



Curriculum

for

The Degree of Bachelor

of

Metallurgy & Materials Engineering

(with effective from 2008-Batch and onwards)

CHAIRMAN

Department of Metallurgy & Materials Engineering

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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.

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CURRICULUM FOR THE DEGREE OF BACHELOR OF METALLURGY & MATERIALS ENGINEERING

First Semester

Sr.No	Name of Subjects	Credit Hours		
		Theory	Practical	Total
1	Functional English	3	0	3
2	Applied Physics	2	1	3
3	Calculus	3	0	3
4	Introduction to Computer Systems	2	1	3
5	Applied Chemistry	2	1	3
Total		12	3	15

Second Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Engineering Drawing Graphics	2	1	3
2	Workshop Practice	1	1	2
3	Introduction to Engineering Materials	3	-----	3
4	Mechanics of Materials	3	-----	3
5	Pakistan Studies	2	-----	2
6	Differential Equations	3	-----	3
Total		14	2	16
First Year Credit Hours		26	5	31

Third Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Communication Skills	3	0	3
2	Islamic Studies/Ethics	2	0	2
3	Numerical Analysis & Computer Programming	3	1	4
4	Instrumentation And Control	3	1	4
5	Physical Metallurgy	3	1	4
Total		14	3	17

Fourth Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Materials Thermodynamics	3	0	3
2	Engineering Ceramics & Glasses	3	1	4
3	Ferrous Metallurgy	3	1	4
4	Heat Treatment & Phase Transformations	3	1	4
5	Social Psychology	3	0	3
Total		15	3	18
Second Year Credit Hours		29	6	35

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Fifth Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Composite & Polymeric materials	3	1	4
2	Foundry Engineering	3	1	4
3	Industrial Safety and Environmental Engineering	3	0	3
4	Mathematical Methods	3	0	3
5	Production & Refining of Materials	3	1	4
Total		15	3	18

Sixth Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Manufacturing Technology	3	1	4
2	Inspection & Testing of Materials	3	1	4
3	Vacuum Technology	3	0	3
4	Welding and Joining Processes	3	1	4
5	Computer applications in Materials Engineering	1	1	2
Total		13	4	17
Third Year Credit Hours		28	7	35

Seventh Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Technical Report Writing & presentation Skills	3	0	3
2	Engineering Economics	3	0	3
3	Statistical Methods & Estimations	3	0	3
4	Advanced Materials	3	1	4
5	Powder Metallurgy	3	1	4
Total		15	2	17

Eighth Semester

Sr.No	Name of Subjects	Credit Hours		Total
		Theory	Practical	
1	Nuclear Materials	3	0	3
2	Metallurgical Plants and Quality Control	3	0	3
3	Corrosion, Protection and Prevention	3	1	4
4	Senior Design Project Part I & II	0	6	6
Total		09	7	16
Final Year Credit Hours		24	9	33

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First Semester

Title of the Course:	Functional English	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	1 st	3	0	3
<p>Objectives: To enhance language skills and develop critical thinking</p> <p>Course Contents:</p> <p>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.</p> <p>Comprehension: Answers to questions on a given text</p> <p>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)</p> <p>Listening: To be improved by showing documentaries/films carefully selected by subject teachers</p> <p>Translation skills: Urdu to English</p> <p>Paragraph writing: Topics to be chosen at the discretion of the teacher</p> <p>Presentation skills: Introduction</p> <p>Note: Extensive reading is required for vocabulary building</p> <p>Recommended books:</p> <p>a) Grammar</p> <ol style="list-style-type: none"> 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. ISBN0194313506 <p>b) Writing</p> <ol style="list-style-type: none"> 1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41. <p>c) Reading/Comprehension</p> <ol style="list-style-type: none"> 1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19453402 2. <p>d) Speaking</p>				

Title of the Course:	Applied Physics	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	1 st	2	1	3
<p>Specific Objectives of Course: To provide in-depth knowledge of the subject.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Stan Gibilisco, “Applied Physics”, McGraw-Hill, 2002, ISBN007138201122 • Kittle C, “ Introduction to Solid State Physics”, Willey New York, 2000 • Arthur Beiser, “Applied Physics”, McGraw-Hill, 4th ed., 2004 ISBN- 0071426116 • John. D Cutnel, “Physics” Wiley; 7th ed., 2006, ISBN00471663158 • Douglas, C., Giancoli, “Physics Principles and Applications”, Pearson Education, 2004 				

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Title of the Course:	Calculus	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	1st	3	0	3
<p>Specific Objectives of Course: To build the basic calculus and analytical geometry background</p> <p>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 nonlinear 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 Quadrature. 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.</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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, • Steven George Krantz, "Calculus Demystified" , McGraw-Hill, 2002, ISBN 0071393080 • Edmund Landau, "Differential and Mathematical Calculus", American Mathematical Society, 2001 • Douglas D. Downing, "Calculus", Barron's Educational Series, 1996, ISBN 0812091418 23 				

Title of the Course:	Introduction to Computer Systems	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	1st	2	1	3
<p>Specific Objectives of Course: This course focuses on a breadth-first coverage of computer: introducing software engineering and information technology.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

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Title of the Course:	Applied Chemistry	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	1st	2	1	3
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: <ul style="list-style-type: none">• Hyman D. Gasser, "Applied Chemistry", Springer 2002, ISBN0306465531• 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				

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Second Semester

Title of the Course:	Engineering Drawing and Graphics	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	2 nd	2	1	3
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: <ul style="list-style-type: none">• 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				

Title of the Course:	Workshop Practice	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	2 nd	1	1	2
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: <ul style="list-style-type: none">• 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				

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Title of the Course:	Introduction to Engineering Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	2 nd	3	0	3
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:				
<ul style="list-style-type: none">• 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				

Title of the Course:	Mechanics of Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	2 nd	3	0	3
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, photo-elastic 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:				
<ul style="list-style-type: none">• Benham, P.P., Crawford, R.J. and Armstrong, J.P., "Mechanics of Engineering Materials", Pitman, 2000 or latest edition• H.Ferdinand BeerH, "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				

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Title of the Course:	Pakistan Studies (Compulsory)	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	2nd	2	0	2
<p>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.</p> <p>Course Outline</p> <p>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.</p> <p>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</p> <p>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</p> <p>Books Recommended</p> <ul style="list-style-type: none">• Burki, Shahid Javed. <i>State & Society in Pakistan</i>, The Macmillan Press Ltd 1980.• Akbar, S. Zaidi. <i>Issue in Pakistan's Economy</i>. Karachi: Oxford University Press, 2000.• S.M. Burke and Lawrence Ziring. <i>Pakistan's Foreign policy: An Historical analysis</i>. Karachi: Oxford University Press, 1993.• Mehmood, Safdar. <i>Pakistan Political Roots & Development</i>. Lahore, 1994.• Wilcox, Wayne. <i>The Emergence of Banglades.</i>, Washington: American Enterprise, Institute of Public Policy Research, 1972.• Mehmood, Safdar. <i>Pakistan Kayyun Toota</i>, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.• Amin, Tahir. <i>Ethno - National Movement in Pakistan</i>, Islamabad: Institute of Policy Studies, Islamabad.• Ziring, Lawrence. <i>Enigma of Political Development</i>. Kent England: WmDawson & sons Ltd, 1980.• Zahid, Ansar. <i>History & Culture of Sindh</i>. Karachi: Royal Book Company, 1980.• Afzal, M. Rafique. <i>Political Parties in Pakistan</i>, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.• Sayeed, Khalid Bin. <i>The Political System of Pakistan</i>. Boston: Houghton Mifflin, 1967.• Aziz, K.K. <i>Party, Politics in Pakistan</i>, Islamabad: National Commission on Historical and Cultural Research, 1976.• Muhammad Waseem, <i>Pakistan Under Martial Law</i>, Lahore: Vanguard, 1987.• Haq, Noor ul. <i>Making of Pakistan: The Military Perspective</i>. Islamabad: National Commission on Historical and Cultural Research, 1993.				

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Title of the Course:	Differential Equations	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	2 nd	3	0	3
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. Heavieside's expansion formula. Simple applications. Limit, continuity, zeros and poles, Cauchy-Reimann Equations, conformal transformations, contour integration				
Lab Outline: N/A				
Recommended Books:				
<ul style="list-style-type: none">• 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				

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Third Semester

Title of the Course:	Communication Skills	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	3 rd	3	0	3
<p>Objectives: To enable the students to meet their real life communication needs</p> <p>Course Contents</p> <p>Paragraph writing: Practice in writing a good, unified and coherent paragraph</p> <p>Essay writing: Introduction</p> <p>CV and job application:</p> <p>Translation skills: Urdu to English</p> <p>Study skills: Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension</p> <p>Academic skills: Letter / memo writing and minutes of the meeting, use of library and internet resources</p> <p>Presentation skills: Personality development (emphasis on content, style and pronunciation)</p> <p>Note: documentaries to be shown for discussion and review</p> <p>Recommended books:</p> <p>a) Grammar</p> <ol style="list-style-type: none">1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises, Third edition. Oxford University Press 1986. ISBN 019 431350 6. <p>b) Writing</p> <ol style="list-style-type: none">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 19435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing). <p>c) Reading</p> <ol style="list-style-type: none">1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 4534030.2. Reading and Study Skills by John Langan3. Study Skills by Richard Yorky.				

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Title of the Course:	ISLAMIC STUDIES (Compulsory)	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	3 rd	2	0	2
<p>Objectives of the : 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</p> <p>Components of Teaching of the Course</p> <p>Unit No.1: Introduction to Quranic Studies: Basic Concepts of Quran,, History of Quran, Uloom-ul -Quran</p> <p>Unit No.2 : Study of selected text of Holly Quran I: Verses of Surah Al-Baqra Related to Faith(Verse No-284-286), Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18), Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11), Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77), Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)</p> <p>Unit No.3 : Study of selected text of Holly Quran II: Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.), Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment, Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)</p> <p>Unit No.4: Seerat of Holy Prophet (S.A.W)I: Life of Muhammad Bin Abdullah (Before Prophet Hood),Life of Holy Prophet (S.A.W) in Makkah, Important Lessons Derived from the life of Holy Prophet in Makkah</p> <p>Unit No.5: Seerat of Holy Prophet (S.A.W) II: Life of Holy Prophet (S.A.W) in Madina, Important Events of Life Holy Prophet in Madina, Important Lessons Derived from the life of Holy Prophet in Madina</p> <p>Unit No.6: Introduction to Sunnah: Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom –ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah.</p> <p>Unit No.7 Selected Study from Text of Hadith:</p> <p>Unit No.8 Introduction to Islamic Law & Jurisprudence: Basic Concepts of Islamic Law & Jurisprudence, History & Importance of Islamic Law & Jurisprudence. Sources of Islamic Law & Jurisprudence, Nature of Differences in Islamic Law, Islam and Sectarianism</p> <p>Unit No.9: Islamic Culture & Civilization: Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues.</p> <p>Unit No.10: Islam & Science: Basic Concepts of Islam & Science</p> <p>Unit No. 11: Islamic Economic System: Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce</p> <p>Unit No.12: Political System of Islam : Basic Concepts of Islamic Political System, Islamic Concept of Sovereignty, Basic Institutions of Govt. in Islam.</p> <p>Unit No.13: Islamic History: Period of Khlaft-e-Rashida, Period of Ummayyads, Period of Abbasids.</p> <p>Unit No.14 : Social System of Islam: Basic Concepts of social system of Islam, Elements of family, Ethical values of Islam.</p> <p>REFERENCE BOOKS:</p> <ul style="list-style-type: none"> • Hameedullah Muhammad, “Emergence of Islam” , IRI, Islamabad. • Hameedullah Muhammad, “Muslim conduct of state”. • Hameedullah Muhammad ‘ Introduction to Islam. • Hussain Hamid Hassan, An Introduction to the Study of Islamic Law: leaf Publication Islamabad, Pakistan. • Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, international Islamic University, Islamabad (1993), • Mir Waliullah, “Muslim Jrisprudence and the Quranic Law of Crimes”, Islamic Book Service (1982) • H.S. Bhatia, “Studies in Islamic Law, Religion and Society”Deep & Deep Publications New Delhi (1989), • Dr. Muhammad Zia-ul-Haq, “Introduction to Al Sharia Al Islamia” Allama Iqbal Open University, Islamabad (2001) 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Numerical Analysis and Computer Programming	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	3 rd	3	1	4
<p>Specific Objectives of Course: To enable students using structured programming techniques in suitable programming languages and implement numerical solutions using computer-based techniques.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

Title of the Course:	Instrumentation and Control	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	3 rd	3	1	4
<p>Specific Objectives of Course: To provide knowledge about the instrumentation and control systems used in materials and metallurgical engineering</p> <p>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).</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Clair Bayne “Applied Electricity and Electronics” Goodheart-Willcox Pub, 2004, TISBN: 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 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Physical Metallurgy	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	3 rd	3	1	4
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:				
<ul style="list-style-type: none">• Reed Hill, R.E. and Abbaschian, R., “Physical Metallurgy Principles”, 3rd ed., PWS, 2000 or latest edition.• Sydney, H. Avenner, “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.				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Fourth Semester

Title of the Course:	Materials Thermodynamics	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	4 th	3	0	3
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:				
<ul style="list-style-type: none">• 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., “TAn Introduction to Aspects of Thermodynamics & KineticsT”, Giro Pr; 2nd ed., DecT 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				

Title of the Course:	Engineering Ceramics and Glasses	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	4 th	3	1	4
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:				
<ul style="list-style-type: none">• 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				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Ferrous Metallurgy	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	4 th	3	1	4
<p>Specific Objectives of Course: To provide in-depth knowledge of iron and steel making technology.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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. 				

Title of the Course:	Heat Treatment and Phase Transformations	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	4 th	3	1	4
<p>Specific Objectives of Course:</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Social Psychology	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	4 th	3	0	3
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:				
<ul style="list-style-type: none">• 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				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Fifth Semester

Title of the Course:	Composite and Polymeric Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	5 th	3	1	4
<p>Specific Objectives of Course: To provide knowledge of composite and polymeric materials.</p> <p>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, methylacrylate (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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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:	Foundry Engineering	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	5 th	3	1	4
<p>Specific Objectives of Course: To provide understanding of foundry process of materials.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Peter, Beeley “Foundry Technology”, Butterworth-Heinemann; 2nd ed., 2006 • Chastain Stephen D, “HTMetal CastingTH,” Chastain Publishing, 2003 • Brooks. Nick, “HTMould making and CastingTH” Crowood Press, 2005 • Campbell. John, “HTCastingsTH” Butterworth-Heinemann; 2nd ed., 2003. • Chastain. Stephen D, “Iron Melting Cupola Furnaces for the Small Foundry” Stephen D. Chastain, 2000 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Industrial Safety and Environmental Engineering	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	5 th	3	0	3
<p>Specific Objectives of Course: To provide thorough knowledge of industrial safety and engineering environment.</p> <p>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.</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

Title of the Course:	Mathematical Methods	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	5 th	3	0	3
<p>Specific Objectives of Course: To provide in-depth knowledge of mathematical methods.</p> <p>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, adjoin 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</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Production and Refining of Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	5th	3	1	4
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 alminum 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 Aluminothermic 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:				
<ul style="list-style-type: none">• Gill, C.B., “ Non-Ferrous Extractive Metallurgy”, Krieger, 2000• Polmear, I.J., “Light Alloys”, Edward Arnold, 2000• Balá and Zcaron. P “HTExtractive Metallurgy of Activated Minerals”TH Elsevier Science, 2000• Roundhill, Max D., “TExtraction of Metals from Soils and Waters”T, Springer; 1 Springer, 2001				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Sixth Semester

Title of the Course:	Manufacturing Technology	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	6th	3	1	4
<p>Specific Objectives of Course: To understand manufacturing processes available for materials.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

Title of the Course:	Inspection and Testing of Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	6th	3	1	4
<p>Specific Objectives of Course: To provide thorough understanding of inspection and testing of materials</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory.</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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. 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Vacuum Technology	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	6 th	3	0	3
<p>Specific Objectives of Course: To impart knowledge on vacuum techniques used in the field of materials and metallurgy.</p> <p>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 bio-bombardment heating, valves used in vacuum technology.</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

Title of the Course:	Welding and Joining Processes	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	6 th	3	1	4
<p>Specific Objectives of Course: To provide knowledge of joining processes of materials.</p> <p>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, nonconsumable tungsten electrodes, gas supply and equipment, and TIG joint preparation, spot welding, electrode wire, gas supply, spray metal transfer method, COB2B – 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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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., "HTManual on Joining Processes by Welding, Brazing and SolderingTH" Minerva Press, 2003 • Thomas Böllinghaus and Herold. Horst, "Hot Cracking Phenomena in Welds" Springer; 1st ed., 2005 • HCreative Publishing International, "Welding Basics" Creative Publishing International, 2003 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Computer Application in Materials Engineering	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	6 th	1	1	2
<p>Specific Objectives of Course: To provide knowledge of applications of computer in Materials engineering.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none">• 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				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Seventh Semester

Title of the Course:	Technical Report Writing and Presentation Skills	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	7 th	3	0	3
<p>Objectives: To enhance language skills and develop critical thinking</p> <p>Course Contents:</p> <p>Presentation skills:</p> <p>Essay writing: Descriptive, narrative, discursive, argumentative</p> <p>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)</p> <p>Technical Report writing</p> <p>Progress report writing</p> <p>Note: Extensive reading is required for vocabulary building</p> <p>Recommended books:</p> <p>a) Essay Writing and Academic Writing</p> <p>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).</p> <p>2. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.</p> <p>3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.</p> <p>b) Presentation Skills</p> <p>c) Reading</p> <p>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).</p>				

Title of the Course:	Engineering Economics	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	7 th	3	0	3
<p>Specific Objectives of Course: To impart knowledge of engineering economy.</p> <p>Course Outline:</p> <p>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</p> <p>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.</p> <p>Lab Outline: N/A</p> <p>Recommended Books.</p> <ul style="list-style-type: none"> • 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 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Statistical Methods & Estimation	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	7 th	3	0	3
<p>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</p> <p>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.</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Jyotiprasad Medhi "Statistical Methods", New Age Publishers, 2005, ISBN 8122404197 • Kenneth. Lange, "Statistical 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 				

Title of the Course:	Advanced Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	7 th	3	1	4
<p>Specific Objectives of Course: To provide students thorough understanding of advanced materials.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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., "TSuperalloys: A Technical Guide", TIHS, 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 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Powder Metallurgy	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	7 th	3	1	4
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:				
<ul style="list-style-type: none">• 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				

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Eighth Semester

Title of the Course:	Nuclear Materials	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	8th	3	0	3
<p>Specific Objectives of Course: To impart knowledge on nuclear materials.</p> <p>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.</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

Title of the Course:	Metallurgical Plants and Quality Control	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	8th	3	0	3
<p>Specific Objectives of Course: To provide knowledge of metallurgical plants and the quality control procedures used.</p> <p>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, 21 JIS GOST and ISO. Pakistan Standards, Quality assurance for final products, Measures for quality control.</p> <p>Lab Outline: N/A</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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. 17P th P, “Non-destructive Testing and Quality Control”, American Society for Metals USA, 2005 				

DEPARTMENT OF METALLURGY AND MATERIALS ENGINEERING

Dawood College of Engineering & Technology, Federal Degree Awarding Institute, Karachi

Title of the Course:	Corrosion, Protection and Prevention	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	8 th	3	1	4
<p>Specific Objectives of Course: To impart knowledge of corrosion protection and prevention techniques.</p> <p>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.</p> <p>Lab Outline: Lab Manuals will be available in the concerned laboratory</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • 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 				

Title of the Course:	Senior Design Project Part-1	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	8 th	0	3	3
<p>Specific Objectives of Course: To provide students learning of research techniques used in the industry.</p> <p>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</p> <p>Lab Outline: Experimental work will be carried out in the relevant laboratories/industry according to the nature of the project</p> <p>Recommended Books: Reference book and journal for latest literature survey and methodology</p>				

Title of the Course:	Senior Design Project Part-II	Credit Hours		
Pre-requisites:		Th	Pr	Total
Semester:	8 th	0	3	3
<p>Specific Objectives of Course: Same as Part-I</p> <p>Course Outline: Same as Part-I</p> <p>Lab Outline: Experimental work will be carried out in the relevant laboratories/industry according to the nature of the project</p> <p>Recommended Books: Reference book and journal for latest literature survey and methodology</p>				