jr. and Frank J. Owens, "Introduction to Nanotechnology", Wiley-Interscience, 2003
- Van de Voorde, M.H. and Meetham, G.W., "Materials for High Temperature Engineering Applications", Springer, 2000
- Edelstein, A.S. and Cammarata, R.C., "Nanomaterials: Synthesis, Properties and Applications", IoP, 2001

- Donachie, M. and Donachie, S., “Superalloys: A Technical Guide”, IHS , 2002
- Park, Joon B. and Bronzino, Joseph D., “Biomaterials: Principles and Applications”, Taylor and Francis, 2002
- Nenov, T. G., Yordanov, S.R , “Ceramic Sensors”, Technomic, 1996

Title of the Course: Welding and Joining Processes

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide knowledge of joining processes of materials.

Course Outline:

Introduction to welding and joining, weld defects, selection of appropriate welding process, effect of heat on metals, pre-heating , stress, strain, weldability , type of joints, types of welds, filler metals, welding problems. Gas welding and equipments. Arc welding, power sources, DC and AC power sources, cables, electrodes, current and circuit polarity, electrode selection, weld deposit. TIG & MIG welding; Introduction, principles, non-consumable tungsten electrodes, gas supply and equipment, and TIG joint preparation, spot welding, electrode wire, gas supply, spray metal transfer method, CO₂ – MIG welding, MIG spot welding. Submerged arc and other shielded methods, equipment, current, flux, electrodes, atomic hydrogen welding, plasma arc welding electro slag welding under water shielded metals, arc welding, vapour shielded metal arc welding- Resistance welding , resistance spot welding, multiple spot welding, flash and upset welding, percussion welding, Thermit welding, equipment and techniques, process, ignition powder removing, the weld inspection, Other welding processes; laser welding, electron beam welding, pressure welding and ultrasonic welding. Soldering, brazing, joining of dissimilar materials, plastic welding, adhesive bonding, bonding materials, inspection and testing of weldments. Riveting and fastening processes.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Easterling, K., “Introduction to the Physical Metallurgy of Welding”, Butterworth-Heinemann, 2000
- Lancaster, J.F., “Metallurgy of Welding”, William Andrew, 1999 or latest edition
- Tiku, G.L., “Manual on Joining Processes by Welding, Brazing and Soldering” Minerva Press, 2003
- Thomas Böllinghaus and Herold. Horst, “Hot Cracking Phenomena in Welds” Springer; 1st ed., 2005
- Creative Publishing International, “Welding Basics” Creative Publishing International, 2003

Journals/Periodicals

World Wide Web

Title of the Course: Foundry Engineering**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To provide understanding of foundry process of materials.**Course Outline:**

Introduction to Foundry Engineering and Practice, Scope and importance of the subject, Simple foundry plant layout, Tooling, equipment, machines and types of furnaces used in foundry, Selection of suitable moulding and core materials, Properties of moulding and core materials, Analysis, testing and control of moulding and core materials requirements.

Types of pattern, pattern making, shrinkage and contraction allowances, melting furnaces i.e. pit furnaces, induction melting furnaces, cupola furnaces, selection and control of melting processes, control of chemical compositions, casting and fettling operation, metal gas interaction, causes of defects in sand casting and their remedies, inspection and quality assurance, introduction to new casting techniques.

Lab Outline: Lab Manuals will be available in the concerned laboratory**Recommended Books:**

- Peter, Beeley "Foundry Technology", Butterworth-Heinemann; 2nd ed., 200
- Chastain Stephen D, "Metal Casting," Chastain Publishing, 2003
- Brooks. Nick, "Mould making and Casting" Crowood Press, 2005
- Campbell. John, "Castings" Butterworth-Heinemann; 2nd ed., 2003.
- Chastain. Stephen D, "Iron Melting Cupola Furnaces for the Small Foundry" Stephen D. Chastain, 2000

Journals/Periodicals

World Wide Web

Title of the Course: Corrosion, Protection and Prevention**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To impart knowledge of corrosion protection and prevention techniques.**Course Outline:**

General concepts, corrosive environments, atmosphere, water, chemicals, gases, general corrosion, galvanic corrosion, oxygen concentration cell, atmospheric corrosion, chemical corrosion, corrosion in gas, types of scale, mechanism of scale protection, oxide, defect structure, oxidation rates, high temperature corrosion, localized corrosion, pit and crevice corrosion.

Mechanically assisted corrosion, stress corrosion cracking, intergranular and transgranular corrosion, corrosion fatigue, hydrogen damage, corrosion in ceramics and plastics and chemical corrosion. Corrosion prevention and protection. Chemical inhibitors and environmental control. Corrosion resistant materials.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Fontana, M.G., "Corrosion Engineering", McGraw-Hill, 2000
- Einar Bardal, Einar Bargal, "Corrosion and Protection", Springer, 2004
- Helmut Kaesche, "Corrosion of Metals", Springer, 2003
- Mansfeld., Florian, "Analytical Methods in Corrosion Science and Engineering", CRC, 2005
- Jones D.A., "Principles and Prevention of Corrosion", Macmillan, 1996

Journals/Periodicals

World Wide Web

Title of the Course: Materials Characterization

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course:

Course Outline:

Production of x-rays. Absorption of x-rays, use of filters, x-ray diffraction, Bragg's law, structure factor calculations. Powder diffraction, Debye-Scherrer technique, Laue back/reflection and rotating crystal method, x-ray diffractometer. Crystal structure determination, orientation of single crystal, applications of x-ray diffraction, Introduction to Stereographic projections. Wet analysis, image analysis, electron diffraction, transmission electron microscopy, analytical transmission electron microscopy, scanning electron microscopy, electron micro-probe analysis, gas analysis by mass spectrometry, Thermal characterization of materials, TGA, DTA, DSC. Spectroscopic techniques.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Brandon, D. and Kaplan, W.D., "Microstructural Characterisation of Materials", Wiley, 1999
- Wachtman, J.B., "Characterization of Materials, Butterworths-Heinemann, 2000 Loretto, M.H., "Electron Beam Analysis of Materials", 2nd ed., Chapman and Hall, 1984
- Williams, D.B. and Carter, C. B., "Transmission electron Microscopy", Plenum, 1996
- Magonov, S. N. and Myung-Hwan Whangbo, "Surface Analysis with STM and AFM. Experimental and Theoretical Aspects of Image Analysis", VCH, 1996
- Goodhew, P.J., Humphreys F.J., "Electron Microscopy and Analysis", 2nd ed., Taylor & Francis, 1988
- Goldstein, J.I. et. al., "Practical Scanning Electron Microscopy", Plenum, 1975

Journals/Periodicals

World Wide Web

Title of the Course: Powder Metallurgy**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To provide understanding of powder metallurgy techniques.**Course Outline:**

Commercial methods for production of metal powders, powder characterization and testing, powder conditioning and function of addition agents. Consolidation of metal powders, Cold Isostatic Compacting, Hot Isostatic Compacting, Powder Rolling, Powder Forging, Powder Extrusion, Powder Injection Moulding, Spray Forming. Theory of Sintering, Sintering Practice, Sintering Atmospheres, Sintering Furnaces. Powder Metallurgy of Refractory and Reactive Metals, Powder metallurgy of Super Alloys, Dispersion-Strengthened materials. Secondary Operation Performed on P/M parts and products. Inspection and Quality Control for P/M Materials. The Economic of P/M Production.

Lab Outline: Lab Manuals will be available in the concerned laboratory**Recommended Books:**

- German. Randall, "A - Z of Powder Metallurgy", Elsevier Science, 2006
- West, William G, F. Leander, Pease, "Fundamentals of Powder Metallurgy", Metal Powder Industries Federation 2002
- German, R. M., "Sintering Theory and Practice", Metal Powder Industries Federation, 1996
- Yule, A.J., and Dunkley, J. D., "Atomization of Melts for Powder Production and Spray Deposition" Clarendon Press, 1994
- German, R. M., "Powder Metallurgy Science", Metal Powder Industries Federation, 1984
- Gessinger, G. H., "Powder Metallurgy of Super alloys", Butterworths, 1984

Title of the Course: Surface Engineering and Coating Techniques**Credit Hours: 3-3-4****Pre-requisites:****Specific Objectives of Course:** To provide knowledge of surface engineering and coating techniques.**Course Outline:**

Basis of Surface engineering, Surface Energy, Thermodynamics of Surfaces, Surface Reconstruction Models, Surface tension, Wetting, Adsorption Models and Surface Area Analysis based on Adsorption, Surface interactions with Ion Beams, Electron Beams and Radiations. Classification of Surface Coatings, Chemical Methods for Surface 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. Coatings for Mechanical Applications, Thermal Methods for Surface Coatings, High Temperature coatings, high temperature coating systems, Plasma Spraying, Thin Films, PVD, CVD and PECVD techniques, Coating Growth, Coating Characterization and applications, Coatings for wear resistance. Laser treatment of materials, fundamentals and applications. Surface modification and melting by laser treatment.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- John B Hudson, "Surface Engineering: An Introduction", Butterworth Heinemann, 2000
- Lang E., "Coatings for High Temperature Applications", Applied Science, 2000
- Heinz Dimigen, "Surface Engineering", Wiley-VCH, 2000, ISBN 3527301968
- Smith, D.L. "Thin Film Deposition, Principles and Practice", McGraw-Hill, 2000.
- Grainger, S. and Blunt, J., "Engineering Coatings", Woodhead, 1998.
- Lang E., "Coatings for High Temperature Applications", Applied Science, 2000
- Peter Seyffarth , Igor Krytsun, "Laser-Arc Processes and Their Applications in Welding and Material Treatment", CRC,2002, ISBN-10: 041526961X
- J. Mazumder Kluwer, "Laser Processing Surface Treatment and Film Deposition" Academic Publishers, 1996, ISBN 0792339010

Title of the Course: Advanced Steels

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide thorough understanding of advanced steels.

Course Outline:

Introduction: Microstructure and property relationships in steels, High strength low Alloy (HSLA) steels, micro alloyed steels, stainless steels, duplex steels, high yield steels and super alloys.

Production and Processing: Classifications, production and processing principles, thermomechanical processing, advantages and limitations, TMT steels, dual phase steels, IF (interstitial-free) and ultra-low carbon steels for structural and automotive applications, ultra-low-carbon bainitic steels (ULCB), martensitic steels.

Special Steels: Stainless steels, nitrogen containing fine grained steels, orthopedic steels, superduplex corrosion resistant stainless steels, special steels, TRIP steels, maraging steels, tool steels, die steels, special steels for low to moderate temperature applications for nuclear and thermal power plants, heat resistance steels for superheaters, tool and die steels, processing and properties. Design and processing. Ultra-fine grain

refinement in steel.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Honeycombe, R. W. K., "Steels: Microstructure & Properties", Edward Arnold, London, 2005
- Pickering, F. B., "Physical Metallurgy and Design of Steels", Applied Science Publishers, 2000.
- Marshall, P., "Austenitic Stainless Steels: Microstructure and Mechanical Properties", Elsevier Applied Science Publishers, 2000 or latest edition

Journals/Periodicals

World Wide Web

Title of the Course: Fracture Mechanics and Failure Analysis

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide thorough understanding of fracture and failure analysis.

Course Outline:

Ductile and Brittle fracture, Tensile fracture, Creep and Creep fracture, fatigue and Fatigue fracture, impact testing, Izod and Charpy test, ductile to brittle transition, effect of temperature, Griffith's crack theory, microvoids formation and ductile fracture, cleavage for brittle fracture, cleavage planes, crack opening displacement (COD), stress intensity factor, J integral, elastic-plastic fracture mechanics, Fracture toughness, plane stress and plane strain fracture toughness, real time fracture toughness, fracture re-inforcement mechanisms. Fractography, differentiation among different types of fracture surfaces.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- Anderson, Ted, Anderson, T. L., "Fracture Mechanics Fundamentals", 3rd edition, Taylor & Francis Group, 2005.
- Knott, J.F. and Withey, P., "Fracture Mechanics - Worked examples", IoM, Latest edition.
- Lancaster, J.F., "Engineering Catastrophes", Woodhead, 2005
- Gordon W. Powell, "A Fractography Atlas of Casting Alloys", Battelle, 1992
- ASM International, "Fractography", Metals Handbook, 12, 9th ed., ASM International, 19 87

Journals/Periodicals

World Wide Web

Title of the Course: Fuels and Furnaces**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To impart knowledge of fuel and furnace used in metallurgical industry.**Course Outline:**

Fuels: Classification, preparation, storage, handling, transportation. Combustion of Fuels, low and high temperature carbonisation of coal, liquid fuels, study of petroleum, knock rating. Light and heavy oils., furnace oil. Gaseous fuels, producer gas, water gas, coke oven gas and LPG. Natural gas and its viscosity, calorific intensity, octane number and Cetane number of fuel, analysis of fuel and fuel economy. Furnaces: Types of furnaces, electric, oil, gas, coal. Heat treatment furnaces, vacuum furnaces and controlled atmosphere furnaces. Design and construction of furnaces, temperature measurement procedures and instruments, energy management and cost effectiveness.

Lab Outline: N/A**Recommended Books:**

- Gilchrist. J.D., "Fuels", Edward Arnold, 2000
- Dame and King, "Fuels Technology" Edward Arnold, 2000

Journals/Periodicals

World Wide Web

Title of the Course: Mineral Processing**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To provide knowledge of mineral processing processes.**Course Outline:**

Theory of crushing, operation and application of jaw-, gyrator-, cone-, roll, gravity stamp- and special crushers. The theory and application of liberation techniques. Theory and attributes of comminution and use of ball, rod and tube mills. Industrial screening, types and operating characteristics screens, the movement of solids in fluids. Stoke's, Newton-, Rettinger's Law. Reynolds number free setting ratio and hindered setting ratio. Heavy fluid separation, heavy liquids and suspension, principles of jigging.

Hydraulic and pneumatic jigs, flowing film concentration and tabling. Flotation and dispersion. Magnetic separation and magnetic properties of substances. Miscellaneous processes of separation depending on colour and general appearance, heat properties, electrical properties, differential hardness, amalgamation. Separation of solids from fluids by thickening process, filtration, dust elimination and drying. Theory and techniques of concentrates, palletising, nodulizing and briquetting. Flow sheets and circuit diagrams of typical mills treating ores, non-metallic and the solid fuels.

Lab Outline: N/A

Recommended Books:

- Wills Barry & Napier-Munn Tim, "Mineral Processing Technology", 7th ed., Butterworth-Heinemann, 2006
- M. C. Fuerstenau, & N. Han, Kenneth "Principles of Mineral Processing". Society for Mining Metallurgy & Exploration, 2003
- Howard L. Hartman, Jan M. Mutmansky, "Introductory Mining Engineering", Wiley; 2nd ed., 2002

Journals/Periodicals

World Wide Web

Title of the Course: Nuclear Materials**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To impart knowledge on nuclear materials.**Course Outline:**

Nuclear structure, radioactive decay, nuclear fission and fusion reactions, neutron absorption cross section, nuclear energy, nuclear reactors. Type of reactors, nuclear fuels, uranium, thorium, plutonium, fuel cladding materials, aluminum alloys, stainless steels, zirconium alloys, reflecting materials, graphite, beryllium, moderators, light water, heavy water, graphite, control rod materials, cadmium, boron. Structural materials, low alloy steels, stainless Steels, super alloys, Inconel, Incolloy. Effect of radiations on ductile to brittle transition of materials, effect of alloying elements to resist ductile to brittle transition during irradiation. Electromagnetic radiations damage, particulate damage, radiation hazards, health physics. Disposal of radio active wastes, study of properties of irradiated materials.

Lab Outline: N/A**Recommended Books:**

- Materials Science and Technology, Volume 10, Nuclear Materials, Parts I & II, Vol. Editor: Frost, B. R. T, VCH, 1994.
- The American Society of Mechanical Engineers, "Performance and Evaluation of Light Water Reactor Pressure Vessels", 1987

Journals/Periodicals

World Wide Web

Title of the Course: Vacuum Technology**Credit Hours: 3-0-3****Pre-requisites:****Specific Objectives of Course:** To impart knowledge on vacuum techniques used in the field of materials and metallurgy.**Course Outline:**

Vacuum technology: Different units of measuring pressure vacuum regimes, mean free path, collision frequency. Vacuum pumps: Water pumps, positive displacement pumps, rotary and roots pump, vapour

ejector and vapour entrainment pumps, diffusion pump, turbo-molecular pump, ion pumps, sieve pumps, adsorption pumps. Classification and working principles of vacuum measuring devices: Manometers, McLeod gauge, Penning gauge, Pirani gauge. Calculation of vacuum systems, conductance and through put, effective pumping speed, gas flow through pipes and orifices. Sources of leakage, leakage detection and remedies. Application of vacuum in materials processing.. Vacuum induction melting, vacuum arc melting. Metal refining in vacuum, degassing in liquid state, vacuum heat treatment, vacuum sintering, vacuum coating, use of vacuum technology in the production of strategic materials. Design of vacuum furnaces.

Vacuum Coatings: Introduction, purpose of vacuum coating, process of vacuum coating, vacuum coating system by electro bombardment heating, valves used in vacuum technology.

Lab Outline: N/A

Recommended Books:

- Alexander Roth, "Vacuum Technology", North-Holland, 2007
- Mattox, D. M., "The Foundations of Vacuum Coating Technology", Noyes Data Corporation/Noyes Publications, 2003
- Choudhury, A, "Vacuum Metallurgy, ASM Intl, 2000
- Inker. O.W, "Vacuum Metallurgy", Elsevier, 2001
- Alexander Roth, "Vacuum Technology", North-Holland, 2007

Journals/Periodicals

World Wide Web

Title of the Course: Composite and Polymeric Materials

Credit Hours: 3-3-4

Pre-requisites:

Specific Objectives of Course: To provide knowledge of composite and polymeric materials.

Course Outline:

Survey and classification of polymeric materials. Review of polymer chemistry, introduction to polymers, classification of polymers, polymerisation, co-polymerisation, structure and properties of thermoplastic and thermosetting polymers, elastomers and rubber, vulcanisation, additives and fillers. Manufacturing, properties and applications of polymers, polystyrene, polybutadiene, polyester, polymethyl methacrylate (PMMA), nylon 6:6, acrylonitrile-butadiene-styrene (ABS), silicon resin, epoxy resin, phenol- formaldehyde and other advanced polymers, forming processes, testing and identification of polymers, fibers, foams and adhesives, Plastics, conductive polymers and plastics, Introduction to Composite materials, classification characteristics, mechanical behavior potential advantages, properties and applications. Composite material design, specific stiffness and strength, and recent developments such as metal matrix composite, ceramic matrix composites, carbon fiber reinforced composite, production and processing of fibres and

other reinforcements, polymeric matrix composites, processing principles and design of ply and laminate structures, filament winding and pultrusion.

Lab Outline: Lab Manuals will be available in the concerned laboratory

Recommended Books:

- McCrum, N.G. and Buckley, C., "Principles of Polymer Engineering", OUP, 2002
- Rodriguez, F., "Principles of Polymer Systems", 5th ed., McGraw-Hill, 2003.
- Rodger, Brendan, "Rubber Compounding: Chemistry and Applications", Taylor and Francis, 2004
- Margolis J. M. "Conductive Polymers and Plastics", Chapman & Hall, 1989.
- Mills, N. J., "Plastics: Microstructure, Properties and Applications", Arnold, 1993
- Deborah D L Chung, "Composite Materials", Springer, 2003
- Charles E. Bakis, "Composite Materials", ASTM International, 2003
- Hull, D. and Clyne, T.W., "Introduction to Composite Materials", CUP, 1996

Title of the Course: Senior Design Project Part-1

Credit Hours: 0-9-3

Pre-requisites:

Specific Objectives of Course: To provide students learning of research techniques used in the industry.

Course Outline:

Selected problems from the industry and current materials research issues regarding selection processing, designing, manufacturing and development. Fabrication of prototype/models and laboratory experimentation shall be assigned to individual students/ Grading shall be the reports produced by individual students and their evaluation through an oral examination

Lab Outline: Experimental work will be carried out in the relevant laboratories/industry according to the nature of the project

Recommended Books:

Reference book and journal for latest literature survey and methodology

Title of the Course: Senior Design Project Part-1I

Credit Hours: 0-9-3

Pre-requisites:

Specific Objectives of Course: Same as Part-I

Course Outline:

Same as Part-I

Lab Outline: Experimental work will be carried out in the relevant laboratories/industry according to the nature of the project

Recommended Books:

Reference book and journal for latest literature survey and methodology

RECOMMENDATIONS

After thorough deliberations the committee proposed the following recommendations:

1. In order to ensure uniformity in all the universities/educational institutions offering degrees in Metallurgy and Materials Engineering, the programme should have 65-70 percent engineering courses and 30-35 percent of non-engineering courses.
2. The courses/curriculum must be revised regularly after every three years.
3. Board of studies of the universities/institutes should be allowed to incorporate new developments and ideas in the course contents.
4. The universities should be encouraged to co-opt the industry representatives in the Board of Studies.
5. Final year projects should be relevant to the industry.
6. A suitable mechanism must be developed for facilitating the students to obtain internship with various industries and public sector organizations.
7. Universities/Institutes should arrange short visits of students to industries in order to enhance their confidence about the relevance of engineering subjects.
8. To facilitate the provision of high quality education, the latest text books and educational software should be provided to the students on affordable prices. HEC should provide funds to the Universities/Institutes for this purpose.
9. The training of teachers in teaching methodologies should be increased. University-Industry interaction and regular participation of teachers in relevant conferences must be ensured. Universities should take necessary steps and provide financial resources for this purpose.
10. Computing and IT facilities along with relevant software, databases and online technical research journals should be available for faculty members of all the universities/institutes.

COMPULSORY COURSES IN ENGLISH FOR BE/BSc IN ENGINEERING DISCIPLINE

Semester – I

Functional English

Objectives: To enhance language skills and develop critical thinking

Course Contents

Basics of Grammar
Parts of speech and use of articles
Sentence structure, Active and passive voice
Practice in unified sentence
Analysis of phrase, clause and sentence structure
Transitive and intransitive verbs
Punctuation and spelling

Comprehension

Answers to questions on a given text

Discussion

General topics and every day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Listening

To be improved by showing documentaries/films carefully selected by subject teachers)

Translation skills

Urdu to English

Paragraph writing

Topics to be chosen at the discretion of the teacher

Presentation skills

Introduction

Note: Extensive reading is required for vocabulary building

Recommended books:

1. Functional English

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
- b) Writing
1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
- c) Reading/Comprehension
1. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
- d) Speaking

Semester II

Communication Skills

Objectives: To enable the students to meet their real life communication needs

Course Contents

Paragraph writing

Practice in writing a good, unified and coherent paragraph

Essay writing

Introduction

CV and job application

Translation skills

Urdu to English

Study skills

Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

Academic skills

Letter / memo writing and minutes of the meeting, use of library and internet resources

Presentation skills

Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

**Recommended books:
Communication Skills**

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

c) Reading

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
2. Reading and Study Skills by John Langan
3. Study Skills by Richard Yorky.

Semester III

Technical Writing and Presentation Skills

Objectives: To enhance language skills and develop critical thinking

Course Contents

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended books:

Technical Writing and Presentation Skills

- a) Essay Writing and Academic Writing
 1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
 2. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004.
 3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- b) Presentation Skills
- c) Reading
The Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

Semester III

Technical Writing and Presentation Skills

Objectives: To enhance language skills and develop critical thinking

Course Contents

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended books:

Technical Writing and Presentation Skills

- a) Essay Writing and Academic Writing
 1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
 4. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004.
 5. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- d) Presentation Skills
- e) Reading
The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

ISLAMIC STUDIES (Compulsory)**COURSE PROFILE**

S.NO	TITLES	DETAIL
1	Name of Course	Islamic Studies(Compulsory)
2	No. of Credit Hours	2 Credit Hours
3	Nature of Course	Compulsory at Graduation Level
4	Total Teaching Weeks	18
5	Objectives of the Course	This course is aimed at: 1-To provide Basic information about Islamic Studies 2-To enhance understanding of the students regarding Islamic Civilization 3-To improve Students skill to perform prayers and other worships 4-To enhance the skill of the students for understanding of issues related to faith and religious life
6	Components of Teaching of the Course	

LEVEL OF COURSE	GRADUATION
NAME OF DEGREE	BS
NAM OF COURSE	ISLAMIC STUDIES
SEMESTER	AS PER REQUIREMENT OF THE UNIVERSITY
NO. OF CREDIT	2
TOTAL TEACHING HOURS	AS PER HEC REQUIRMENTS
NO. OF PERIODS PER WEEK	2
TOTAL TEACHING PERIOD OF COURSE	18 WEEKS

UNIT NO.1: INTRODUCTION TO QURANIC STUDIES

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

UNIT No.2 : STUDY OF SELLECTED TEXT OF HOLLY QURAN

- 1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)

- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

UNIT No.3 : STUDY OF SELLECTED TEXT OF HOLLY QURAN

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

UNIT NO.4: SEERAT OF HOLY PROPHET (S.A.W) I

- 1) Life of Muhammad Bin Abdullah (Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

UNIT NO.5: SEERAT OF HOLY PROPHET (S.A.W) II

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

UNIT NO.6: INTRODUCTION TO SUNNAH

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

UNIT NO.7 SELLECTED STUDY FROM TEXT OF HADITH

UNIT NO.8 INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

UNIT NO.9: ISLAMIC CULTURE & CIVILIZATION

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

UNIT NO.10:ISLAM & SCIENCE

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

UNIT NO.11:ISLAMIC ECONOMIC SYSTEM

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

UNIT NO.12: POLITICAL SYSTEM OF ISLAM

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

UNIT NO.13: ISLAMIC HISTORY

- 1) PERIOD OF KHLAFT-E-RASHIDA
- 2) PERIOD OF UMMAYYADS
- 3) PERIOD OF ABBASIDS

UNITNO.14 : SOCIAL SYSTEM OF ISLAM

- 1) BASIC CONCEPTS OF SOCIAL SYSTEM OF ISLAM
- 2) ELEMENTS OF FAMILY
- 3) ETHICAL VALUES OF ISLAM

REFERENCE BOOKS:

- 1) HAMEED ULLAH MUHAMMAD, "**EMERGENCE OF ISLAM**" , IRI, ISLAMABAD
- 2) HAMEED ULLAH MUHAMMAD, "**MUSLIM CONDUCT OF STATE**"
- 2) HAMEED ULLAH MUHAMMAD, "**INTRODUCTION TO ISLAM**"
- 3) MULANA MUHAMMAD YOUSAF ISLAHI,"
- 4)Hussain Hamid Hassan, "**An Introduction to the Study of Islamic Law**" leaf Publication Islamabad, Pakistan.
- 5)Ahmad Hasan, "**Principles of Islamic Jurisprudence**" Islamic Research Institute, international Islamic University, Islamabad (1993)
- 6)Mir Waliullah, "**Muslim Jrisprudence and the Quranic Law of Crimes**" Islamic Book Service (1982)
- 7)H.S. Bhatia, "**Studies in Islamic Law, Religion and Society**" Deep & Deep Publications New Delhi (1989)
- 8)Dr. Muhammad Zia-ul-Haq, "**Introduction to Al Sharia Al Islamia**" Allama Iqbal Open University, Islamabad (2001)

Pakistan Studies (Compulsory)

(As Compulsory Subject for Degree Students)

Introduction / Objectives

The course has been designed as a compulsory subject for the students studying for Bachelor’s degree, general or professional. The course is of 3 credit hours carrying 100 marks (recommended). The teaching work is comprised of three dimensions: Historical Perspective (20%); Government and Politics (40%); and Contemporary Pakistan (40%).

The course framework is issue-oriented. It has many dimensions, the historical and ideological background of Pakistan the process of governance and national development as well as the issues arising in the modern, age and posing challenges to Pakistan. The course has been designed with a vision that Pakistan Studies should open a window to future.

Course Outline

1. Historical Perspective

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and Geo-Physical features.

2. Government and Politics in Pakistan

Political and constitutional phases:

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward

3. Contemporary Pakistan

- a. Economic institutions and issues
- b. Society and social structure

- c. Ethnicity
- d. Foreign policy of Pakistan and challenges
- e. Futuristic outlook of Pakistan

Books Recommended

1. Burki, Shahid Javed. *State & Society in Pakistan*, The Macmillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Banglades.*, Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.
12. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, *Pakistan Under Martial Law*, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.

COURSES FOR SOCIAL SCIENCE

Sociology and Development (For Engineers)

Objectives: The main objective of this course is to apprise potential engineers about social factors that contribute towards enhancing their professional performance for the good of society and the country. This course is culture specific and has to be taught within the context of local and national socio-economic environment. The engineers are expected to supervise several people in different capacities and their understanding about human behaviour is critical for their optimum performance. Modification of human behaviour or getting work done from sub-ordinates and seniors remain a major challenge for all the professional engineers. This course will enhance understanding about the determinants of human behaviour, which ultimately will result in improved individual efficiency.

1. Introduction to Sociology

- 1.1 What is sociology?
- 1.2 Nature, Scope, and Importance of Sociology
- 1.3 Social Interactions
- 1.4 Social Groups
- 1.5 Social Institutions

2. Culture and Related Concepts

- 2.1 Definition of Culture
- 2.2 Types of Culture
- 2.3 Elements of Culture
- 2.4 Role of Culture in Organization
- 2.5 Socialization and Personality

3. Interpersonal Relations

- 3.1 Interpersonal Behaviour
- 3.2 Formation of Personal Attitudes
- 3.3 Language and Communication
- 3.4 Motivations and Emotions
- 3.5 Public Opinion

4. Social Stratification

- 4.1 Factors of Social Stratification
- 4.2 Caste and class
- 4.3 Power, Prestige, and Authority
- 4.4 Social Mobility
- 4.5 Migration

5. Human Ecology

- 5.1 Ecological Processes
- 5.2 Ecosystem and energy
- 5.3 Ecosystem and Physical Environment

- 5.4 Solid Waste Disposal
- 5.5 Pollution

6. Population Dynamics

- 6.1 World Population Growth and Distribution
- 6.2 Population Dynamics in Pakistan
- 6.3 Causes and Consequences of Urbanization
- 6.4 Population Policy in Pakistan
- 6.5 Population and Development

7. Community Development

- 7.1 Meaning, Scope, and Subject Matter of Community Development
- 7.2 Processes of Community Development
- 7.3 Community Development Programs in Pakistan
- 7.4 Community Organization and Related Services
- 7.5 Cooperation and Conflict in Community Development

8. Deviance and Crime

- 8.1 Crime as a Social and Cultural Phenomenon
- 8.2 Crime and Social Organization
- 8.3 Organized Crime
- 8.4 Culture Based Crime
- 8.5 Economics of Crime

9. Sociology of Change and Development

- 9.1 What is Social Change and Development?
- 9.2 Dynamics of Social Change
- 9.3 Role of NGOs in Development
- 9.4 World System and Development
- 9.5 Gender and Development

Recommended Readings

1. Allport, G. W. (1985). *The Historical Background of Modern Social Psychology*. New York, Random House.
2. Bernard, A. and T. Burgess (2004). *Sociology*, Cambridge University Press.
3. DuBrin, A. J. (2007). *Human Relations: Interpersonal Job Oriented Skills*. New York, Prentice Hall.
4. Gardezi, H. N., Ed. (1991). *Understanding Pakistan: The Colonial Factor in Societal Development*. Lahore, Maktaba Fikr-o-Danish.
5. Hafeez, S. (1991). *Changing Pakistan Society*. Karachi, Royal Book Company. Gardezi, H. N., Ed. (1991).
6. Jones, G. W. (2005). "Why are Population and Development Issues not Given Priority?" *Asia-Pacific Population Journal* **20**(1).
7. Macionis, J. J. (1999). *Sociology 7th Edition*, National Book Foundation, Islamabad

8. Maser, C. (1997). Sustainable Community Development: Principles and Concepts. Florida St. Lucie Press.
9. Nelson, N. and S. Wright (1995). Power and Participatory Development: Theory and Practice. London, Intermediate Technology Publications.
10. Syed, S. H. (2003). The State of Migration and Multiculturalism in Pakistan: The Need for Policy and Strategy. Islamabad, UNESCO: 1-30.
11. Utton, A. E. (1976). Human Ecology, West View Press.
12. Webster, A. (1990). Introduction to Sociology of Development. London, Nacmillan Education Ltd.
13. Weiss, A. M. (2001). Power and civil society in Pakistan, Oxford University press.

SOCIAL ANTHROPOLOGY

(For Engineers)

Objectives: The students are expected to learn anthropological skills for application by professional engineers and other related practitioners. Societal growth needs are to be understood within our own cultural environment. Such a body of applied knowledge will result in improving the professional performance of would-be engineers. As culture and society play an important role towards all human activities, this course will help students relate technical skills to the societal needs and requirements.

I Introduction

1. Anthropology and Social Anthropology
2. Fields of Anthropology
3. Anthropological Research Methods
4. Social Anthropology and other Social Sciences
5. Significance of Social Anthropology

II Culture

1. Definition, Properties and Taxonomy
2. Evolution of Growth and Culture
3. Evolution of Man: Religious and Modern Perspectives
4. Evolution of Culture
5. Culture and Personality

III Evolution and Growth of Culture

1. Evolution of Man
2. Schools of Thought in Cultural Anthropology
3. Acculturation
4. Enculturation
5. Ethnocentrism and Xenocentrism

IV Language and Culture

1. Communication
2. Structural Linguistics
3. Historical Linguistics
4. Relationship between Language and Culture
5. Ethnography

V Economic System

1. Global Economic System
2. The Allocation of Resources
3. The Conversion of Resources
4. The Distribution of Goods and Services
5. Poverty and Inequality

VII Marriage and Family

1. Marriage and Mate Selection
2. The Family: Types and Functions
3. Kinship System
4. Structure and Function of Family
5. Gender Relations

VIII Political Organization

1. Political Sociology
2. Origin of Political Organization and Organizational System
3. Types of Political Organizations
4. Power Politics and Factionalism in Pakistan
5. Resolution of Conflict

IX Religion and Magic

1. The Universality of Religion
2. Comparative Religions
3. Religion and Society
4. Religious Beliefs and Practices
5. Witchcraft and Sorcery

XI Culture Change

1. Forms of Art
2. Expressive Culture
3. Process of Cultural Change
4. Cultural Change in the Modern World
5. Cultural Change in Pakistani society

Recommended Books

1. *Ahmad, Akbar S. 1990. Pakistani Society, Karachi, Royal Books Co.*
2. *Bernard, H. Russel. 1994. Research Methods in Anthropology, Qualitative and Quantitative Approaches. London: Sage Publications*

3. Bodley, John H. 1994. *Cultural Anthropology*, California: Mayfield Publishing Co.
4. Brogger, Jan. 1993. *Social Anthropology and the Lonely Crowd*. New Delhi: Reliance Publishing
5. Ember, Carol R. & Ember Melvin. 2005. *Anthropology*, 11th ed. Englewood Cliffs: Prentice Hall, Ince. Harper and Row
6. Harris Marvin. 1987. *Cultural Anthropology*. New York: Harper and Row
7. Harris Marvin. 1985. *Culture, People, nature; An Introduction to General Anthropology* London: Harper and Row
8. Haviland, W. A. (2005). *Anthropology: The Human Challenge*. New York, Thomson Learning Inc.
9. Hertzler J. O. 1981. *The Social Structure of Islam*. Cambridge: Cambridge University Press.
10. Keesing, Roger m. 1998. *Cultural Anthropology: A contemporary perspective*. 3rd ed. New York: Harcourt Brace College Publishers.
11. Kottak, Conard Phillip. 2002. *Anthropology: The Exploration of Human Diversity*. 9th ed. Boston: McGraw Hill Higher Education.
12. Kennedy, Charles H. 1992. *Pakistan* London: Westview Press,.
13. Marron, Stanley. 1057. *Pakistani Society and Culture*. New Heaven
14. Wilson, Richard A. 1996. *Human Rights, Culture and Context: Anthropological Perspective*. London: Pluto Press.

Psychology courses for B.Sc/B.E in Engineering Programme

Course-I **Understanding Psychology and Human Behaviour** 3 credit hrs

- What is Psychology?
- Nature, Scope and Application with Special Reference to Pakistan
- Different Schools of Psychology
- Methods of Psychology
- Learning
- Intelligence and Artificial Intelligence
- Personality and its Assessment
- Understanding Maladjustive Behaviour
- Positive Emotional States and Processes
- Stress Management and Anger Management

Books Recommended

1. Atkinson R.C., & Smith E.E. (2000), *Introduction to Psychology* (13th ed.), Harcourt Brace College Publishers.

2. Fernald, L.D., & Fernald, P.S. (2005), Introduction to Psychology, USA: WMC Brown Publishers.
3. Hergenhahn, B.R. (2001). An Introduction to the History of Psychology, New York: Wadsworth.
4. Goodwin, C.J, (2000) Research in Psychology: Methods and Design, (3rd ed.), New York: John Wiley & Sons.
5. Synder, C.R., & Lopez, S.J. (2007) Positive Psychology, USA, Sage Publications.
6. Allen, B.P. (1997), Personality Theories: Development, Growth and Diversity, (2nd Ed.), Boston: Allyn & Bacon.
7. Cohen, R.J., & Swerdlik, M.E. (2005) Psychological Testing & Assessment (6th ed.), New York: McGraw-Hill.
8. Corcini, R., (2000). Current Psychotherapies. London: Thompson & Co Publishers.
9. Comer, R.J. (2004). Abnormal Psychology, USA: Freeman & Company.
10. Schwartz, B., Wasserman, E., & Robbins, S. (2002), Psychology of Learning and Behaviour, 5th Ed. Norton and Company.

Course II **Professional Psychology** 3 credit hrs

- Introduction to Professional Psychology
- Psychological Testing
- Educational Psychology
- Industrial/Organizational Psychology
- Social Psychology
- Health Psychology
- Clinical Psychology
- Positive Psychology
- Legal, Ethical, and Professional Issues.

Books Recommended

1. Crow, L., & Crow, A. (2000) Educational Psychology, New Delhi: Euroasia Publishing House Ltd.
2. Spiegel, P.K., & Koocher, G.P. (1998), Ethics in Psychology, New York: Oxford University Press
3. Snyder, C.R., & Lopes, S.J. (2000), Handbook of Positive Psychology, New York: Oxford University Press.
4. Compton, W.C. (2005), Introduction to Positive Psychology, USA, Thomson Wadsworth.
5. Debra, L.N. & James Campbell Quick, (2000) Organizational Behaviour (3rd ed), Cincinnati: South Western.

6. Fred Luthans, Alexander, D.S. & Edwin, A. Locke (2000) (Eds), Handbook of Principles of Organizational Behaviour, London: Blackwell.
7. Brannon, L.& Reist, J. (2000), Health Psychology: An Introduction to Behaviour and Health (4th ed.), USA Wadsworth.
8. Donohue, W. & Ferguson, K. (Eds), (2003), Handbook of Professional Ethics for Psychologists; Issues, Questions and Controversies, London: Sage Publications.
9. Meyers, D. (2005), Social Psychology, 8th Ed. McGraw Hill Inc.
10. Cooper, J. & Hogg, M. (2003) Handbook of Social Psychology, Sage Publications
11. Halgin, R.P., Whitbourne, S.K., & Halgin, R. (2004), Abnormal Psychology: Clinical Perspectives on Psychological Disorders, New York: McGraw Hill.
12. Thorndike R.L., & Hage, E.P. (1995), Measurement and Evaluation in Psychology and Education (4th Ed), New York, MacMillan.

PROFESSIONAL ETHICS

Course Description:

Prerequisite: None

Corequisite: None

This course introduce contemporary and controversial ethical issues facing the business community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.

Course Objectives:

At the completion of the course requirements, the student will be able to:

- a. Define business ethics
- b. Describe the evolution of business ethics
- c. Describe major ethical perspectives
- d. Understand and apply n ethical decision-making framework
- e. Understand social responsibility from several dilemmensions
- f. Understand how the organization influences ethical decision-making
- g. Examine how significant others influence ethical decision-making
- h. Develop an effective ethics programme.
- i. Understand international business ethics.

Course Outline:

An Overview of Business Ethics: Business Ethics Defined, Social Responsibility, and Business Ethics, The Development of Business Ethics, Why study Business Ethics?, Framework for Studying Business Ethics.

Ethical issues in Business: Foundation of Ethical Conflict, Classifications of Ethical, Issues, Ethical Issues Related to Participants and Functional Areas of Business, Recognizing an Ethical Issue.

Applying Moral Philosophies to Business Ethics: Moral Philosophy Defined, Moral Philosophy Perspectives.

Social Responsibility: The Economic Dimension, The legal Dimension, The Ethical Dimension, the Philanthropic Dimension.

An Ethical Decision-Making Framework: Ethical Issue Intensity, Individual Factors: Stages of Cognitive Moral Development, Corporate Culture, Significant others, Opportunity, Business Ethics Evaluations and Intentions, Using the Ethical Decision-Making Framework to Improve Ethical Decisions.

How the Organization Influences Ethical Decision Making: Organizational Structure and Business Ethics, the role of Corporate Culture in Ethical Decision-Making, Group Dimensions of Organizational Structure and Culture, Implications of Organizational Relationships for Ethical Decisions.

The Role of Opportunity and Conflict: Opportunity, Conflict.

Development of an Effective Ethics Programme: An Effective Ethical Compliance, Programme, Codes of Ethics and Compliance Standards, High-Level Manager's Responsibility for Ethical Compliance Programme and the Delegation of Authority, Effective Communication of Ethical Standards, Establishing Systems to Monitor, Audit, and Enforce Ethical Standards, Continuous Improvement of the Ethical Compliance Programme, The Influence of Personal Values in Business Ethics Programmes, The Ethical Compliance Audit.

International Business Ethics: Ethical Perceptions and International Business, Culture As a Factor in Business, Adapting Ethical Systems to a Global Framework: Cultural Relativism, the Multinational Corporation, A universal Set of Ethics, Ethical Issues Around the Globe.

Text Books:

- Ferrell, O.C., and Fraedrich, John, Ethical Decision Making and Cases, New York: Houghton Mifflin.

- Introduction to Organizational Behaviour
 - Organizational Disciplines and topics
 - Psychological Perspective
 - Social-Psychological Perspectives
- Structure and Control in Organization
 - Introduction
 - Bureaucracy
 - Managerial Work
 - Contingency theory
 - Organizational Design
- Individual and Work Learning
 - Learning Theories
 - Learning and Work
- Stress
 - Types of Stress and Work
 - Occupational Stress Management
- Individual Differences
 - Personality and its factors
 - Personality dimensions and social learning
 - Intelligence
- Motivation and Job Satisfaction
 - Needs at Work
 - Theories of Motivation and job satisfaction
 - Correlates of Job satisfaction
 - Correlates of Job satisfaction
- Group and Work
 - Social Interaction
 - Dramaturgy and impression Management
 - Social Skill
- Group and Inter group Behaviour
 - Group Structure & Norms
 - Group Processes
 - How throne Studies
- Leadership
 - Leadership as an attribute
 - Leadership Style

- Patterns of Work
 - Work-the classical approach
 - Marx, Weber, & The critique of labor
 - Foucault & Disciplinary Power

- Conflict and Consent in Work
 - The labor Process debate
 - Work place control and resistance
 - Industrial conflict and industrial relations

- Organizational culture
 - Organizational culture and strategic management
 - Exploring organizational culture
 - Evaluating concept of culture

Books Recommended:

1. Fincham, R., & Rhodes, P. (2003), Principles of Organizational Behaviour, 3rd Oxford.
2. Noe, R., Hollenbeck, J. Gerhart, B., & Wright, P. (2006), Human Resource Management, 5th ed., McGraw Hill.
3. Newstrom John W. (2007), Organizational Behaviour, (12th Ed), McGraw Hill.
4. Luthan Fred, (2005), Organizational Behaviour, McGraw Hill Inc.
5. Robins, Stephen, (2005), Organizational Behaviour, McGraw Hill Inc.

- The Nature of Sociology
 - The study of social life
 - Exploring the global village
 - Sociology as a science
 - The Sociological imagination
 - The development of Sociology
 - Pioneers of Sociology
 - Nature, scope and subject matter of Sociology
 - Brief historical development of Sociology
 - Society and community
 - Relationship with other social sciences
 - Social Interaction Processes

- Social groups
 - Definition and functions
 - Types of social groups

- Social institutions
 - Definition
 - Structure and function of social institutions
 - Inter-relationships among various social institutions

- Culture and related concepts
 - Definition and aspects of culture
 - Elements of culture
 - Organization of culture
 - Other concepts, cultural relativism, sub cultures, ethnocentrism, culture lag

- Socialization and personality
 - Role and status
 - Socialization
 - Culture and personality

- Deviance and social control
 - Definition and types of deviance
 - Juvenile delinquency
 - Formal and information methods of social control

- Social stratification
 - Approach to study social stratification
 - Caste class and race as basics of social stratification

- Major perspectives in Sociology
 - Functionalist perspective

- Conflict perspective
- Interactionistic perspective
- Social Control and deviance
 - Agencies of social control
- Social stratification
 - Determinants of social stratification
 - Social mobility, types and definition
 - Dynamics of social mobility
- Concept of social movement
 - Theories of social movement
 - Social and cultural change
- Social and cultural change
 - Definition of social change
 - Dynamics of social change
 - Impact of globalization on society and culture
 - Resistance to change
- Collective behaviour
 - Definition
 - Characteristics
 - Causes
 - Types
 - Social movements
 - Mob and crowd behaviour

Books Recommended

1. Neulreck, Kenneth, J. 2005, Sociology: Diversity, Conflict and Change, Boston
2. Barnard, Andy. 2004. Sociology, Cambridge University Press
3. Giddens, Anthony, 2004, Sociology 4th edition, Cambridge Polity Press
4. Albrow, Martin, 2003, Sociology, London Routledge.
5. Richard, T. Schaefer, 2003, Sociology 5th edition, McGraw Hill College
6. Kendall, Diana, 2004. Sociology in our Times, 4th ed, Wadsworth
7. Tyler Melissa, Wallace Claire & Abbott Pamela, 2005, An Introduction to Sociology, 3rd ed. Routledge.

CRITICAL THINKING

3 Credit Hrs

- The Power of Critical Thinking
 - Claims and Reasons
 - Reasons and Arguments
 - Arguments in the Rough

- The Environment of Critical Thinking
 - Perils of Haunted Mind
 - Self and the Power of the Group
 - Subjective and Social Relativism
 - Skepticism
- Making Sense of Arguments
 - Arguments Basics
 - Patterns
 - Diagramming Arguments
 - Assessing Long Arguments
- Reasons for Belief and Doubt
 - Conflict Experts and Evidence
 - Personal Experience
 - Fooling Ourselves
 - Claims in the News
- Faulty Reasoning
 - Irrelevant Premises
 - Genetic Fallacy, Composition, Division
 - Appeal to the Person, Equivocation, Appeal to Popularity
 - Appeal to Tradition, Appeal to Ignorance, Appeal to Emotion
 - Red Herring, Straw Man
- Unacceptable Premises
 - Begging the Question, False Dilemma
 - Slippery Slope, Hasty Generalization
 - Faulty Analogy
- Deductive Reasoning: Propositional Logic
 - Connectives and Truth Values
 - Conjunction, Disjunction, Negation
 - Conditional, Checking for Validity
 - Simple Arguments, Tricky Arguments
 - Streamlined Evaluation
- Deductive Reasoning: Categorical Logic
 - Statements and Classes
 - Translations and Standard Form
 - Terms, Quantifiers
 - Diagramming Categorical Statements
 - Sizing up Categorical Syllogisms
- Inductive Reasons
 - Enumerative Induction
 - Sample Size, Representativeness, Opinion Polls

- Analogical Induction
- Casual Arguments, Testing for Causes
- Casual Confusions
- Inference to the Best Explanation
 - Explanations and Inference
 - Theories and Consistency
 - Theories and Criteria
 - Testability, Fruitfulness, Scope, Simplicity
 - Conservatism
- Judging Scientific Theories
 - Science and Not Science
 - The Scientific method, Testing Scientific Theories
 - Judging Scientific Theories
 - Copernicus versus Ptolemy, Evolution Versus Creationism
 - Science and Weird Theories
 - Making Weird Mistakes
 - Leaping to the Weirdest Theory, Mixing What Seems with What is
 - Misunderstanding the Possibilities
 - Judging Weird Theories
 - Crop Circles, Talking with the Dead

BOOKS RECOMMENDED

1. Vaughn Lewis, 2005, The Power of Critical Thinking, Oxford University Press.
2. Paulsen David W., Cederblom Jerry:2000, Critical Reasoning, Wadsworth
3. Restall Greg. 2005, Logic: An Introduction, Routledge

INTRODUCTION TO PHILOSOPHY

3 Credit Hrs

- Definition and Nature of Philosophy
- Theory of Knowledge
 - Opinion and Knowledge
 - Plato, the Republic Selection
 - Knowledge through Reason
 - Descartes Meditation on First Philosophy
 - Knowledge through Experience
 - Hume an Inquiry concerning Human Understanding (Selection)
 - Experience Structured by the Mind
 - Kant Critique of Pure Reason (Selection)
 - Knowing and Doing
 - James Pragmatism (Selection)
 - Knowledge and Emotion

- Jaggar Love and Knowledge (Selection)
- Philosophy of Religion
 - Proving that Existence of God
 - Anselm, Aquinas, Paley, Dawkins (Selection)
 - Justifying Religious Beliefs
 - Pascal Pensees (Selection)
 - James The will to Believe Selection
 - Freud the Future of An Illusion (Selection)
 - Confronting the Problems of Evil
 - Mackie Evil and Omnipotence (Complete)
 - Hick Philosophy of Religion (Selection)
- Metaphysics
 - Idealism and Materialism
 - Berkeley Three Dialogues Between Hylas and Pholonous (Selection)
 - Armstrong Naturalism, Materialism and First Philosophy (Selection)
 - The Mid-Body Problem
 - Descartes Meditations on First Philosophy (Selection)
 - O'Hear Introduction to the Philosophy of Science (Selection)
 - Dennett The Origins of Selves (Complete)
 - Pali Canon (Selection)
 - Penelhum Religion and Rationality (Selection)
- Freedom to Choose
 - Libertarianism
 - James The Dilemma of Determinism (Selection)
 - Taylor Metaphysics (Selection)
 - Determinism
 - Hospers Meaning and Free Will (Selection)
 - Skinner Walden Two (Selection)
 - Compatibilism
 - Stace Religion and the Modern Mind (Selection)
 - Radhakrishnan Indian Philosophy (Selection)
- Ethics
 - Fulfilling Human Nature
 - Aristotle Nicomachean Ethics (selection)
 - Loving God
 - Augustine The Morals of the Catholic Church and the City of God (Selection)
 - Following Natural Law
 - Aquinas Summa Theologiae (Selection)
 - Doing One's Duty
 - Kant Fundamental Principles of the Metaphysics of Morals (Selection)

- Maximizing Utility
- Mill Utilitarianism (Selection)
- Turning Values of Upside Down
- Nietzsche Human, All too Human and Beyond Good and Evil (Selection)
- Creating Ourselves
- Sartre Existentialism is a Humanism (Selection)
- Hearing the Feminine Voice
- Gilligan In a Different Voice (Selection)
- Baier What do Women Want in a Moral Theory (Selection)

- Political and Social Philosophy
 - The State as Natural
 - Plato the Republic (Selection)
 - Aristotle Politics (Selection)
 - The State as a Social Contract
 - Hobbes Philosophical Rudiments Concerning Government and Society (Selection)
 - Locke the Second Treatise of Government (Selection)
 - Liberty of the Individual
 - Mill On Liberty (Selection)
 - Alienation in Capitalism
 - Marx Economic and Philosophic Manuscripts of 1844 (Selection)
 - Justice and Social Trust
 - Rawls A Theory of Justice (Selection)
 - Nozick Anarchy, State, and Utopia (Selection)
 - Held Rights and Goods (Selection)
 - Women in Society
 - Wollstonecraft A Vindication of the Rights of Women (Selection)
 - De Behaviour The Second Sex (Selection)
 - The Value of Philosophy
 - Russel The Problems of Philosophy (Selection)
 - Midgley Philosophical Plumbing (Selection)

BOOKS RECOMMENDED

1. Abel Donald C., Stumpf Samuel Enoch, 2002. Elements of Philosophy: An Introduction, 4th Ed. McGraw Hill.
2. Scruton Roger, 2001. A short History of Modern Philosophy, 2nd ed. Routledge.

MANAGEMENT COURSES

ENTREPRENEURSHIP

Course Objective:

Entrepreneurship is an important component in the process of economic development. The purpose of this course is to analyse the theories of entrepreneurship and to go for case studies of successful entrepreneurs.

Course Contents:

Introduction: The concept of entrepreneurship, The economist view of entrepreneurship, The sociologist view, Behavioural approach, Entrepreneurship and Management

The Practice of Entrepreneurship: The process of entrepreneurship, Entrepreneurial Management, The entrepreneurial business, Entrepreneurship in service institutions, The new venture

Entrepreneurship and Innovation: The innovation concepts, Importance of innovation for entrepreneurship, Sources of innovative opportunities, The innovation process, Risks involved in innovation

Developing Entrepreneur: Entrepreneurial profile, Trait approach to understanding entrepreneurship, Factors influencing entrepreneurship, The environment, Socio cultural factors, Support systems

Entrepreneurship Organization: Team work, Networking organization, Motivation and compensation, Value system

Entrepreneurship and SMES: Defining SMEs, Scope of SMEs, Entrepreneurial managers of SME, Financial and marketing problems of SMEs

Entrepreneurial Marketing: Framework for developing entrepreneurial marketing, Devising entrepreneurial marketing plan, Entrepreneurial marketing strategies, Product quality and design

Entrepreneurship and Economic Development: Role of entrepreneur in the economic development generation of services, Employment creation and training, Ideas, knowledge and skill development, The Japanese experience

Case Studies of Successful Entrepreneurs

Text Books:

- Paul Burns and Jim Dew Hurst: Small Business and Entrepreneurship
- P.N. Singh: Entrepreneurship fo0r Economic Growth
- Peter F. Drucker: Innovation and Entrepreneurship Peter F. Drucker
- John B. Miner: Entrepreneurial Success

PRINCIPLES OF MANAGEMENT

Course Objectives:

This is a rudimentary course for the students of business administration. The focus of attention will be given to learning fundamental principles of management and of managing people and organization in a historical as well as contemporary world. Students are expected to develop analytical and conceptual framework of how people are managed in small, medium and large public and private national and international organizations.

Course Contents:

- Introduction, overview and scope of discipline
- The evolution and emergence of management thought
- Management functions
- Planning concepts, objectives, strategies and policies
- Decision making
- Organizing; departmentalization, line/staff authority, commitments and group decision making
- Staffing: principles of selection, performance, career planning
- Leading: Motivation, leadership, communication
- Controlling: the system and process and techniques of controlling
- Management and Society: future perspective

Text Books:

- Stephen P. Robins, Mary Coulter: Management
- H. Koontz Odonnel and H. Weihrich: Management
- Mc Farland: Management: Foundation and Practice
- Robert M. Fulmer: The New Management.