

Courses of Reading for

**B.Sc. (Engineering) Metallurgy and Materials Engineering
Programme
(Semester System)
Revised for Session 2015 onwards**



**Department of Metallurgy and Materials Engineering
College of Engineering and Emerging Technologies
(CEET)**

**Faculty of Engineering & Technology
University of the Punjab, Lahore**

Course Code Methodology:

- The first two/three alphabets in a course indicate the discipline, for example, B.Sc. (Engg) for Metallurgy and Materials Engineering.
- The first digit in the course code indicates the academic year during which the course is offered, for example, the first digit 2 in “MME 214 Material Thermodynamics” indicates that this course is offered during the 2nd academic year.
- The second digit in the course code indicates the semester of the academic year, for example, the second digit 1 in “MME 214 Material Thermodynamics” indicates that this course is offered during the 1st semester of the 2nd academic year.
- The Third digit in the course code indicates the serial number of the course amongst the courses being taught in a semester, for example, the third digit 4 in “MME 214 Material Thermodynamics” indicates that it is the fourth course being taught in the 1st semester of the 2nd academic year.
- NS stands for Natural sciences, CS stands for computer sciences, ME stands for Mechanical Engineering, HS stands for Humanities, MS stands for Management sciences, MIN stands for Mining Engineering and CHE stands for Chemical Engineering.

Courses of Reading for B.Sc (Engg) Metallurgy & Materials Engineering

First Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I	HS 111	Functional English	3	0	3
II	NS 112	Applied Physics	3	1	4
III	NS 113	Calculus	3	0	3
IV	CS 114	Introduction to Computing and Computer systems	2	1	3
V	MME 115	Introduction to Metallurgy and Materials Engineering	2	0	2
VIII	HS 116	Islamic Studies/Ethics*	2	0	2
Total			15	2	17

Second Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I.	ME 121	Engineering Drawing and CAD	1	1	2
II.	ME 122	Workshop practice	1	1	2
III.	NS 123	Applied Chemistry	3	1	4
IV.	ME 124	Engineering Mechanics	3	0	3
V.	HS 125	Pakistan Studies	2	0	2
VI.	MME 126	Metallurgical Engineering Calculations	3	0	3
VII.	NS 127	Differential Equations and Applied Techniques	3	0	3
Total			16	3	19

*Only for non-Muslim students in place of Islamic Studies.

Third Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I.	HS 211	Communication skills and Report writing	3	0	3
II.	MIN 212	Mineral Processing	3	1	4
III.	CS 213	Numerical Analysis and Computer Programming	2	1	3
IV.	MME 214	Materials Thermodynamics and Kinetics	3	0	3
V.	MME 215	Materials Science	3	0	3
VI.	MME 216	Iron Manufacturing Technology	3	0	3
Total			17	2	19

Fourth Semester

Paper	Course Code	Course Title	Lecture Hours	Lab Hours	Credit Hours
I.	MME 221	Mechanical Behaviour of Engineering Materials	3	1	4
II.	MME 222	Engineering Ceramics and Glasses	3	1	4
III.	MME 223	Physical Metallurgy	3	1	4
IV.	MME 224	Foundry Engineering-1	3	1	4
V.	HS 225	Critical Thinking	2	0	2
Total			14	4	18

Fifth Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I.	MME 311	Polymeric and Composite Materials	3	1	4
II.	MME 312	Foundry Engineering-II	3	1	4
III.	MME 313	Heat treatment and Phase Transformation	3	1	4
IV.	MME 314	Steel Manufacturing Technology	3	0	3
V.	MME 315	Manufacturing Processes	3	0	3
Total			15	3	18

Sixth Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I.	MME 321	Corrosion Engineering	3	1	4
II.	MS 322	Industrial Safety and Environmental Engineering	3	0	3
III.	MME 323	Welding and Joining Processes	3	1	4
IV.	MME 324	Non-Ferrous Metallurgy	3	0	3
V.	CS 325	Computer Applications in Materials Engineering	2	1	3
Total			14	3	17

Seventh Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I.	MME 411	Surface Engineering and Tribology	3	1	4
II.	MS 412	Production and Quality Management	2	0	2
III.	MME 413	Advanced Materials	3	0	3
IV.	HS414	Industrial sociology and psychology	2	0	2
V.	MME 415	Materials Characterization	2	1	3
VI.	MME 416 [^]	Research Project	0	3	3
Total			12	5	17

Eighth Semester

Paper	Course Code	Course Title	Lecture Hours	Lab. Hours	Credit Hours
I.	MS 421	Industrial Management and Process Economics	2	0	2
II.	MME 422	Instrumentation and Process Control	2	1	3
III.	NS 423	Statistical Methods and Estimation	2	0	2
IV.	MME 424	Powder Metallurgy	2	0	2
V.	MME 416 [^]	Research Project	0	3	3
Total			8	4	12

Total Credit Hours of the Course = 137

First Semester

Paper I

Course Code: HS 111

Functional English

Credit Hours: 3(3,0)

Objective:

To improve students English proficiency in line with the requirement of various international testing systems.

Course Outline

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

a) Grammar

1. A. J. Thomson and A. V. Martinet, "Practical English Grammar" Exercises 1. 3rd Edition. Oxford University Press. 1997.

2. A. J. Thomson and A. V. Martinet, "Practical English Grammar", Exercises 2. 3rd Edition. Oxford University Press, 1997.

b) Writing

1. S. Brinand and F. Grellet , "Writing. Intermediate" Oxford Supplementary Skills. Fourth Impression, 1993.

c) Reading/Comprehension

1. B. Tomlinson and R. Ellis, "Reading. Upper Intermediate Oxford Supplementary Skills", Third Impression, 1992.

Paper II

Course Code: NS 112

Applied Physics

Credit Hours: 4(3,1)

Pre-requisites: F.Sc. (Pre-Engineering)

Objective

To provide in-depth knowledge of physics relevant to the Metallurgy and Materials Engineering discipline.

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

1. D. Halliday and R. Resnik, "Fundamentals of Physics", Wiley, 2010
2. D. Ewen and N. Schurter, "Applied Physics" Prentice Hall, Ed. 10, 2011
3. S. Gibilisco, "Applied Physics", McGraw-Hill, 2002
4. A. Beiser, "Applied Physics", McGraw-Hill, 4th Ed., 2004
5. J. D. Cutnel, "Physics" Wiley; 8th ed., 2009,
6. C. Douglas, Giancoli, "Physics Principles and Applications", Pearson Education, 2004
7. S. Gibilisco, "Applied Physics", McGraw-Hill, 2002.
8. C. Kittle, "Introduction to Solid State Physics", Wiley, 2000.
9. A. Beiser, "Applied Physics", McGraw-Hill, 2004.

Paper III

Course Code: NS 113

Calculus

Credit Hours: 3(3,0)

Pre-requisites: F.Sc. (Pre-Engineering)

Objectives

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 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.

Recommended Books

1. E. William, B. Richard, and C. Diprima, "Calculus", John Wiley, 2006
2. R. Courant and F. John, "Introduction to Calculus and Analysis" Springer, 2000
3. S. G. Krantz, "Calculus Demestified" , McGraw-Hill, 2002
4. E. Landau, "Differential and Mathematical Calculus", American Mathematical Society, 2001
5. D.D. Downing, "Calculus", Barron's Educational Series, 1996

Paper IV

Course Code: CS 114

Introduction to Computing and Computer Systems

Credit Hours: 3(2,1)

Pre-requisites: F.Sc. (Pre-Engineering)

Objectives

This course focuses on fundamentals of computers, 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

1. O. Leary "Computing Essentials 2012", McGraw-Hills, 22nd Edition 2011.
2. A. J. Herbert, R. M. Needham, "Computer Systems", Springer, 2004.
3. G. H. MacEwen, "Introduction to Computer Systems", McGraw-Hill, 2007
4. J. A. Aseltine, "Introduction to Computer Systems", Wiley, 2007

5. N. A. B. Gray, "Introduction to Computer Systems" Prentice-Hall 1987.

Journals/Periodicals

Paper V

Course Code: MME 115

Introduction to Metallurgy and Materials Engineering

Credit Hours: 2(2,0)

Pre-requisites: F.Sc. (Pre-Engineering)

Objectives

To introduce students about the basic knowledge of Metallurgy and Materials Engineering.

Course Outline

Objectives of Metallurgy, Importance of Metallurgy, Metallurgical Engineer's Jobs, Scope of Metallurgy in Pakistan, Branches of Metallurgy, Classification of Elements, Metals & Their Characteristics, Classification of Metals and alloys, Non-metals, raw materials for engineering materials: their availability and demand, Introduction to polymers, ceramics and composite materials and their properties and applications, An introduction to new breeds of engineering materials e.g., shape memory materials, smart materials, biomaterials, electrical, magnetic and optical materials. Materials of aerospace and transportation industries, Material Selection criteria

Recommended Books

1. S. H. Avner, "Introduction to Physical Metallurgy", Tata McGraw-Hill, Inc., 1997.
2. R. W. Heine, C. R. Loper and P. C. Rosenthal, "Principles of Metal Casting", Tata McGraw-Hill, Inc. 1976.
3. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley and Sons, 8th Edition, 2009.
4. W.F. Smith, "Principles of Materials Science Engineering", McGraw Hill, 1995.

Paper VI

Course Code: HS 116

Islamic Studies/Ethics

Credit Hours: 2(2,0)

Objectives

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 skills to perform prayers and other worships
4. To enhance the skill of the students for understanding of issues related to faith and religious life

اهداف و مقاصد

- ۱۔ طلبہ کو قرآن وحدیث سے استفادہ کے قابل بنانا۔
- ۲۔ طلبہ کے قلوب و اذہان میں قرآن وسنت کی روح اور علم کو راسخ کرنا۔
- ۳۔ طلبہ میں اسوہ ختم المرسلین صلی اللہ علیہ وسلم کے اتباع اور حجت رسولؐ کا جذبہ پیدا کرنا۔
- ۴۔ اسلام کی بنیادی تعلیمات کا فہم آسان بنانا اور طلبہ کی اسلامی بنیادوں پر تربیت کرنا۔
- ۵۔ امت مسلمہ کو درپیش عصر جدید کے چیلنجوں سے طلبہ کو آگاہ کرنا۔

نصابی تفصیلات (تفصیل المنهج الدراسي)

1. القرآن الكريم

الف. قواعد لغة القرآن (قرآنی گرامر)

- الماضی و المضارع، الأمر والنهی، الجملة الاسمية والفعلیة، المركب الإضافی والتوصیفی، الضمان و حروف الجر
- ب۔ منتخب قرآنی آیات کا لغوی و بالمحاویرہ ترجمہ و تشریح (ضمیمہ "الف")
- (ترجمة و شرح نخبة من الآيات القرآنية لغة وسلاسة: ملحق "الف")

2. الحديث النبوی

- منتخب احادیث نبویہ کا لغوی و بالمحاویرہ ترجمہ اور تشریح (ضمیمہ "ب")
- (ترجمة و شرح نخبة من الاحادیث النبوية لغة وسلاسة: ملحق "ب")

نوٹ: اساتذہ کرام آیات واحادیث کی تعلیم وتدريس کے دوران لغوی اور بالمحاویرہ ترجمہ کے ضمن میں مندرجہ بالا قواعد عربیہ کی تطبیق کا اہتمام کریں۔

3. سیرۃ النبی صلی اللہ علیہ وسلم

- (۱) مطالعہ سیرت کی ضرورت و اہمیت (اہمیت و ضرورت دراستہ السیرۃ)
- (۲) نبی کریم صلی اللہ علیہ وسلم کی حکمت انقلاب (الحکمة الثوریۃ للنبی الکریم صلی اللہ علیہ وسلم)
(ہجرت، مواخات، یشاق مدینہ، صلح حدیبیہ، خطبہ جہ الوداع)
- (۳) تزکیہ نفس اور تعمیر سیرت و شخصیت کا نبوی منہاج اور عملی نمونہ
(المنہج النبوی لتکوین الشخصیۃ و السیرۃ و تزکیۃ النفس و نماذجہا الفعلیۃ)
(عشرہ مبشرۃ، اممات المؤمنین، اولاد النبی)
- (۴) تشکیل اجتماعی و معاشرت اور اسوۂ حسنہ (تکوین المجتمع و المعاشرة فی ضوء الاسوۃ الحسنۃ)

4. اسلامی تہذیب و ثقافت (الحضارة والثقافة الاسلامیۃ)

- (الف) اسلامی تہذیب و ثقافت کے خصائص
توحید، روحانیت، تصور مسوئیت، انسانی عظمت و مساوات، عالمگیر اخوت،
عدل اجتماعی، اخلاقی اقدار، انسانی حقوق، رواداری، اعتدال و توازن
- (ب) اسلامی تہذیب و ثقافت کے عالمی اثرات
- (ج) مغربی تہذیب و ثقافت اور اسلام
 - (i) مغربی تہذیب و ثقافت کے خصائص و اثرات
 - (ii) تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ

معروضی سوالات: پورے نصاب پر مشتمل ہوں گے۔

نوٹ: ایڈہاک کمیٹی نے اس نصاب برائے اسلامیات لازمی کے بی اے، بی ایس سی، بی کام نیز گریجویٹیشن کے دیگر تمام پروگراموں کی سطح پر ستمبر 2010ء سے شروع ہونے والے تعلیمی سال سے نفاذ کی سفارش کی۔

نوٹ: اس مضمون کی تدریس و امتحانات کے لئے اردو، عربی اور انگریزی زبانوں کی اجازت ہے۔

ضميمه الف: منتخب آيات قرآن
(ملحق الف: نخبة من آيات القرآن)

البقرة (٢) الآية ١ تا ٥ و ٢٨٣ تا ٢٨٦ (إيمانيات)

الَّذِينَ هَدَىٰ لِلْمَعْرِفَةِ [2] الَّذِينَ يُؤْمِنُونَ بِالْغَيْبِ وَيُقِيمُونَ
الصَّلَاةَ وَمِمَّا رَزَقْنَاهُمْ يُنْفِقُونَ [3] وَالَّذِينَ يُؤْمِنُونَ بِمَا أُنزِلَ إِلَيْكَ وَمَا أُنزِلَ مِنْ قَبْلِكَ وَ
بِالْآخِرَةِ هُمْ يُوقِنُونَ [4] أُولَٰئِكَ عَلَىٰ هُدًى مِنْ رَبِّهِمْ وَأُولَٰئِكَ هُمُ الْمُفْلِحُونَ [5]
لِلَّهِ مَا فِي السَّمَاوَاتِ وَمَا فِي الْأَرْضِ وَإِنْ تُبَدُّوا مَا فِي أَنْفُسِكُمْ أَوْ تُخَفُّوهُ يَحَاسِبْكُمْ بِهِ اللَّهُ
فَيَغْفِرُ لِمَنْ يَشَاءُ وَيُعَذِّبُ مَنْ يَشَاءُ وَاللَّهُ عَلَىٰ كُلِّ شَيْءٍ قَدِيرٌ [284] آمَنَ الرَّسُولُ بِمَا أُنزِلَ
إِلَيْهِ مِنْ رَبِّهِ وَالْمُؤْمِنُونَ كُلٌّ آمَنَ بِاللَّهِ وَمَلَكِهِ وَكِتَابِهِ وَرُسُلِهِ لَا نَفَرَقَ بَيْنَ أَحَدٍ مِنْ رُسُلِهِ وَ
قَالُوا سَمِعْنَا وَأَطَعْنَا غُفْرَانَكَ رَبَّنَا وَإِلَيْكَ الْمَصِيرُ [285] لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا لَهَا مَا
كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَا إِنْ نَسِينَا أَوْ أَخْطَأْنَا رَبَّنَا وَلَا تَحْمِلْ عَلَيْنَا إَصْرًا
كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِنْ قَبْلِنَا رَبَّنَا وَلَا تُحَمِّلْنَا مَا لَا طَاقَةَ لَنَا بِهِ وَاعْفُ عَنَّا وَاعْفِرْ لَنَا وَ
ارْحَمْنَا أَنْتَ مَوْلَانَا فَانصُرْنَا عَلَى الْقَوْمِ الْكَافِرِينَ [286]

الأحزاب (٣٣) الآية ٦، ٢١، ٣٢، ٣٣، ٣٤، ٥٦ تا ٥٨، ٥٩

(تخصّصات نبويه: اسوه حسنه، ختم نبوت، مقام رسالت، ناموس رسالت، ازواج النبی)
النَّبِيُّ أَوْلَىٰ بِالْمُؤْمِنِينَ مِنْ أَنْفُسِهِمْ وَأَزْوَاجُهُ أُمَّهَاتُهُمْ وَأُولُوا الْأَرْحَامِ مِنْ بَعْضِهِمْ أَوْلَىٰ بِبَعْضٍ فِي
كِتَابِ اللَّهِ مِنَ الْمُؤْمِنِينَ وَالْمُهَاجِرِينَ إِلَّا أَنْ تَفْعَلُوا إِلَىٰ أَوْلِيَائِكُمْ مَعْرُوفًا كَانَ ذَلِكَ فِي الْكِتَابِ
مَسْطُورًا [6]

لَقَدْ كَانَ لَكُمْ فِي رَسُولِ اللَّهِ أُسْوَةٌ حَسَنَةٌ لِمَنْ كَانَ يَرْجُوا اللَّهَ وَالْيَوْمَ الْآخِرَ وَذَكَرَ اللَّهَ كَثِيرًا [21]
يُنِسَاءَ النَّبِيِّ لَسْتُنَّ كَأَحَدٍ مِنَ النِّسَاءِ إِنْ اتَّقَيْتُنَّ فَلَا تَخْضَعْنَ بِالْقَوْلِ فَيَطْمَعَ الَّذِي فِي قَلْبِهِ مَرَضٌ
وَقُلْنَ قَوْلًا مَعْرُوفًا [32] وَقُرْآنَ فِي يُسُوتِكُنَّ وَلَا تَبَرَّجْنَ تَبَرُّجَ الْجَاهِلِيَّةِ الْأُولَىٰ وَأَقِمْنَ
الصَّلَاةَ وَآتِينَ الزَّكَاةَ وَأَطِعْنَ اللَّهَ وَرَسُولَهُ إِنَّمَا يُرِيدُ اللَّهُ لِيُذْهِبَ عَنْكُمُ الرِّجْسَ أَهْلَ الْبَيْتِ
وَيُطَهِّرَكُمْ تَطْهِيرًا [33]

مَا كَانَ مُحَمَّدٌ أَبَا أَحَدٍ مِنْ رِجَالِكُمْ وَلَكِنْ رَسُولَ اللَّهِ وَخَاتَمَ النَّبِيِّينَ وَكَانَ اللَّهُ بِكُلِّ شَيْءٍ عَلِيمًا [40]
إِنَّ اللَّهَ وَمَلَائِكَتَهُ يُصَلُّونَ عَلَى النَّبِيِّ يَا أَيُّهَا الَّذِينَ آمَنُوا صَلُّوا عَلَيْهِ وَسَلِّمُوا تَسْلِيمًا [56]

إِنَّ الَّذِينَ يُؤْذُونَ اللَّهَ وَرَسُولَهُ لَعَنَهُمُ اللَّهُ فِي الدُّنْيَا وَالْآخِرَةِ وَأَعَدَّ لَهُمْ عَذَابًا مُهِينًا [57]
وَالَّذِينَ يُؤْذُونَ الْمُؤْمِنِينَ وَالْمُؤْمِنَاتِ بَغْيٍ مَا اكْتَسَبُوا فَقَدْ احْتَمَلُوا بُهْتَانًا وَإِثْمًا مُبِينًا [58]
يَا أَيُّهَا النَّبِيُّ قُلْ لِمَ أُوْاجِلُكَ وَبَنَاتِكَ وَنِسَاءَ الْمُؤْمِنِينَ يُدْرِنَ عَلَيْهِنَّ مِنْ جَلَالِيبِهِنَّ ذَلِكَ أَدْلَى أَنْ
يُعرفنَ فَلَا يُؤْذِنَ وَكَانَ اللَّهُ غَفُورًا رَحِيمًا [59]

(iii) الفتح (۳۸) الآية : ۲۹ (رسالت محمدیہ اور خصائص اصحاب رسول)

مُحَمَّدٌ رَسُولُ اللَّهِ وَالَّذِينَ مَعَهُ أَشِدَّاءُ عَلَى الْكُفَّارِ رُحَمَاءُ بَيْنَهُمْ تَرَاهُمْ رُكَّعًا سُجَّدًا يَبْتَغُونَ
فَضْلًا مِنَ اللَّهِ وَرِضْوَانًا سِيمَاهُمْ فِي وُجُوهِهِمْ مِنْ أَثَرِ السُّجُودِ ذَلِكَ مَثَلُهُمْ فِي التَّوْرَةِ وَمَثَلُهُمْ
فِي الْإِنْجِيلِ كَزَرْعٍ أَخْرَجَ شَطَنَهُ فَازْرَرَهُ فَاسْتَغْلَظَ فَاسْتَوَى عَلَى سُوقِهِ يُعْجِبُ الزُّرَّاعَ لِيَغِظَ
بِهِمُ الْكُفَّارَ وَعَدَ اللَّهُ الَّذِينَ آمَنُوا وَعَمِلُوا الصَّالِحَاتِ مِنْهُمْ مَغْفِرَةً وَأَجْرًا عَظِيمًا [29]

(iv) الصف (۶) الآية : ۱۴ (بشارت بعثت ختم المرسلین، ہجرت، جہاد، نصرت اور غلبہ دین)

سَبَّحَ لِلَّهِ مَا فِي السَّمُوتِ وَمَا فِي الْأَرْضِ وَهُوَ الْعَزِيزُ الْحَكِيمُ [1] يَا أَيُّهَا الَّذِينَ آمَنُوا لِمَ تَقُولُونَ
مَا لَا تَفْعَلُونَ [2] كَبُرَ مَقْتًا عِنْدَ اللَّهِ أَنْ تَقُولُوا مَا لَا تَفْعَلُونَ [3] إِنَّ اللَّهَ يُحِبُّ الَّذِينَ يُقَاتِلُونَ
فِي سَبِيلِهِ صَفًّا كَأَنَّهُمْ بُنْيَانٌ مَرْصُورٌ [4] وَإِذْ قَالَ مُوسَى لِقَوْمِهِ يَقُمْ لِمَ تَقُولُونَ لَمْ تَقُولُوا
تَعْلَمُونَ إِنِّي رَسُولُ اللَّهِ إِلَيْكُمْ فَلَمَّا زَاغُوا أَزَاغَ اللَّهُ قُلُوبَهُمْ وَاللَّهُ لَا يَهْدِي الْقَوْمَ الْفَاسِقِينَ [5]
وَإِذْ قَالَ عِيسَى ابْنُ مَرْيَمَ بَنِي إِسْرَائِيلَ إِنِّي رَسُولُ اللَّهِ إِلَيْكُمْ مُصَدِّقًا لِمَا بَيْنَ يَدَيَّ مِنَ التَّوْرَةِ
وَمُبَشِّرًا بِرَسُولٍ يَأْتِي مِنْ بَعْدِي اسْمُهُ أَحْمَدُ فَلَمَّا جَاءَهُمْ بِالْبَيِّنَاتِ قَالُوا هَذَا سِحْرٌ مُبِينٌ [6]
وَمَنْ أَظْلَمُ مِمَّنِ افْتَرَى عَلَى اللَّهِ الْكُذْبَ وَهُوَ يُدْعَى إِلَى الْإِسْلَامِ وَاللَّهُ لَا يَهْدِي الْقَوْمَ الظَّالِمِينَ [7]
يُرِيدُونَ لِيُطْفِئُوا نُورَ اللَّهِ بِأَفْوَاهِهِمْ وَاللَّهُ مُتِمُّ نُورِهِ وَلَوْ كَرِهَ الْكَافِرُونَ [8] هُوَ الَّذِي أَرْسَلَ
رَسُولَهُ بِالْهُدَى وَذِينَ الْحَقِّ لِيُظْهِرَهُ عَلَى الدِّينِ كُلِّهِ وَلَوْ كَرِهَ الْمُشْرِكُونَ [9] يَا أَيُّهَا الَّذِينَ آمَنُوا
هَلْ أَذِلَّكُمْ عَلَى تِجَارَةٍ تُنْجِيكُمْ مِنْ عَذَابٍ إِلَيْكُمْ [10] تُؤْمِنُونَ بِاللَّهِ وَرَسُولِهِ وَتُجَاهِدُونَ فِي
سَبِيلِ اللَّهِ بِأَمْوَالِكُمْ وَأَنْفُسِكُمْ ذَلِكَُمْ خَيْرٌ لَكُمْ إِنْ كُنْتُمْ تَعْلَمُونَ [11] يَغْفِرْ لَكُمْ ذُنُوبَكُمْ
وَيُدْخِلْكُمْ جَنَّاتٍ تَجْرِي مِنْ تَحْتِهَا الْأَنْهَارُ وَمَسْكِنٌ طَيِّبَةً فِي جَنَّاتٍ عَدْنٍ ذَلِكَ الْفَوْزُ الْعَظِيمُ [12]
وَأُخْرَى تُحِبُّونَهَا نَصْرٌ مِنَ اللَّهِ وَفَتْحٌ قَرِيبٌ وَبَشِيرِ الْمُؤْمِنِينَ [13] يَا أَيُّهَا الَّذِينَ آمَنُوا كُونُوا
أَنْصَارَ اللَّهِ كَمَا قَالَ عِيسَى ابْنُ مَرْيَمَ لِلْحَوَارِيِّينَ مَنْ أَنْصَارِي إِلَى اللَّهِ قَالَ الْحَوَارِيُّونَ نَحْنُ
أَنْصَارُ اللَّهِ فَأَمْنَتْ طَائِفَةٌ مِنْ بَنِي إِسْرَائِيلَ وَكَفَرَتْ طَائِفَةٌ فَأَيَّدْنَا الَّذِينَ آمَنُوا عَلَى عَدُوِّهِمْ
فَأَصْبَحُوا ظَاهِرِينَ [14]

يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَقْدِمُوا بَيْنَ يَدَيِ اللَّهِ وَرَسُولِهِ وَاتَّقُوا اللَّهَ إِنَّ اللَّهَ سَمِيعٌ عَلِيمٌ [1] يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَرْفَعُوا أَصْوَاتَكُمْ فَوْقَ صَوْتِ النَّبِيِّ وَلَا تَجْهَرُوا لَهُ بِالْقَوْلِ كَجَهْرِ بَعْضِكُمْ لِبَعْضٍ أَن تَحْبَطَ أَعْمَالُكُمْ وَأَنتُمْ لَا تَشْعُرُونَ [2] إِنَّ الَّذِينَ يَغُضُّونَ أَصْوَاتَهُمْ عِنْدَ رَسُولِ اللَّهِ أُولَئِكَ الَّذِينَ امْتَحَنَ اللَّهُ قُلُوبَهُمْ فَلتَتَقَوَّى لَهُمْ مَغْفِرَةٌ وَأَجْرٌ عَظِيمٌ [3] إِنَّ الَّذِينَ ينادُونَكَ مِنْ وَرَاءِ الْحُجُرَاتِ أَكْثَرُهُمْ لَا يَعْقِلُونَ [4] وَلَوْ أَنَّهُمْ صَبَرُوا حَتَّى تَخْرُجَ إِلَيْهِمْ لَكَانَ خَيْرًا لَهُمْ وَاللَّهُ غَفُورٌ رَحِيمٌ [5] يَا أَيُّهَا الَّذِينَ آمَنُوا إِنْ جَاءَكُمْ فَاسِقٌ بِنَبَأٍ فَتَبَيَّنُوا أَنْ تُصِيبُوا قَوْمًا بِجَهَالَةٍ فَتُصْحَبُوا عَلَى مَا فَعَلْتُمْ نَادِمِينَ [6] وَاعْلَمُوا أَنَّ فِيكُمْ رَسُولَ اللَّهِ لَوْ يُطِيعُكُمْ فِي كَثِيرٍ مِنَ الْأُمْرِ لَعَزَّيْتُمْ وَلَكِنَّ اللَّهَ حَبَّبَ إِلَيْكُمُ الْإِيمَانَ وَزَيَّنَهُ فِي قُلُوبِكُمْ وَكَرَّهَ إِلَيْكُمُ الْكُفْرَ وَالْفُسُوقَ وَالْعِصْيَانَ أُولَئِكَ هُمُ الرَّاشِدُونَ [7] فَضَلَّاهُ مِنَ اللَّهِ وَنِعْمَةً وَاللَّهُ عَلِيمٌ حَكِيمٌ [8] وَإِنْ طَائِفَتَيْنِ مِنَ الْمُؤْمِنِينَ اقْتَتَلُوا فَأَصْلَحُوا بَيْنَهُمَا فَإِنْ بَغَتْ إِحْدَاهُمَا عَلَى الْأُخْرَى فَفَاتَحُوا ابْنَ تَبْيِ حَتَّى تَفِيءَ إِلَى أَمْرِ اللَّهِ فَإِنْ فَاءَتْ فَأَصْلَحُوا بَيْنَهُمَا بِالْعَدْلِ وَأَقْسِطُوا إِنَّ اللَّهَ يُحِبُّ الْمُقْسِطِينَ [9] إِنَّمَا الْمُؤْمِنُونَ إِخْوَةٌ فَأَصْلَحُوا بَيْنَ أَخَوَيْكُمْ وَاتَّقُوا اللَّهَ لَعَلَّكُمْ تُرْحَمُونَ [10] يَا أَيُّهَا الَّذِينَ آمَنُوا لَا يَسْخَرُ قَوْمٌ مِنْ قَوْمٍ عَسَى أَنْ يَكُونُوا خَيْرًا مِنْهُمْ وَلَا نِسَاءٌ مِنْ نِسَاءٍ عَسَى أَنْ يَكُنَّ خَيْرًا مِنْهُنَّ وَلَا تَلْمِزُوا أَنْفُسَكُمْ وَلَا تَنَابَزُوا بِالْأَلْقَابِ بِئْسَ الْأَسْمُ الْفُسُوقُ بَعْدَ الْإِيمَانِ وَمَنْ لَمْ يَتُبْ فَأُولَئِكَ هُمُ الظَّالِمُونَ [11] يَا أَيُّهَا الَّذِينَ آمَنُوا اجْتَنِبُوا كَثِيرًا مِنَ الظَّنِّ إِنَّ بَعْضَ الظَّنِّ إِثْمٌ وَلَا تَجَسَّسُوا وَلَا يَغْتَبِ بَعْضُكُمْ بَعْضًا أَيُحِبُّ أَحَدُكُمْ أَنْ يَأْكُلَ لَحْمَ أَخِيهِ مَيْتًا فَكَرِهْتُمُوهُ وَاتَّقُوا اللَّهَ إِنَّ اللَّهَ تَوَّابٌ رَحِيمٌ [12] يَا أَيُّهَا النَّاسُ إِنَّا خَلَقْنَاكُمْ مِنْ ذَكَرٍ وَأُنْثَى وَجَعَلْنَاكُمْ شُعُوبًا وَقَبَائِلَ لِتَعَارَفُوا إِنَّ أَكْرَمَكُمْ عِنْدَ اللَّهِ أَتَقَى اللَّهَ إِنَّ اللَّهَ عَلِيمٌ خَبِيرٌ [13]

قَالَتِ الْأَعْرَابُ آمَنَّا قُلْ لَمْ تُؤْمِنُوا وَلَكِنْ قُولُوا أَسْلَمْنَا وَلَمَّا يَدْخُلِ الْإِيمَانُ فِي قُلُوبِكُمْ وَإِنْ تُطِيعُوا اللَّهَ وَرَسُولَهُ لَا يَلِتْكُمْ مِنْ أَعْمَالِكُمْ شَيْئًا إِنَّ اللَّهَ غَفُورٌ رَحِيمٌ [14] إِنَّمَا الْمُؤْمِنُونَ الَّذِينَ آمَنُوا بِاللَّهِ وَرَسُولِهِ ثُمَّ لَمْ يَرْتَابُوا وَجَاهَدُوا بِأَمْوَالِهِمْ وَأَنْفُسِهِمْ فِي سَبِيلِ اللَّهِ أُولَئِكَ هُمُ الصَّادِقُونَ [15] قُلْ اتَّعَلَّمُونَ اللَّهَ بِدِينِكُمْ وَاللَّهُ يَعْلَمُ مَا فِي السَّمُوتِ وَمَا فِي الْأَرْضِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ [16] يَسْمُنُونَ عَلَيْكَ أَنْ أَسْلَمُوا قُلْ لَا تَمُوتُوا عَلَى إِسْلَامِكُمْ بَلِ اللَّهُ يَمُنُّ عَلَيْكُمْ أَنْ هَدَاكُمْ لِلْإِيمَانِ إِنْ كُنْتُمْ صَادِقِينَ [17] إِنَّ اللَّهَ يَعْلَمُ غَيْبَ السَّمُوتِ وَالْأَرْضِ وَاللَّهُ بَصِيرٌ بِمَا تَعْمَلُونَ [18]

(vi) الأنعام (٦) الآية: ١٥١ تا ١٥٣ (حقوق العباد)

قُلْ تَعَالَوْا أَتْلُ مَا حَرَّمَ رَبِّي عَلَيْكُمْ أَلَّا تُشْرِكُوا بِهِ شَيْئًا وَبِالْوَالِدَيْنِ إِحْسَانًا وَلَا تَقْتُلُوا
 أَوْلَادَكُمْ مِنْ إِمْلَاقٍ نَحْنُ نَرْزُقُكُمْ وَإِيَّاهُمْ وَلَا تَقْرَبُوا الْفَوَاحِشَ مَا ظَهَرَ مِنْهَا وَمَا بَطَنَ وَلَا
 تَقْتُلُوا النَّفْسَ الَّتِي حَرَّمَ اللَّهُ إِلَّا بِالْحَقِّ ذَلِكُمْ وَصَّيْتُكُمْ بِهِ لَعَلَّكُمْ تَعْقِلُونَ [151] وَلَا تَقْرَبُوا مَالَ
 الْيَتِيمِ إِلَّا بِالَّتِي هِيَ أَحْسَنُ حَتَّى يَبْلُغَ أَشُدَّهُ وَأَوْفُوا الْكَيْلَ وَالْمِيزَانَ بِالْقِسْطِ لَا نُكَلِّفُ نَفْسًا
 إِلَّا وُسْعَهَا وَإِذَا قُلْتُمْ فَاعْدِلُوا وَلَوْ كَانَ ذَا قُرْبَىٰ وَبِعَهْدِ اللَّهِ أَوْفُوا ذَلِكُمْ وَصَّيْتُكُمْ بِهِ لَعَلَّكُمْ
 تَذَكَّرُونَ [152] وَأَنَّ هَذَا صِرَاطِي مُسْتَقِيمًا فَاتَّبِعُوهُ وَلَا تَتَّبِعُوا السُّبُلَ فَتَفَرَّقَ بِكُمْ عَنْ سَبِيلِهِ
 ذَلِكُمْ وَصَّيْتُكُمْ بِهِ لَعَلَّكُمْ تَتَّقُونَ [153]

(vii) الفرقان (٢٥) الآية: ٦٣ تا ٧٧ (آداب معاشرت)

وَعِبَادُ الرَّحْمَنِ الَّذِينَ يَمْشُونَ عَلَى الْأَرْضِ هَوْنًا وَإِذَا خَاطَبَهُمُ الْجَاهِلُونَ قَالُوا سَلَامًا [63]
 وَالَّذِينَ يَبِيتُونَ لِرَبِّهِمْ سُجَّدًا وَقِيَامًا [64] وَالَّذِينَ يَقُولُونَ رَبَّنَا اصْرِفْ عَنَّا عَذَابَ جَهَنَّمَ إِنَّ
 عَذَابَهَا كَانَ غَرَامًا [65] إِنَّهَا سَاءَتْ مُسْتَقَرًّا وَمُقَامًا [66] وَالَّذِينَ إِذَا أَنْفَقُوا لَمْ يُسْرِفُوا وَلَمْ
 يَقْتُرُوا وَكَانَ بَيْنَ ذَلِكَ قَوَامًا [67] وَالَّذِينَ لَا يَدْعُونَ مَعَ اللَّهِ إِلَهًا آخَرَ وَلَا يَقْتُلُونَ النَّفْسَ الَّتِي
 حَرَّمَ اللَّهُ إِلَّا بِالْحَقِّ وَلَا يَزْنُونَ وَمَنْ يَفْعَلْ ذَلِكَ يَلْقَ أَثَامًا [68] يُضَاعَفْ لَهُ الْعَذَابُ يَوْمَ الْقِيَمَةِ
 وَيَخْلُدْ فِيهِ مُهَانًا [69] إِلَّا مَنْ تَابَ وَآمَنَ وَعَمِلَ صَالِحًا فَأُولَٰئِكَ يَبَدِّلُ اللَّهُ سَيِّئَاتِهِمْ
 حَسَنَاتٍ وَكَانَ اللَّهُ غَفُورًا رَحِيمًا [70] وَمَنْ تَابَ وَعَمِلَ صَالِحًا فَإِنَّهُ يَتُوبُ إِلَى اللَّهِ مَتَابًا [71]
 وَالَّذِينَ لَا يَشْهَدُونَ الزُّورَ وَإِذَا مَرُّوا بِاللَّغْوِ مَرُّوا كِرَامًا [72] وَالَّذِينَ إِذَا ذُكِّرُوا بِآيَاتِ رَبِّهِمْ لَمْ
 يَخِرُّوا عَلَيْهَا صُمًّا وَعُمْيَانًا [73] وَالَّذِينَ يَقُولُونَ رَبَّنَا هَبْ لَنَا مِنْ أَزْوَاجِنَا وَذُرِّيَّاتِنَا قُرَّةَ أَعْيُنٍ
 وَاجْعَلْنَا لِلْمُتَّقِينَ إِمَامًا [74] أُولَٰئِكَ يُجْزَوْنَ الْغُرْفَةَ بِمَا صَبَرُوا وَيُلَقَّوْنَ فِيهَا تَحِيَّةً وَسَلَامًا [75]
 خَالِدِينَ فِيهَا حَسُنَتْ مُسْتَقَرًّا وَمُقَامًا [76] قُلْ مَا يَعْبُودُ بِكُمْ رَبِّي لَوْلَا دُعَاؤُكُمْ فَقَدْ كَذَّبْتُمْ
 فَسَوْفَ يَكُونُ لِزَامًا [77]

(viii) النحل (١٦) الآية: ١٣ تا ١٤ (تفكر وتدبر)

وَسَخَّرَ لَكُمُ اللَّيْلَ وَالنَّهَارَ وَالشَّمْسَ وَالْقَمَرَ وَالنُّجُومَ مُسَخَّرَاتٍ بِأَمْرِهِ إِنَّ فِي ذَلِكَ لَآيَاتٍ
 لِّقَوْمٍ يَعْقِلُونَ [12] وَمَا ذَرَأْنَا فِي الْأَرْضِ مُخْتَلِفًا أَلْوَانُهُ إِنَّ فِي ذَلِكَ لَآيَةً لِّقَوْمٍ يَتَذَكَّرُونَ [13]
 وَهُوَ الَّذِي سَخَّرَ الْبَحْرَ لِتَأْكُلُوا مِنْهُ لَحْمًا طَرِيًّا وَتَسْتَخْرِجُوا مِنْهُ حَبْلًا مَلْبَسُونَهَا وَتَرَى
 الْفُلُكَ مَوَاجِرَ فِيهِ وَلِتَبْتَغُوا مِنْ فَضْلِهِ وَلَعَلَّكُمْ تَشْكُرُونَ [14]

ضميمه ب: منتخب احاديث نبويه

(ملحق ب: نخبة من الأحاديث النبويه)

(١) عن عمر بن الخطاب رضى الله عنه قال: سمعت رسول الله صلى الله عليه وسلم يقول: إنما الأعمال بالنيات، وإنما لامرئ ما نوى، فمن كانت هجرته إلى الله ورسوله فهجرته إلى الله ورسوله ومن كانت هجرته إلى دنيا يصيبها أو امرأة يتزوجها فهجرته إلى ما هاجر إليه. (رواه البخارى ومسلم)

(٢) عن عثمان بن عفان رضى الله عنه عن النبي صلى الله عليه وسلم قال: خيركم من تعلم القرآن وعلمه. (رواه البخارى)

(٣) عن مالك بن انس قال، قال رسول الله صلى الله عليه وسلم: تركت فيكم أمرين لن تضلوا ما تمسكتم بهما، كتاب الله وسنة رسوله. (رواه مالك فى الموطأ مرسلًا)

(٣) عن ابن عمر رضى الله عنهما قال، قال رسول الله صلى الله عليه وسلم: بنى الإسلام على خمس، شهادة أن لا إله إلا الله وأن محمداً عبده ورسوله وإقام الصلاة وإيتاء الزكاة والحج وصوم رمضان. (متفق عليه)

(٥) عن عمر بن الخطاب رضى الله عنه قال: بينما نحن عند رسول الله صلى الله عليه وسلم ذات يوم إذ طلع علينا رجل شديد بياض الثياب شديد سواد الشعر لا يرى عليه أثر السفر ولا يعرفه منا أحد حتى جلس إلى النبي صلى الله عليه وسلم فأسند ركبتيه إلى ركبتيه ووضع كفيه على فخذيه وقال: يا محمد، أخبرنى عن الإسلام؟ فقال رسول الله صلى الله عليه وسلم: الإسلام أن تشهد أن لا إله إلا الله وأن محمداً رسول الله وتقيم الصلاة وتؤتى الزكاة وتصوم رمضان وتحج البيت إن استطعت إليه سبيلاً، قال: صدقت، قال: فاعجبنا له يسأله ويصدقه، قال: فأخبرنى عن الإيمان؟ قال: أن تؤمن بالله وملكته ورسوله واليوم الآخر وتؤمن بالقدر خيره وشره، قال: صدقت، قال: فأخبرنى عن الإحسان؟ قال: أن تعبد الله كأنك تراه فإن لم تكن تراه فإنه يراك، قال: فأخبرنى عن الساعة؟ قال: ما المسؤول عنها بأعلم من السائل، قال: فأخبرنى عن أماراتها؟ قال: أن تلد الأمة رببتها وأن ترى الحفاة العراة العالة رعاء الشاء يتطاولون فى البنيان، قال: ثم انطلق، فلبثت ملياً ثم قال لى: يا عمر أتدرى من السائل؟ قلت: الله ورسوله أعلم، قال: فإنه جبرئيل أتاكم يعلمكم دينكم. (رواه مسلم)

(٦) عن شبرمة بن معبد رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: مروا الصبيان الصلوة إذا بلغ سبع سنين وإذا بلغ عشر سنين فاضربوه عليها. أخرجه أبو داود والترمذى ولفظه: علموا الصبى الصلوة ابن سبع سنين واضربوه عليها ابن عشر. (صحيح البخارى)

- (٤) عن معاوية رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: من يُرد الله به خيراً يفقهه في الدين. (رواه البخارى)
- (٨) عن أبى هريرة رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: من سلك طريقاً يلتمس فيه علماً سهل الله له به طريقاً إلى الجنة، وما اجتمع قوم في بيت من بيوت الله يتلون كتاب الله ويتدارسون بينهم إلا نزلت عليهم السكينة وغشيتهم الرحمة وحفتهم الملائكة وذكرهم الله فيمن عنده، ومن بطأ به عمله لم يسرع به نسبه. (رواه مسلم)
- (٩) عن أبى هريرة رضى الله عنه قال: كان رسول الله صلى الله عليه وسلم يقول: اللهم إني أعوذ بك من أربع، من علم لا ينفع، ومن قلب لا يخشع، ومن نفس لا تشبع، ومن دعاء لا يسمع. (رواه احمد، وأبو داود، وابن ماجه: مشكوة المصابيح)
- (١٠) عن ابن مسعود رضى الله عنه عن النبي صلى الله عليه وسلم قال: لا تزول قدمي ابن آدم حتى يسئل عن خمس عن عمره فيما أفناه وعن شبابه فيما أبلاه وعن ماله من أين اكتسبه وفيما أنفقه وماذا عمل فيما علم. (جامع الترمذى)
- (١١) عن عبد الله قال: قال رسول الله صلى الله عليه وسلم: طلب كسب الحلال فريضة بعد الفريضة. (شعب الإيمان للبيهقي)
- (١٢) عن أبى سعيد رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: التاجر الصدوق الأمين مع البائمين والصديقين والشهداء. (جامع الترمذى، سنن الدارمى، سنن دار قطنى)
- (١٣) عن أبى هريرة رضى الله عنه أن رسول الله قال: أتدرون ما المفلس؟ قالوا: المفلس فينا من لا درهم له ولا متاع، فقال: إن المفلس من امتى من يأتى يوم القيامة بصلوة وصيام وزكاة، ويأتى قد شتم هذا وقذف هذا وأكل مال هذا وسفك دم هذا وضرب هذا فيعطى هذا من حسناته وهذا من حسناته، فإن فنيت حسناته، قبل أن يقضى ما عليه أخذ من خطاياهم فطرح عليه ثم طرح فى النار. (مسلم: كتاب البر)
- (١٣) عن أبى الدرداء رضى الله عنه أن رسول الله صلى الله عليه وسلم قال: إن أثقل شئ يوضع فى ميزان المؤمن يوم القيامة خلق حسن، وإن الله يفيض الفاحش البلى. (رواه الترمذى)
- (١٥) عن ابن عباس رضى الله عنهما أن النبي صلى الله عليه وسلم قال: أربع من أعطيهن فقد أعطى خير الدنيا والآخرة، قلباً شاكراً ولساناً ذاكراً وبدناً على البلاء صابراً وزوجة لا تبغى حواً فى نفسها وماله. (سنن اسنى)
- (١٦) عن أبى هريرة رضى الله عنه قال: قال رسول الله صلى الله عليه وسلم: اجتنبوا السبع الموبقات، قالوا: يا رسول الله وما هن؟ قال: الشرك بالله والسحر وقتل النفس التى حرم الله إلا بالحق وأكل الربا وأكل مال اليتيم والتولى يوم الزحف وقذف المحصنات المؤمنات الغافلات. (متفق عليه)
- (١٧) عن أبى سعيد الخدرى رضى الله عنه، عن رسول الله صلى الله عليه وسلم قال: من رأى منكم منكراً فليغيره بيده فإن لم يستطع فبلسانه، وإن لم يستطع فبقلبه وذلك أضعف الإيمان. (رواه مسلم)

- (١٨) قال رسول الله صلى الله عليه وسلم يجاء بالرجل يوم القيامة فيلقى في النار فتندلق أفتابه في النار فيطحن فيها كطحن الحمار برحاه فيجتمع أهل النار عليه فيقولون، أي فلان ما شأنك؟ أليس كنت تأمرنا بالمعروف و تنهاينا عن المنكر؟ قال كنت أمركم ولا آتية وأنهاكم عن المنكر وآتية. (رواه مسلم)
- (١٩) عن انس قال قال رسول الله والذي نفسي بيده لا يؤمن عبد حتى يحب لا خيه ما يحب لنفسه (متفق عليه)
- (٢٠) عن النعمان بن بشير رضي الله عنه قال: قال رسول الله صلى الله عليه وسلم: ترى المؤمنين في تراحمهم وتواضعهم وتعاطفهم كمثل الجسد اذا اشتكى عضو تداعى له سائر الجسد بالسهر والحمى (متفق عليه)
- (٢١) عن عبد الله بن عمر رضي الله عنهما قال، قال رسول الله صلى الله عليه وسلم: ألا كلكم راع و كلكم مسئول عن رعيته فالأمام الذي على الناس راع و هو مسئول عن رعيته والرجل راع على أهل بيته و هو مسئول عن رعيته والمرأة راعية على بيت زوجها ولده و هي مسئولة عنهم و عبد الرجل راع عن مال سيده و هو مسئول عنه ألا فكلكم راع و كلكم مسئول عن رعيته (متفق عليه)
- (٢٢) عن أبي هريرة رضي الله عنه قال، قال رسول الله صلى الله عليه وسلم: مثل الأنبياء كمثل قصر أحسن بنيانه، ترك منه موضع لبنة، فطاف به النظار يتعجبون من حسن بنائه إلا موضع تلك اللبنة، فكنت أنا سددت موضع اللبنة، ختم بي البنيان و ختم بي الرسل... وفي رواية: فأنا اللبنة و أنا خاتم النبيين. (رواه البخاري)
- (٢٣) و عن أنس رضي الله عنه عن النبي صلى الله عليه وسلم قال: أرحم أمتي بأمي أبوبكر و أشدهم في أمر الله عمر و أصد قههم حياء عثمان، وأقضاهم على، وأفضهم زيد بن ثابت وأقراهم أبي بن كعب وأعلمهم بالحلال والحرام معاذ بن جبل و لكل أمة أمين و أمين هذه الأمة أبو عبيدة بن الجراح. (رواه احمد و الترمذي، مشكوة المصابيح، باب مناقب العشرة)
- (٢٤) عن أبي بكر رضي الله عنه قال: رأيت رسول الله صلى الله عليه وسلم على المنبر والحسن بن علي إلى جنبه و هو يقبل على الناس مرة و عليه أخرى ويقول: إن ابني هذا سيد و لعن الله أن يصلح به بين فئتين عظيمتين من المسلمين. (رواه البخاري)
- (٢٥) و عن عمران بن حصين رضي الله عنه قال، قال رسول الله صلى الله عليه وسلم: خير أمتي قرني ثم الذين يلونهم، ثم الذين يلونهم... (متفق عليه، مشكوة المصابيح، باب مناقب الصحابة)
- (٢٦) عن جابر بن عبد الله رضي الله عنه قال: خطبنا رسول الله صلى الله عليه وسلم في وسط أيام التشريق خطبة الوداع فقال: يا أيها الناس: إن ربكم واحد وإن أباكم واحد، ألا لا فضل لعربي على عجمي ولا لعجمي على عربي ولا لأحمر على أسود، ولا لأسود على أحمر إلا بالتقوى، إن أكرمكم عند الله أتقاكم، ألا هل بلغت؟ قالوا: بلى يا رسول الله، قال: فليبلغ الشاهد الغائب. (البیهقي، شعب الايمان، باب في حفظ اللسان، فصل في حفظ اللسان عن الفخر بالآباء).

مجوزہ کتب (الکتب المقترحة) Recommended Books

(عربی)

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| ۹. دروس اللغة العربیة | دکتر فاء عبدالرحیم |
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انجلیزی (English) انگریزی

11. The Holy Quran(Text, Translation & Commentary):Abdullah Yousuf Ali.
12. The Glorious Quran:Muhammad Marma Duke Pickthall.
13. The Message of Quran: Muhammad Asad (Leopold Weiss).
14. Sahih-al-Bukhari (English Translation) Muhammad Mohsin Khan.
15. Takalam-al-Arabiyyah (تکلم العربیة) Arabic-English: Mahmud Ismaeel al-Seeni.
16. al-Mawrid (المورد) English - Arabic Dictionary: Munir al-Balabakki.
17. The Road To Makkah: Muhammad Asad (Leopold Weiss).
18. Quran, Bible & Science (القرآن والانجیل والعلم) Maurice de Bouccai.
19. Towards Understanding Islam(دینیات(مبادئ الاسلام): Abul Ala Maudoodi.
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24. Social Justice in Islam :Sayyid Qutb.
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25. Islam in Theory & Practice :Maryam Jameela.(Margrate Marcus)
اسلام ایک نظریہ ایک تحریک (الإسلام في النظرية و التطبيق)
26. Umar the Great: (الفاروق): Shibli Nomani (Translated by Zafar Ali Khan)

Note: The books available in two or three languages

(Arabic, English, Urdu (have been mentioned accordingly.)

Urdu (اردو)

- | | | |
|-----|---|---------------------------------------|
| ۱۔ | معارف القرآن | مفتی محمد شفیع |
| ۲۔ | تفہیم القرآن | سید ابوالاعلیٰ مودودی |
| ۳۔ | تذکرہ قرآن | امین احسن اصلاحی |
| ۴۔ | ضیاء القرآن | پیر کرم شاہ الازہری |
| ۵۔ | معارف الحدیث | محمد منظور نعمانی |
| ۶۔ | ترجمان السنۃ | بدر عالم میرٹھی |
| ۷۔ | اللسان العربی | محمد نعمان طشقندی (AIUO) |
| ۸۔ | قواعد القرآن (مختصر قرآنی عربی گریمر) | عبد الرحمن طاہر مدنی |
| ۹۔ | تعلیم اللغة العربیة: مختصر القواعد (مختصر عربی گرامر) | ڈاکٹر مظہر معین |
| ۱۰۔ | عربی کا معلم | مولانا عبدالستار خان |
| ۱۱۔ | عربک گرامر اینڈ ٹرانسلیشن | ایم ڈی چوہدری |
| ۱۲۔ | مصباح اللغات (عربی، اردو و کشتری) | عبد الحفیظ بلیاوی... |
| ۱۳۔ | سیرۃ النبیؐ | شبلی نعمانی، سلیمان ندوی |
| ۱۴۔ | الرحیق المختوم | صفی الرحمن مبارکپوری |
| ۱۵۔ | رحمۃ للعالمینؐ | محمد سلیمان منصور پوری |
| ۱۶۔ | انسان کاملؐ | ڈاکٹر خالد علوی |
| ۱۷۔ | سیرۃ عائشہؓ | سید سلیمان ندوی |
| ۱۸۔ | سیر الصحابہؓ | شاہ معین الدین ندوی |
| ۱۹۔ | تاریخ اسلام | شاہ معین الدین ندوی |
| ۲۰۔ | اصحابی کالجیوم | حفیظ تائب |
| ۲۱۔ | (الثقافة الاسلامیة) تاریخ افکار و علوم اسلامی | داغب الطباخ (ترجمہ: افتخار احمد بلخی) |
| ۲۲۔ | اسلامی تہذیب اور اس کے اصول و مبادی | سید ابوالاعلیٰ مودودیؒ |

Second Semester

Paper I

Course Code: ME 121

Engineering Drawing and Computer Aided Design

Credit Hours: 2(1,1)

Pre-requisites: F.Sc. (Pre-Engineering)

Objective

To provide in-depth knowledge of engineering drawings and graphics applicable to Metallurgy and Materials Engineering.

Course Outline

Geometric Construction:

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, Development and Intersection of Surfaces and Shadows. Projection System; Free Hand Sketching and Geometric Views of Mechanical Objects, Fasteners, Joints-Riveted, Cotter, Knuckle and Universal Couplings, Pipes, Shafts, Plug Cock, Stuffing Box etc., Drawing of Miscellaneous Machines, Pumps, Boiler Mounting, Valves, Condensers, Heat Exchangers, Autoclaves, Evaporators, Distillation Columns, Representation through Section, Use of First and Third Angle Projection, Principles of Isometric Projection, Use of Scales.

Computer Aided Design:

Getting to Know Auto CAD, Commands, Setting up a Drawing, Gaining Drawing Strategies, Using Layers to Organize Drawing, using Blocks and W blocking, Generating Elevations, Working with Hatches and Fills, Controlling Text in a Drawing, Dimensioning a Drawing, Managing External References, Printing on Auto CAD Drawing.

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

Recommended Books

1. T. E. French, "Engineering Drawing", McGraw-Hill, 2006.
2. H. L. Thompson, "Engineering Drawing Practice and Theory and Practice", International Textbook Company, 2007.

3. C. W. Weick, "Elementary Mechanical Drawing", McGraw-Hill, 2006.
4. J. D. Bethune, "Engineering Graphics with AutoCAD 2009", Phi Learning, 2009.
5. A.C Parkinson, "A First Year Engineering Drawing", Pitman, 1946

Paper II

Course Code: ME 122

Workshop Practice

Credit Hours: 2(1,1)

Pre-requisites: F.Sc. (Pre-Engineering) or equivalent

Objective

To impart knowledge of workshop techniques being used in different Metallurgical and Materials Industries.

Course Outline

Work shop tools, Bench Fitting; Description, proper use and maintenance of the fitting tools, use and care of measuring instruments, preparation of some specific jobs. Machining; parts of lathe machine, tools and their uses for different machining operations, introduction to milling, planning and CNC machines. Wood working; use and care of wood working tools, clamps, planes, files, etc. screwing, joining and doweling. Pipe fitting; use and types of pipe fittings, tools used for pipe fitting operations. Electrical fitting; types of electrical fitting and their use, power cables and their selection, joining of electrical cables, etc., Metal joining processes; welding, brazing, soldering and riveting etc. Identification of various types of hazard, Health and Safety, use of personal protective equipment (PPE).

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

Recommended Books

1. A. P. Longmans, "Workshop Practice", Green & Co., 2007.
2. H. W. Baker, "Modern Workshop Technology", Cleaver- Hume Press, 2006.
3. A. P. Longmans, "Machine Tools and Workshop Practice" Green & Co., 2007.
4. R. F. Yates, "Model Making Including Workshop Practice", The Norman W. Henley Publishing Co., 2007.
5. S.K. Garg, "Workshop Technology", Laxmi Publications, 2005.
6. W.A.J. Chapman, "Workshop Technology", Viva Books Private Limited, 1961.

Paper III

Course Code: NS 123

Applied Chemistry

Credit Hours: 4(3,1)

Pre-requisites: F.Sc. (Pre-Engineering), Introduction to Engg. Materials

Objective

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), crystal systems, kinetic theory of gases, Laws of diffusion and effusion solutions. Basic laws; Roul't's law, Henry's law, Sievert's law, Theory of crystallization, bonding theory and quantum theory, Chemical equilibrium; Homogeneous and heterogeneous equilibrium, phase rule, chemical kinetics, Electro-chemistry.

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 hydrocarbons, cracking, Reforming, Octane number.

Analytical chemistry; Introduction, qualitative and quantitative analysis of ferrous and non-ferrous metals, analysis of various ores, coals, liquid solution, Introduction to analytical instruments

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

Recommended Books

1. H. D. Gasser, "Applied Chemistry", Springer, 2002.
2. E. A. Parnell, "Applied Chemistry", D. Appleton & Co., 2007.
3. T. E. Brown, "Chemistry: The Central Science", Prentice Hall, 2005.
4. M. F. Ali and B. Ali, "Handbook of Industrial Chemistry: Organic Chemicals", McGraw-Hill, 2004.

Paper IV

Course Code: ME 124

Engineering Mechanics

Credit Hours: 3(3,0)

Pre-requisites: Applied Physics, Calculus

Objective

To develop knowledge of action of forces on the behavior of the materials in service.

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.

Recommended Books

1. P. P. Benham, R. J. Crawford and J. P. Armstrong, "Mechanics of Engineering Materials", Pitman, 2000.
2. F. P. Beer, "Mechanics of Materials", McGraw-Hill, 2005.
3. M. F. Ashby and D. R. H. Jones, "Engineering Materials 1: An Introduction to Their Properties and Applications", Butterworth-Heinemann, 2005.
4. M. Vable, "Mechanics of Materials", OUP, 2002.
5. J. M. Gere and S. P. Timoshenko, "Mechanics of Materials", PWS Kent, 1997.

Paper V

Course Code: HS 125

Pakistan Studies

Credit Hours: 2(2,0)

Objective

This course is aimed to provide the historical and ideological background of Pakistan and also the process of governance and national development as well as the issues arising in the modern age and posing challenges to Pakistan.

Course Outline

Muslim Heritage; Glories of Muslim Rule in India. Pakistan Movement: Historical and Ideological Perspective; Communalism and Muslim Revivalist Movements in India, The Two-Nation Theory (From Sir Syed Ahmed Khan to Allama Iqbal), The Struggle for Pakistan (From Lahore Resolution to the creation of Pakistan), Quaid-i-Azam Muhammad Ali Jinnah's Role in Struggle for Pakistan, Creation of Pakistan (Early Challenges). Land and People of Pakistan; Physical features and Geo-strategic location of Pakistan, Culture and Traditions (Regional Dimensions), Social Issues and Challenges to Pakistan. History and Politics in Pakistan (1947-2002); Early Parliamentary Governments (1947-1958), Military and Politics in Pakistan (1958-1971), Democratic Era (1971-1977), From General Zia-ul-Haq to General Pervaiz Musharraf (1977-2002). Contemporary Pakistan; Politics in Pakistan (Emerging Trends and Issues), Some Internal Security Challenges and Issues, The Constitution (Silent Features), Foreign Policy and Relations with neighboring countries, National Resources, Salient Features of Economy, Agriculture and Industry.

Recommended Books

1. S. Qalb-i-Abid, "Muslim Struggle for Independence: From Sir Syed Ahmad Khan to Quaid-I-Azam Mohd Ali Jinnah, 1857-1947", Sang-e-Meel Publications, 1997.
2. I. H. Qureshi, "The Struggle for Pakistan", University of Karachi, 1974.

3. اشتیاق حسین قریشی، جدوجہد پاکستان، کراچی یونیورسٹی، 1992.

4. سید حسن ریاض، پاکستان ناگزیر تھا، کراچی یونیورسٹی، 1984.

Paper VI

Course Code: MME 126

Metallurgical Engineering Calculations

Credit Hours: 3(3,0)

Pre-requisites: Introduction to Engineering Materials

Objective

To impart knowledge of calculations involved in metallurgical reactions, their kinetics and energy and material balance of a particular metallurgical process.

Course Outline

Mathematical Procedures, Graphs Papers, Fundamental and Derived Units, Dimensions, Conversion of Units, Dimensional Analysis, Presentation and Correlation of Metallurgical Data, Composition Relationships, Stoichiometric Calculations of Metallurgical Reactions, Excess Air, Flue Gas Analysis, P-V-T Relations for Gases, Material Balances in Metallurgical Processes, Thermochemistry and Thermo-Physics, Thermodynamic Functions, Use of Thermodynamic Data, Energy Balances, Heat Transfer (Conduction, Convection, Radiation), Alloy Calculations.

Recommended Books

1. A. Butts, "Metallurgical Problems", Johnston Press, 2007.
2. D. M. Himmelblau, J. B. Riggs, "Basic Principles and Calculations in Chemical Engineering", Prentice Hall, 2003.
3. C. Davies, "Calculations in Furnace Technology", Elsevier, 1970.

Paper VII

Course Code: NS 127

Differential Equations and Applied Techniques

Credit Hours: 3(3,0)

Pre-requisites: Calculus

Objectives

To 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. 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 3×3 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

Recommended Books

1. R. Bronson, "Differential Equations", McGraw-Hill, 2003.
2. V. Groesen, E. W. C. and E. Soewono, "Differential Equations" Springer, 2003.
3. D. G. Zill, "A First Course in Differential Equations with Modelling Applications", Cole Publishing, 2001.
4. C. H. Edwards and E. David, "Penney Elementary Differential Equations with Applications", Prentice Hall, 1993.
5. C. M. Dafermos, "Differential Equations", CRC Press, 2000.
6. P. B. Kahn, "Mathematical Methods" Courier Dover Publications, 2004
7. H. Anton, "Elementary Linear Algebra" 7th ed., John Willey, 1993.
8. S. Hassani, "Mathematical Methods", Springer, 2000.
9. C. M. Bender and S. A. Orszag, "Advanced Mathematical Methods for Engineers", Springer, 1999.

Third Semester

Paper I

Course Code: HS 211

Communication skills and Report writing

Credit Hours: 3(3,0)

Pre-requisites: Communication skills

Objective

To enable students to meet their professional communication needs and to enhance their ability to compose technical write-up and to transform their creative thinking into presentational skills.

Course Outline

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write project thesis (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Class assignments and presentations

Note: Extensive reading is required for vocabulary building

Recommended Books

Communication Skills

a) Grammar

1. A.J. Thomson and A.V. Martinet, "Practical English Grammar", Exercises 2, Oxford University Press, 1986.

b) Writing

1. M. Boutin, S. Brinand and F. Grellet, "Writing: Intermediate", Oxford Supplementary Skills. 1993.

2. R. Nolasco, "Writing: Upper-Intermediate", Oxford Supplementary Skills, 1992.

c) Reading

1. B. Tomlinson and R. Ellis, "Reading: Advanced", Oxford Supplementary Skills, 1991.

2. J. Langan, "Reading and Study Skills", McGraw-Hill Higher Education, 2002.

Report Writing

a) Essay Writing and Academic Writing

1. R. White, "Writing: Advanced", Oxford Supplementary Skills, 1992.
2. J. Langan, "College Writing Skills", McGraw-Hill Higher Education, 2004.
3. L. G. Kirszner and S. R. Mandell, "Patterns for College Writing", St. Martin's Press, 2009.

b) Reading

1. J. Neulieb and K. S. Cain, "The Mercury Reader: A Custom Publication", Pearson Custom Publishing, 2005.

Paper II

Course Code: MIN 212

Mineral Processing

Credit Hours: 4(3,1)

Pre-requisites: Introduction to Engineering Materials, Applied Chemistry and Applied Physics

Objective

To provide knowledge of different mineral processing techniques to be used to enrich an ore and extract the metal from the concentrate.

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. 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 including leaching and separation, 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 briquitting. Flow sheets and circuit diagrams of typical mills treating ores, non-metallic and the solid fuels. Mineral deposits in Pakistan.

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

Recommended Books

1. T. Rosenqvist, "Principles of Extractive Metallurgy", Tapir Academic Press, 2004.
2. J. Newton, "Extractive Metallurgy", John Wiley & Sons Inc, 1959.
3. W. Barry and N. Tim, "Mineral Processing Technology", Butterworth-Heinemann, 2006.
4. M. C. Fuerstenau and N. H. Kenneth "Principles of Mineral Processing". Society for Mining Metallurgy & Exploration, 2003

Paper III

Course Code: CS 213

Numerical Analysis and Computer Programming

Credit Hours: 3(2,1)

Pre-requisites: Calculus, Differential Equation and Applied Techniques and Introduction to computing and computer systems

Objective

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

1. Z. Li, L. Vulkov and J. Waśniewski, "Numerical Analysis and its Applications", Springer, 2005.
2. M. Schatzman, "Numerical Analysis", Oxford University Press, 2002.
3. S. T. Karris, "Numerical Analysis", Orchard Publications, 2004.

Paper IV

Course Code: MME 214

Materials Thermodynamics and Kinetics

Credit Hours: 3(3,0)

Pre-requisites: Applied Physics and Applied Chemistry

Objective

To provide in-depth knowledge of materials thermodynamics function and reaction kinetic parameters.

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.

Recommended Books

1. D. R. Gaskell, "Introduction to Metallurgical Thermodynamics", Taylor & Francis, 1981.
2. G. S. Upadhyaya and R. K. Dube, "Problems in Metallurgical Thermodynamics and Kinetics", Pergamon, 1977.
3. R. Joel, "Basic Engineering Thermodynamics", Longman, 1996.

4. Y. A. Chang, W. Alan Oates, "Materials Thermodynamics (Wiley Series on Processing of Engineering Materials", 1st Ed, December 2009

Paper V

Course Code: MME 215

Materials Science

Credit Hours: 3(3,0)

Pre-requisites: Introduction to Engineering Materials, Applied Physics

Objective

To impart fundamental knowledge of bonding, crystal structures, phase diagrams.

Course Outline

Introduction to Engineering Materials and Their Properties, Atomic Bonding, Ionic Bonding, Covalent Bonding, Metallic Bonding, Van Der Waal forces, Secondary Bonding & Mix Bonding. The Space Lattice and Unit Cells, Crystal Systems and Bravais Lattices, Principal Metallic Crystal Structures, Atom Position in Cubic Unit Cells, Directions in Cubic Unit Cells. Miller Indices for Crystallographic Planes in Cubic Unit Cells, Crystallographic Planes and Directions in Hexagonal Unit Cells, Comparison of FCC, HCP and BCC Crystal Structures, Volume, Planar and Linear Density, Unit Cell Calculations, Polymorphism or Allotropy, Crystal Structure Analysis; Effect of Bond Type on Structure and Properties such as Density, Stability, Melting Point, Stiffness and Electrical Properties. Constitution of Alloys, Metallic Solid Solutions, Solid Solubility, Equilibrium Phase Diagrams; Phase diagram of pure substances, Gibbs Phase Rule, Binary Isomorphous Alloy Systems, Nonequilibrium Solidification of Alloys, Binary Eutectic Alloy Systems, Binary Monotectic Systems, Invariant Reactions, Phase Diagrams with Intermediate Phases and Compounds, Ternary Phase Diagrams.

Recommended Books

1. S. H. Avner, "Introduction to Physical Metallurgy", Tata McGraw-Hill, Inc., 1997.
2. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley & Sons, Inc., 2007.
3. W. F. Smith, "Principles of Materials Science and Engineering", McGraw-Hill, 1995.
4. R. S. Khurmi, "Materials Science", S. Chand, 2009.

Paper VI

Course Code: MME 216

Iron Manufacturing Technology

Credit Hours: 3(3,0)

Pre-requisites: Mineral processing, Materials Thermodynamics and Metallurgical Calculations

Objective

To provide in-depth knowledge of iron making technology.

Course Outline

Evolutionary advancement in Iron making Process, The Blast Furnace Burden; Iron Ores, Geologic/Geographic Occurrence, Classification and Valuation, Preparation for Blast furnace feed; comminution, Assay building and Agglomeration, Blast furnace Fuels, Metallurgical Coals and their classification, Carbonization Process for coke making, Quality and features of required metallurgical coke, Natural gas, Blast furnace Flux, Classification, Selection and Preparation for BF, Blast Furnace Air, Pre-heating into Stoves for Blast furnace supply, The Blast Furnace; Designing Parameters, Structure and Material of Construction, Refractories, Auxiliary Equipment, Operation, Irregularities in operation and Trouble Shooting, The Physical Chemistry of Iron Making; Metallurgical Thermodynamics, involvement of Free energy, oxygen potential, Ellingham diagrams, Chemical Kinetics and Mechanism of BF reactions, Combustion, Reduction and Slag Making Reaction, Analytical approach to CO-CO₂ Ratio, Material & Energy Balance, Charge calculations, Blast Furnace Products; Hot Iron / Pig Iron, chemical composition, grades, Uses etc., Slags, structure and composition, Basicity, functions and features of good slag, uses, analytical approach to calculate basicity and flux requirements, Blast Furnace Effluent gases. Thermochemistry and Chemical composition, Disposal and treatment of BF gas, Modernization in Iron making Process; Up-gradation in equipment, software incorporation, Processing Techniques, Pakistan Steel, Karachi; Iron Making process at Pakistan steel, Equipment and products of Pakistan Steel, Iron and steel making in Pakistan, Introduction to Cast Irons; Various types, manufacturing techniques, micro-Structures and chemical compositions, Properties, uses and modification, Alternate Methods of Iron/Steel making; Alternate routes for making iron or steel other than BF. Use of HBI and DRI

etc., Classification, techniques, equipment used for adopting the direct methods of Iron or steel making.

Recommended Books

1. C. Bodsworth, "Physical Chemistry of Iron and Steel Manufacture", Prentice Hall, 1972.
2. R. H. Tupkary, V. R. Tupkary, "An Introduction to Modern Iron Making", Khanna Publishers, 2010.
3. J. G. Peacey, W. G. Daveonport, "The Iron Blast Furnace", Pergamon Press, 1979.
4. A. Butts, "Metallurgical Problems", McGraw-Hill Book Company, 1971.
5. J.J. Moore, "Chemical Metallurgy", Butterworth-Heinemann, 1990.
6. J. Newton, "Extractive Metallurgy", John Wiley & Sons Inc, 1959.
7. R. H. Parker, "An Introduction to Chemical Metallurgy", Pergamon, 1967.
8. S. H. Avner, " An Introduction to Physical Metallurgy", 2nd Edition, Tata McGraw-Hill, Inc., 2010.
9. H. E. McGannon, "The Making, Shaping and Treating of Steel", USS, 9th Edition 1971.

Fourth Semester

Paper I

Course Code: MME 221

Mechanical Behaviour of Engineering Materials

Credit Hours: 4(3,1)

Pre-requisites: Engineering Mechanics

Objective

To provide basic understandings of mechanical properties of materials for material selection and performance.

Course Outline

Introduction to Mechanical Behavior of Materials, Concept of Stress and Strain, Elastic and Plastics Deformation, Stress Strain Behavior, Hardness, Variability of Mechanical Properties, Deformation by Slip and Twinning, Slip Systems, Linear and Planar Densities, Closed Packed Structures, Critical Resolved Shear Stress and Yielding Phenomena in Metals, Introduction to Linear Fracture Mechanics, Types of Fractures, Impact Fracture Testing, Creep and Fatigue Properties, Relationship of Mechanical Properties and Microstructure, Brittle Fracture of Ceramics, Stress Strain Behavior and Mechanisms of Plastic Deformation in Ceramics, Mechanical and Thermo-mechanical Properties of Polymers.

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

Recommended Books

1. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley & Sons, Inc., 2007.
2. F. Karim, "Testing of Engineering Ceramics and Plastics", Ferozsons (Pvt.) Ltd., 1998.
3. W. F. Smith, "Principles of Materials Science and Engineering", McGraw-Hill, 1995.
4. T. H. Courtney, "Mechanical Behavior of Materials", McGraw-Hill, 2000.
5. F. Karim, "Testing of Metals", Ferozsons (Pvt.) Ltd., 1995.

Paper II

Course Code: MME 222

Engineering Ceramics and Glasses

Credit Hours: 4(3,1)

Pre-requisites: Introduction to Engineering Materials, Applied Chemistry, Mineral processing

Objective

To develop basic concepts of conventional and advanced ceramics and glasses

Course Outline

Classification and engineering applications of conventional and advanced ceramics, review of bonding and structural principles, concept of octahedral and tetrahedral holes and sites in unit cells, Pauling rules, ceramic structures (Cesium chloride, Rocksalt, Zinc Blende, Fluorite, Anti Fluorite, Corundum, perovskite, Spinel, inverse spinel, silicate structures), conventional ceramic raw materials; Clays (structure, types, properties and applications), Non- plastic raw materials: Silica (minerals, metamorphism, applications, Conversion and inversions in silica), fluxes (feldspar, Cornish stone, Bone ash), Nanoclays, Thermal decomposition of clays, Triaxial ware compositions, Firing and microstructural evolution in clay based ceramics, Secondary processes in firing of clay based ceramics (defects in ceramics), Firing cycle for clay based ceramics, imperfections in ceramics, Important Ceramic phase diagrams (MgO-Al₂O₃ System, ZrO₂-CaO system, ZrO₂-MgO system, SiO₂-Al₂O₃ System, Al₂O₃-Cr₂O₃ System), Mechanical properties of ceramics (bend test), Processing of Ceramics: slip casting, hydroplastic forming, tape casting dry/powder pressing, gel casting (major operations with flow sheet diagram), sintering, refractories; classification, properties and applications (Alumina, Magnesite, Dolomite, Chromite, Rutile, Zirconia, Beryllia, Graphite), Glazes; types, compositions, significance, preparation of glazes, application techniques, glazing defects and their identification, causes and remedies, porcelain enameling, cement; introduction, classification of cement, raw materials, important processes and operations in cement industry, plaster of paris; properties and uses, glasses; introduction, classification, composition, structure and properties of glasses, glass forming techniques, heat treatment of glasses, ceramic and glass industry with special reference to Pakistan

Lab Outline:

Lab Manuals will be available in the concerned laboratory.

Recommended Books

1. W. D. Callister, “ Materials Science and Engineering: An Introduction”, 8th Edition, John Wiley and Sons, Inc, 2007
2. W. Rayan, “ Properties of Ceramic Raw Materials”, 2nd Edition, Pregamon Press, 1978
3. W. F. Smith, “Principles of Materials Science and Engineering” 3rd Edition, Mcgraw Hills, 2003
4. W. E. Worrall, “ Ceramic Raw Materials”, Pregamon Press, 1982
5. D. Kingery, H. K. Bowen, D. R. Uhlmann, “Introduction to Ceramics”, Wiley, 2nd Edition, 2004

Paper III

Course Code: MME 223

Physical Metallurgy

Credit Hours: 4(3,1)

Pre-requisites: Introduction to Engineering Materials, Applied Physics

Objective

To develop understanding of metals and alloys' macro and microstructures.

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. macro and micro structures, Crystallization; Solidification, Grain boundaries, Grain size, crystal defects (point defects, line defects) and their importance, Cold Working, Recovery, Recrystallization and Grain Growth, Metallography; Micro and macro examination; Chemical and Electrochemical Etching; Metallurgical Microscope, Iron-Iron Carbide Equilibrium Diagram, Microstructure of Steels, Cast Irons and Non-Ferrous alloys.

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

Recommended Books

1. G. L. Kehl, "Principles of Metallographic Laboratory Practice", McGraw-Hill, 1949.

2. J. D. Verhoeven, "Fundamentals of Physical Metallurgy", John Wiley & Sons, 1975.
3. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley & Sons, Inc., 2007.
4. S. H. Avner, "Introduction to Physical Metallurgy", Tata McGraw-Hill, Inc., 1997.
5. V. John, "Introduction to Engineering Materials", McMillan Press Ltd., 1994.

Paper IV

Course Code: MME 224

Foundry Engineering-I

Credit Hours: 4(3,1)

Pre-requisites: Introduction to Engineering Materials, Workshop Practice

Objective

To develop fundamental knowledge of moulding techniques used in conventional and advanced foundries.

Course Outline

Foundry, casting, cast objects vs wrought objects, essential requirements of a foundry, metal casting: a process of shaping, classification of foundries, flow sheet diagram of foundry operations, comparison of casting method with other shaping techniques, basic steps in making sand casting, role of Engineer in the foundry Industry. Patterns; Introduction to patterns, pattern materials, types of patterns, functions of patterns, patterns for machine moulding, ordinary pattern vs master pattern, pattern allowances. Moulding/Casting Processes; Green sand moulding, dry sand moulding, shell moulding, core sand moulding, Investment casting, gravity die casting, pressure die casting, centrifugal casting, CO₂ – Moulding process, and other processes. Miscellaneous sand moulding process: Pit and floor moulding, loam moulding, cement bonded sand, etc. Moulding Processes Equipment and Mechanization: Moulding machines, moulding equipment, foundry mechanization. Moulding Sands; Ingredients of moulding sands, special additives, general properties of moulding sands, testing of moulding sands, mould coatings and methods of applications. Cores; Ingredients of core sand, properties of sand cores, binders for cores, core making, core baking, finishing of cores, core setting, testing of core sands, core coatings, cores and casting defects.

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

Recommended Books

1. J. Campbell, "Castings", Butterworth-Heinemann, 2003.
2. R. A. Flinn, "Fundamentals of Metal Casting", Addison Wesley Inc, 1983.
3. R. W. Heine, Carl R. Loper and Philip C. Rosenthal, "Principles of Metal Casting", Tata McGraw-Hill, Inc., 1976.
4. P. Beeley, "Foundry Technology", Butterworth-Heinemann, 2001.
5. J. R. Brown, "The Foseco Non-Ferrous Foundryman's Handbook", Butterworth-Heinemann, 1999.

Paper V

Course Code: HS 225

Critical Thinking

Credit Hours: 2(2,0)

Pre-requisites: Functional English

Objective

To develop students' skills for critical analysis, reasoning and decision making in line with the requirement of various international testing systems.

Course Outline

- 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

Recommended Books

1. V. Lewis, The Power of Critical Thinking, Oxford University Press.
2. P. W. David, C. Jerry: 2000, Critical Reasoning, Wadsworth
3. R. Greg. 2005, Logic: An Introduction, Routledge

Five Semester

Paper I

Course Code: MME 311

Polymeric and Composite Materials

Credit Hours: 4(3,1)

Prerequisites: Introduction to Engineering Materials, Applied Chemistry

Objective

To provide in-depth knowledge of polymeric and composite materials so that students can effectively work in polymer and composite industries.

Course Outline

Introduction to polymers, Important definitions, raw materials, polymerization (mechanism and techniques), General classification of polymers, Bonding in polymers (thermoplastics, thermosetting polymers), molecular weight of polymers, properties dependence on molecular weight and distribution, melt index, structure and behavior of polymers, steric effects, linear polymers, branched chain, crosslinked and network polymers, polymer crystallinity, thermal transitions in polymers (glass transition, heat distortion temperature, melting point and degradation), diffusion in polymers, deformation of polymers, elastomers (structure, properties, vulcanization, types and applications), Degradation of polymers, polymer additives, polymer forming

techniques (extrusion, injection molding, blow molding, vacuum forming, clandering, drawing, foaming, spinning, etc), properties and applications of some important polymeric materials (natural rubber, polyethene, polypropylene, polystyrene, acrylonitrile butadiene styrene, polyvinyl chloride, silicones, phenolics, Teflon, polystyrene, nylon, Bakelite, melamine, polyester, polyurethane, etc), impact of polymeric materials on environment, thermal characterization of polymers, viscoelasticity, advanced polymeric materials (liquid crystal polymers, conducting polymers)

Introduction to composite materials, prerequisites for composites, natural composites properties of composite, roles of matrix and dispersed phase, classification of composites, fillers for composites (micro and nanofillers), dimensionality of fillers, production and properties of various fibres used for production of composites (glass, Kevlar, carbon), thermosetting resins and thermoplastic matrix, interfaces in composite materials, geometric aspects of fibres and fillers, particle reinforced composites (cermets), fibre reinforced composites, mechanics of composites, strength of unidirectional lamina, fibre reinforced composites, polymer matrix composites, carbon fibre composites, aramid fibre composites, nanocomposites, metal matrix composites, hybrid composites, sandwich composites, laminates, processing of composites

Recommended Books

1. W. D. Callister, “ Materials Science and Engineering: An Introduction”, 8th Edition, John Wiley and Sons, Inc, 2007
2. W. F. Smith, “Principles of Materials Science and Engineering” 3rd Edition, McGraw Hills, 2003
3. P. Bahadur, “Principles of Polymer Science”, Narosa publishing house, 2003
4. A. Brent Strong, “Plastics: Materials and Processing”, 2nd edition, 2000.
5. R. Sinha, “Outlines of Polymer Technology: Manufacture of Polymers”, Phi learning, 2002.
6. A. K. Kaw, “Mechanics of composite materials”, CRC Press, 2005.
7. M. M. Schwartz, “Composite Materials Handbook”, McGraw-Hill, 1983.
8. M. Chanda and S. K. Roy, “Plastics Technology Handbook”, CRC Press, 1998

Paper II

Course Code: MME 312

Foundry Engineering-II

Credit Hours: 4(3,1)

Prerequisites: Foundry Engineering-I, Materials Thermodynamics

Objective

To provide information about various casting principles and techniques used in foundries.

Course Outline

Design of gating system; Elements of the gating system, essential requirements of gating system, characteristics of gates, pouring cups, sprue, types of runners and gates, gating ratio, pressurized and un-pressurized gating system, casting design considerations, defects due to improper gating design. Riser Design; Primary functions of riser, theoretical considerations including riser shape, riser size as a function of casting shape and location of risers, directional solidification, use of chills, use of insulators and exothermic compounds. Solidification of metals; Introduction, freezing of a pure metal: solidification in a mould, nucleation and growth, non-metallic inclusions, casting structures, freezing of alloys, properties related to the freezing mechanism. Cleaning and Inspection; Rough cleaning including flogging, mechanical cut off, torch cutting. Surface cleaning including tumbling, blasting and other types of surface cleaning. Trimming including dripping, grinding, stand grinding, finishing of castings. Inspections of casting including visual, dimensional and metallurgical procedures, Treatment of Al-based, Cu-based and other foundry alloys; degasification and modification. Casting defects; Occurrence, appearance and remedial measures of various casting defects for common foundry alloys, Treatment with cover and cleaning fluxes, filtration of aluminum alloy castings, Design and operational procedure of a foundry Cupola, Family of cast irons, Production of Grey and S.G. Irons.

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

Recommended Books

1. J. Campbell, "Castings", Butterworth-Heinemann, 2003.
2. R. A. Flinn, "Fundamentals of Metal Casting", Addison Wesley Inc , 1983.

3. R. W. Heine, C. R. Loper and P. C. Rosenthal, "Principles of Metal Casting", Tata McGraw-Hill, Inc., 1976.
4. P. Beeley, "Foundry Technology", Butterworth-Heinemann, 2001.
5. J. R. Brown, "The Foseco Non-Ferrous Foundryman's Handbook", Butterworth-Heinemann, 11th Edition, 1999.
6. J. R. Brown, "The Foseco Foundryman's Handbook", Butterworth-Heinemann, 10th Edition, 1999.

Paper III

Course Code: MME 313

Heat Treatment and Phase Transformation

Credit Hours: 4(3,1)

Prerequisites: Physical Metallurgy

Objective

To provide fundamental knowledge of heat treatment processes.

Course Outline

Solid Solution, Interstitial solid solution and Substitutional solid solution, Driving force for phase transformation, Diffusional studies, self-diffusion, Volume and grain boundary diffusion. Critical radius. Liquid-solid and solid-solid transformation. Nucleation & growth, homogeneous and heterogeneous nucleation, nucleation on crystalline defects and on grain boundaries. diffusional and diffusionless transformation, iron carbon phase diagram, Annealing, normalizing, quenching and tempering of plain carbon steels, quenching rates and quenching media, martensitic transformation, TTT diagrams, CCT diagrams. Hardenability, austempering, martempering, heat treatment of cast iron, age hardening/precipitation hardening.

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

Recommended Books

1. D. A. Porter and K. E. Easterling, "Phase Transformations in Metals and Alloys", Chapman and Hall, 2001.
2. R. E. Smallman and R. J. Bishop, "Modern Physical Metallurgy and Materials Engineering", Butterworth-Heinemann, 1999.
3. R. W. K. Honeycombe and H. K. D. H. Bhadeshia, "Steels: Microstructure and Properties", Butterworth-Heinemann, 2006.

4. J. W. Christian, "The Theory of Transformations in Metals and Alloys", Pergamon, 2002.
5. G. E. Totten, "Steel Heat Treatment: Metallurgy and Technologies", CRC Press, 2006.
6. Ge. Krauss, "Steels: Heat Treatment and Processing Principles", ASM International, 1990.
7. J. W. Martin, "Precipitation Hardening", Butterworth-Heinemann, 1998.

Paper IV

Course Code: MME 314

Steel Manufacturing Technology

Credit Hours: 3(3,0)

Prerequisites: Iron Manufacturing Technology, Materials Thermodynamics

Objective

To provide thorough understanding of steel manufacturing and advanced steels.

Course Outline

History of modern steel making Processes; Puddling Process for Wrought Iron making, Cementation Process for Blister steel making, Crucible Process for carbon steel making, Birth of Modern Steel Making, Bessemer Converter Steel making Process, Open Hearth Steel Making Process, Raw Materials for Contemporary steel Making; Hot Iron from Blast Furnace, Pig Iron, Direct Reduced Iron. Hot Briquetted Iron, Ferrous Scrap, Mill Scale, Fluxes, refiners and Alloying Master Alloys.

Modern Steel Making Processes; Basic Oxygen Process of Steel Making, Electric Arc Steel Making, Induction Melting for steel Making, Vacuum Induction Melting for Ferrous Alloys Making.

Physical Chemistry of Ferrous Alloys Making; Basis of Principal Reactions associated with Steel Making, Oxidation, slag making, refining and master alloys addition treatment to the molten steels.

Physical Metallurgy of Ferrous Alloys Making; Constitution of alloys, Solid Solutions, IM compounds, Hume-Rothery Factors and selection of alloying elements.

Secondary Steel Making Processes; Ladle Metallurgy, Gases and Non-Metallic Inclusions in molten Steels and their Removal. Vacuum application for degassing, Inert gas and Synthetic slag treatments for NMI expulsion.

Solidification of Molten Steels; Ingot Casting and mould defects, Continuous casting for billets making

Conceptual Introduction to Important Ferrous Alloys; High Strength Low Alloys (HSLA), Stainless Steels, Die and Tool Steels, Interstitial-Free and Ultra Low Carbon bainitic steels, Amorphous (BMG) Steel, Maraging Steels, Advanced Generation Steels.

Recommended Books

1. C. Bodsworth, "Physical Chemistry of Iron and Steel Manufacture", Prentice Hall, 1972.
2. R. H. Tupkary, "An Introduction to Modern Steel Making", Khanna Publishers, 2000.
3. H. E. McGannon, "The Making, Shaping and Treating of Steel", United States Steel, 1964.
4. J.J. Moore, "Chemical Metallurgy", Butterworth-Heinemann, 1990.
5. J. Newton, "Extractive Metallurgy", John Wiley & Sons Inc, 1959.
6. R. H. Parker, "An Introduction to Chemical Metallurgy", Pergamon, 1967.
7. V. A.Kadrin, "Steel Making", 2nd Edition, Mir Publisher, 1985.
8. A. K.Charabarti, "Steel Making", PHI publishers, 2006.
9. J. R.Lewis, "Dictionary of Metallurgy", CBS Publisher, 2006.

Paper V

Course Code: MME 315

Manufacturing Processes

Credit Hours: 3(3,0)

Prerequisites: Engineering Mechanics, Mechanical Behaviour of Engineering Materials

Objective

To enhance the basic understanding of materials manufacturing processes.

Course Outline

Introduction to Shaping Processes and Classification, Structure-Property-Processing Relationship, Stress and strain relationships for elastic behavior, theory of plasticity, Fundamentals of metal working Cold and Hot Working of Metals. Scope and importance of manufacturing technology in Pakistan, Classification of mechanical

working processes, Stamping and Deep Drawing, Weldability, work hardening, forging, extrusion, tube and wire 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, 3D printer manufacturing, Introduction to Non-conventional manufacturing processes such as water jet cutting, and plasma cutting, Tool design.

Recommended Books

1. B. H. Amstead, P. F. Ostwald and M. L. Begeman, "Manufacturing Processes", John Wiley & Sons, 1987.
2. R. C. Creese, "Introduction to Manufacturing Processes and Materials", Taylor and Francis, 1999.
3. S. Kalpakjian and S. R. Schmid, "Manufacturing Processes for Engineering Materials", Pearson Education, Inc., 2003.
4. E. P. DeGarmo, J. T. Black and R. A. Kohser, "Materials and Processes in Manufacturing", Wiley, 2002.
5. M. P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley & Sons, Inc. 2007.
6. H. Geng, "Manufacturing Engineering Handbook", McGraw-Hill, 2004.
7. M. F. Ashby and D. R. H. Jones, "Engineering Materials 2: An Introduction to Microstructures, Processing and Design", Butterworth-Heinemann, 2005.
8. M. F. Ashby and D.R. H. Jones, "Engineering Materials-2", Pergamon, 2005
9. H. Geng, "Manufacturing Engineering Handbook", McGraw-Hill, 2004
10. G.E. Dieter, "Mechanical Metallurgy", McGraw-Hill, 2000

Six Semester

Paper I

Course Code: MME 321

Corrosion Engineering

Credit Hours: 4(3,1)

Prerequisites: Applied Chemistry, Materials Thermodynamics

Objective

To impart basic knowledge of corrosion science and corrosion control methods.

Course Outline

Destruction, Types of Destruction, Factors affecting choice of an engineering material, Definition of corrosion, corrosion effect, corrosion damage, Factor affecting corrosion resistance, Classification of Corrosion, Corrosion rate expressions, Evaluation of materials corrosion resistance in terms of corrosion rate, Methods to control corrosion, Electrical Technology Concepts, Basic Thermodynamics Concepts, Combination of two single electrodes, Electromotive Force series (EMF series), General features, applications and limitations of EMF series, Galvanic series, Characteristics of Galvanic Series and limitations of galvanic series, Chemical, Electrical and Electrochemical Electrode, Reversible and Irreversible Potential, Standard Electrode Potential, Nernst Equation, Types of Reaction, Chemical reaction and Electrochemical reaction, Conversion of Chemical and electrochemical reaction in Nernst Equation, Thermodynamic Calculation of Standard Potentials, Measurement of Standard Electrode Potential, Cell EMF, Direction of spontaneous Reaction and Sign Convention of Electrode Potential, pH and Hydrogen ion activity, Reference Electrode and Types of Reference Electrode, Types of Corrosion Cells/Galvanic cells, Faradays Law and their application in determination of Corrosion rate, Basic Corrosion study, Factors Influencing Corrosion, Potential-pH Diagrams (Iron, Zinc, Aluminum, Copper, Nickel), Domain of thermodynamics Stability of water under 1 atm pressure, Protection of Iron against corrosion, cathodic protection, anodic protection, inhibitor, and alkalization, Limitations of the Pourbaix Diagrams, Eight types of Corrosions, Single Electrode and Helmholtz Double Layer, Polarization, Magnitude of polarization, Depolarization, Thermodynamic irreversibility and polarization, Corrosion kinetics, Reversible electrode, Departure from equilibrium (Activation over-potential), Irreversible Forward Reaction (Anodic Polarization), Irreversible Forward Reaction (Cathodic Polarization), Tafel equation, Exchange current Density, Electrochemical

Polarization Types, Kinetics of Electrochemical Reactions (Tafel Equation), Wagner-Traud Diagrams, Anodic Polarization, Cathodic Polarization, Galvanic Coupling, Three electrode corrosion cell, Influence of polarization on corrosion rate, Significance of E_{corr} and I_{corr} , Cathodic Protection of metals, Types of Cathodic Protection, Problems of Cathodic Protection, Anodic Protection/Passivity, Environmental variables (pH, oxidizing power, Temperature, velocity, concentration), Corrosion control by inhibitor, Corrosion control by coating.

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

Recommended Books

1. I. H. Khan, "Corrosion Technology", Vol-I, Edition 2nd AFAQ, 2010.
2. D. E.J. Talbot, J. D.R. Talbot, "Corrosion Science and Technology", CRC Press- Technology & Engineering, 2010
3. P. R. Roberge, "Corrosion Engineering, Principles and Practice", McGraw-Hill Companies, Inc., 2008
4. Z. Ahmad, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science & Technology Books, 2006.
5. D. Stephen Cramer and S. Bernard Covino, ASM Handbook Volume 13 "Corrosion", ASM International, 2005
6. H. H. Uhlig ; R. Winston Revie, "Corrosion and Corrosion Control", 4th Edition John Wiley & Sons, Inc., 2008.
7. M. G. Fontana, "Corrosion Engineering", Tata McGraw-Hill, Inc., 2006.
8. K. R. Trethewey, "Corrosion for Science & Engineering", Addison Wesley Longman, 1996.

Paper II

Course Code: MS 322

Industrial Safety and Environmental Engineering

Credit Hours: 3(3,0)

Objective

To provide fundamental knowledge of industrial safety and environmental issues.

Course Outline

Industrial safety management, Understanding accident and hazard, Hazard control and loss control. Accident Prevention and Control, Accident reporting and investigation, Fire safety, Types of fire Extinguishers, Electrical Safety, Safety in boilers, Safety in material handling and storage, Material safety data sheet (MSDS), COSHH and Risk assessment, 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.

Recommended Books

1. T. J. Anton, "Occupational Safety & Health Management", McGraw-Hill, 2006.
2. D. Della-Giustina, "Safety and Environmental Management", Government Institutes, 2007.
3. R. Packman, "A Guide to Industrial Safety and Health", Longmans, 2007.
4. J. S. Angle, "Occupational Safety", Thomson Delmar Learning, 2004.

Paper III

Course Code: MME 323

Welding and Joining Processes

Credit Hours: 4(3,1)

Prerequisites: Physical Metallurgy, Heat treatment and Phase transformation

Objective

To provide conventional and advanced knowledge of welding and joining processes according to the needs of industry.

Course Outline

Welding Science and Technology; Welding Science, Fluxes, Filler Metals, Metallurgical aspects of Welding including Effect of heat, welding and deformation on Microstructure and properties of Steels, Stress and distortion in welding, Welding symbols and types of joints, Selection of appropriate processes, Inspection and testing of welding joints, WPS and WPQR. Welding Practice; Arc Welding (SMAW, GTAW, TIG, MIG, FCAW), Friction stir welding, Thermite Welding, power source and polarity (Consumable and Non-consumable), gas Welding and its types, Soldering, Brazing, Resistance Welding and its types, Solid State Welding and Other Joining processes.

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

Recommended Books

1. H. B. Cary and S. C. Helzer, "Modern Welding Technology", Prentice Hall, 2004.
2. A. D. Althouse, C. H. Turnquist and William A. Bowditch, "Modern Welding", Goodheart Wilcox Company, 2000.
3. K. Easterling, "Introduction to the Physical Metallurgy of Welding", Butterworth-Heinemann, 2000
4. J. F. Lancaster, "Metallurgy of Welding", William Andrew, 1999.

Paper IV

Course Code: MME 324

Non-Ferrous Metallurgy

Credit Hours: 3(3,0)

Prerequisites: Mineral Processing, Ferrous Metallurgy, Foundry Engineering-II, Materials Thermodynamics

Objective

To provide in-depth knowledge of production of non-ferrous metals.

Course Outline

Introduction to Non-Ferrous Production Metallurgy, Importance, and Demand of Non-Ferrous Metals, Composition of Earth Crust, Non-Ferrous Metals in Pakistan. Heavy Metals; Cu, Ni, Pb, Zn, Sn, Light Metals; Al, Mg, Noble Metals; Au, Ag, Ferroalloy Metals; Cr, Mn, Refractory Metals; Ti, Zr, W, Following Aspects of the Mentioned Metals will be Discussed: General Properties, Sources, Historical Note, Major Uses, Datasheet, Grade, Main Market Features, Total World's Reserves, Metallurgy of Metals; Various Routes for The Extraction and Refining of Metals with Flow Sheet Diagram, Alloys of Metals, Composition Properties and Uses.

Recommended Books

1. C. B. Gill, "Nonferrous Extractive Metallurgy", Krieger Pub Co., 1988.
2. N. Sevryukov, B. Kuzmin and Y. Chelishchev, "General metallurgy", MIR Publishers, 1969.
3. H. S. Ray, R. Sridhar and K. P. Abraham, "Extraction of Non-Ferrous Metals", Affiliated East-west Press Pvt Ltd, 1987.
4. J.J. Moore, "Chemical Metallurgy", Butterworth-Heinemann, 1990.
5. F. Cardarelli, "Materials Handbook", Springer, 2000.

Paper V

Course Code: CS 325

Computer Applications in Materials Engineering

Credit Hours: 3(2,1)

Prerequisites: Introduction to Computing and Computer Systems

Objective

To provide knowledge of physical system modelling and computer simulation in Materials Engineering.

Course Outline

Introduction to modelling, model development testing and verification, fundamental conservation relationships, boundary conditions, computer modeling; finite difference element, finite element method, mesh and mesh generation, solution methods for linear systems, storage matrices in memory, application of simulation software (met lab, solid cast, thermos calc) to solve practical problems.

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

Recommended Books

1. A. B. Chelyustkin, "The Application of computing Technique to Automatic Control Systems in Metallurgical Plant", MacMillan 2004.
2. Norman, ASTM Series, "Computer Application in Materials Engineering", 2000.
3. J. L. Vedral, "Expert Systems to Materials Selection During Structural Design", National Research Council (U.S.), Natl ACA Press, 2004.
4. National Research Council (U.S.A), "Computer Aided Materials Selection" National Academies Press, 1995.

Seven Semester

Paper I

Course Code: MME 411

Surface Engineering and Tribology

Credit Hours: 4(3,1)

Pre-requisites: Corrosion Engineering

Objective

To increase in-depth understanding of surface engineering and tribology.

Course Outline

Introduction to Surface Engineering and tribology, Friction (types & prevention), Wear losses, types and prevention, Lubrication (Hydrostatic, Hydrodynamic, Mixed, Boundary & Solid-Film Lubrication), Surface interactions with environment (Surface Reconstruction, Segregation, Physisorption, Chemisorption, Compound Formation), Microstructural Effects on Wear and Friction, Wear and Galling Properties of Materials, Wear Behavior of Solid Lubricants and Self-Lubricating Solids, Surface Treatment; Cleaning (Solvent cleaning, Emulsion cleaning Alkaline cleaning, Acid cleaning, Pickling, Salt Bath Descaling, Ultrasonic cleaning, Plasma cleaning), Roughening (abrasive Blasting, Barrel Finishing, Mechanical Polishing and Buffering, Chemical Etching, electropolishing). Coatings; Types of coatings, (Metallic, Non Metallic) Functions of Coatings, Techniques of coating deposition (Spraying, Welding, cladding, Vapor deposition, chemical deposition, Electrochemical deposition, plating), Microstructural treatments on Surfaces: Induction, Hardening, LASER Hardening, electron Beam hardening Chill Casting, Work Hardening, Diffusion treatments: Carburising, Carbonitriding, Nitriding, Nitro-carburizing chromising, Boriding, Aluminising, Siliconising, Sheradizing. Implantation Treatment; Ion Implantation, Ion Beam Implantation, Tribological Applications of Material, Coatings & surface treatments Bearing, Seals Gears, Piston Rings, Bushes, Cutting tools, etc.

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

Recommended Books

1. J. B. Hudson, "Surface Engineering: An Introduction", Butterworth-Heinemann, 2000.
2. B. Bhushan, "Modern Tribology Handbook", CRC Press, 2001.

3. S. Kalpakjian and S. R. Schmid, "Manufacturing Processes for Engineering Materials", Pearson Education, Inc., 2003.

Paper II

Course Code: MS 412

Production and Quality Management

Credit Hours: 2(2,0)

Objective

To provide awareness of management methods to the engineers working in industry.

Course Outline

Introduction and Evolution of Management Science; Nature and Scope of Operation Management: Introduction to production/operation management functions and classification of production systems. Policies and objectives, Strategies, Mission, Goal, Decision Making. Resource Allocation-Linear Programming; Model formulation; Analysis of linear programming model, Graphical approach, Simplex method, Application of linear programming. Forecasting; Type, Techniques, Time Span, Accuracy, Integer Programming; Types of integer programming problems; solution procedure. Breakeven Analysis and Capacity Planning; Linear and non-linear. Quality Management; Introduction , Tools for quality management /control, Six Sigma concept, ISO 9000, Quality Tips. Project Management; PERT, CPM

Recommended Books

1. W. J. Stevenson, "Production/Operations Management ", McGraw-Hill, 1990.
2. E. S. Buffa, "Modern Production/Operations Management", C. B. S Publications, 2003.
3. W. G. Harcourt, "Production and Operation Management", Brace & World, 2006
4. N. J. Aquilano, R. B. Chase, "Production and Operation Management" , Irwin, 2007

Paper III

Course Code: MME 413

Advanced Materials

Credit Hours: 3(3,0)

Prerequisites: Introduction to Engineering Materials, Fundamentals of Materials Science, Engineering Ceramics and Glasses, Polymeric and Composite Materials

Objective

To familiarize students with materials utilized in advanced technologies.

Course Outline

Development of new breeds of engineering materials, smart materials and functionally gradient materials, dielectric materials, ferroelectric and piezoelectric materials, Semiconductors, superconductors, optical and magnetic materials, Biomaterials, Advanced ferrous alloys, Processing and properties of superalloys. Directionally solidified and single-crystal superalloys, Heat-resistant materials, thermally conducting materials, insulating materials, titanium alloys, refractory metals and alloys, nuclear materials, nanomaterials and their classification, carbon nanomaterials, Mechanically alloyed metals, ODS alloys, BMG, Nanostructured materials, Fuel cell materials, materials for hydrogen storage, Shape memory alloys

Recommended Books

1. S. A. Guelcher and J. O. Hollinger, "An Introduction to Biomaterials", Taylor and Francis, 2005.
2. C. P. Poole and F. J. Owens, "Introduction to Nanotechnology", Wiley-Interscience, 2003.
3. M. H. Van de Voorde and G. W. Meetham, "Materials for High Temperature Engineering Applications", Springer, 2000.
4. A. S. Edelstein and R.C. Cammarata, "Nanomaterials: Synthesis, Properties and Applications", IoP, 2001.
5. M. J. Donachie, "Superalloys: A Technical Guide", ASM International, 2002.
6. T. G. Nenov, Stefcho P. Yordanov, "Ceramic Sensors: Technology and Applications", Technomic Pub., 1996.
7. M. P. Hemsworth "Nuclear Materials" Nova science PUB inc. 2011
8. R.E. Smallman and A.H Ngan, "Modern Physical Metallurgy", Butterworth Heinemann, 2014

Paper IV

Course Code: HS 414

Industrial Psychology and Sociology

Credit Hours: 2(2,0)

Objective

To develop understanding of social life and psychological behaviour of workers in industrial environment.

Course Outline

The Structure and Function of work organizations; Formal Organization, Top, Middle, and First-Line Managerial Roles, The Behavior of Work Groups, Power and Union Organization, Functions and Roles of Union Officials, Social Conflict in the Work Organization, Income, Class, and Social Structure, Status and Prestige in the Work Organization. The Individual in the World of Work; Career and Occupational Mobility, Personality and Organization. Major problems of Applied Industrial and Organizational sociology; The evolution of Managerial Philosophies, Leadership, Morale, and Productivity, The Governing of the Work Organization. Industry, Community, and Society; Industry Community Relations, The Future of Industrial Society. Introduction to Industrial Psychology; Introduction, Individual Differences in Behavior, Job Analysis and Job Requirements. Personnel Selection and Appraisal; The Interview and Related Personnel Methods, General Principles of Personnel Testing, Aptitude Tests, Tests of Personality and Interests, Achievement Tests.

Recommended Books

1. E.V. Schneider, Industrial Sociology, McGraw-Hill, 1982.
2. D.C. Miller and W.H. Form, Industrial Sociology, Harper and Row, 1980.
3. J. Tiffin, E. J. McCormick and D. R. Ilgen, "Industrial Psychology", Prentice Hall, 1980.

Paper V

Course Code: MME 415

Materials Characterization

Credit Hours: 3(2,1)

Pre-requisites: Fundamentals of Materials Science, Mechanical Behaviour of Engineering Materials, Applied Physics, Applied Chemistry

Objective

To provide fundamental knowledge about state-of-the-art materials characterisation techniques.

Course Outline

Properties and production of x-rays, absorption of x-rays, use of filters, synchrotron radiation source, x-ray safety, crystallography, reciprocal lattice, Bragg's law, Diffraction methods, x-ray diffraction, Ewald sphere, Debye-Scherrer technique, powder diffraction, indexing planes, diffractometer, experimental consideration during diffraction, intensity calculations, structure factor calculations, application of x-ray diffraction (Scherrer equation, size and strain analysis), wet analysis, electron microscopy (SEM & TEM), electron diffraction, AFM, STM, EDX, XRF, spectroscopic techniques (FTIR, UV, Raman), thermal characterization of materials: TGA, DSC, DTA, DMA, TMA, non-destructive testing.

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

Recommended Books

1. D. Brandon and W. D. Kaplan, "Microstructural Characterisation of Materials", Wiley, 1999.
2. B. D. Culty, "Elements of X-ray Diffraction", 3rd Edition, Prentice Hall, 2002
3. J. B. Wachtman, "Characterisation of Materials, Butterworth- Heinemann, 2000.
4. M. H. Loretto, "Electron Beam Analysis of Materials", Chapman and Hall, 1984.
5. D. B. Williams and C. B. Carter, "Transmission Electron Microscopy", Plenum, 1996.
6. S. N. Magonov and M. Whangbo, "Surface Analysis with STM and AFM: Experimental and Theoretical Aspects of Image Analysis", VCH, 1996.
7. P. J. Goodhew and F. J. Humphreys, "Electron Microscopy and Analysis", Taylor & Francis, 1988.

8. M. E. Brown, "Introduction to Thermal Analysis" Techniques and Applications, Kulwer Academic Publishers, 2001

Paper VI

Course Code: MME 416

Research Project

Credit Hours: 3(3,0)

The students shall perform experimental investigation on some particular research topics assigned to them and prepare the required project thesis in the final year (7th and 8th semester) for submission and for Viva-Voce Examination.

Eighth Semester

Paper I

Course Code: MS 421

Industrial Management and Process Economics

Credit Hours: 2(2,0)

Pre-requisites: Production and Quality Management

Objective

To familiarize students with the Industrial Management and with the concepts of economics and their application in chemical engineering design for the purpose of cost estimation and profitability analysis

Course Outline

Functions of Managements: Management Levels, Managing with Competitive advantage, Organizational structure. Functions of organizations, Planning, Organizing. Power and leadership. Type of leadership, Types of Leaders, Sources of Power, types of managerial projects, role of project manager, delegating authorities, tendering, Development of a Work Breakdown Structure (WBS). Resource Planning and leveling. Team building. Developing a communications plan. techniques for identifying risks, Categorizing risks, industrial audits, audit report.

Company Law of Pakistan: Kinds of companies under section 84 of the companies ordinance, Public and private companies, Company limited. Unlimited company. Name of the Company, Rules for changing the name and place of a company, registered office of the company, article of association.

Plant Location: Needs objectives. Factors influencing plant location strategies, Global location, models for plant location. Engineering economy defined; Measures of financial effectiveness; Non-monetary factors and multiple objectives; principles of engineering economy. Consumer and producer goods; Measures of economic worth; Price, Supply, & Demand relationship; Production; Factors of production; Laws of return. Sunk & opportunity costs; Fixed, variable, and incremental costs; Recurring & nonrecurring costs; Direct, indirect, and overhead costs; Standard costs; Breakeven analysis; Unit cost of production; Cost-benefit analysis; Feasibility studies; Value analysis in designing & purchasing. Islamic and Contemporary financing system and their use in cost estimation. Depreciation accounting. Economic evaluation of processes and equipment; Payback period method, Present worth method, Uniform annual cost method, Rate of return method. Manufacturing lead time; Production rate; Capacity; Utilization; Availability; Work in process; WIP and TIP ratios. Types of ownership; types of stock; Partnership & joint stock companies; Banking & specialized credit institutions, Maintenance: Cost for maintenance & repairs, proactive & active maintenance.

Process Economics: Principles and applications. Characteristics of chemical industry. Cost estimation and its techniques. Cash flow for industrial operations (cumulative cash position); factors affecting investment and production cost; Capital investments, Estimation of capital investment; Types of capital cost estimates; cost indexes; cost factors in capital investment; estimation of total product cost; interests and investment cost; types of interests; present worth and discount; Taxes and insurance; types of tax; federal income tax; insurance and legal responsibilities; types of insurance.

Depreciation: Types of depreciation; Service life. Salvage value. Present value; methods of determining the depreciation; evaluation of depreciation methods, amortization.

Financial Analysis: Payback period method, present value, IRR, MIRR method. Cost volume analysis. Feasibility studies.

Recommended Books

1. F. Gail, B. James, "Mangement in Engineering Principles and Practice" 2nd Ed., Prentice-Hall, 1996.
2. B. E. Spencer, "Elements of production: operations management", John Wiley & Sons, 1981
3. S. Mirza, "Human Resources Management" 2nd Ed., Tata McGraw-Hill, 2000

4. M. S. Peters, K. D. Timmerhaus and R. E. West,. "Plant Design and Economics for Chemical Engineers" 5th Ed. ,McGraw-Hill,2003
5. L. Blank, and A. Tarquin, "Engineering Economy", 6th Edition, McGraw Hill, 2005
6. G.J. Thuesen, and W.J. Fabrycky, "Engineering Economy", 9th Edition, Prentice Hall of India, 2005
7. T. G. Eschenbach, "Engineering Economy" 2nd Edition, Oxford University Press, 2003.
8. J. X. Warg, "What Every Engineer should Know about Business Communication", CRC Press, 2008
9. L. Blank, and A. Tarquin, " Engineering Economy", 6th Edition, McGraw Hill, 2005.

Paper II

Course Code: MME 422

Instrumentation and Process Control

Credit Hours: 3(2,1)

Pre-requisites: Process Engineering, Differential Equations and Applied Mathematics

Objective

To provide knowledge about the instrumentation and process control.

Course Outline

Basic Concepts, Characteristics, Functions of Instruments Especially for Indicating and Recording Length, Weight, Volume, Temperature, Pressure, Flow Level etc. Measuring Errors, Calibration, High Temperature Measurements with Special Emphasis. Introduction to Principles of Automatic Control Systems Encountered in Engineering, Open-loop and Closed Loop System, Feed Back, Mode of Operations of Hydraulic, Pneumatic Electrical Components, Amplifier Servomotors, Process Controller, Regulating Valves, Response and Transfer Functions of First-Order Systems along with Physical Examples of First-Order Systems, Systems in Series, Block Diagram of Control System Control Element, Time Constant of Different Physical Systems, Control Values On-Off Control Pneumatic and Solenoid Value of Control System.

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

Recommended Books

1. D. R. Coughanowr, "Process Systems Analysis and Control", McGraw-Hill, 1991.
2. J. M. Coulson and J. F. Richardson, "Coulson & Richardson's Chemical Engineering", Butterworth-Heinemann, 2007.
3. J. Park, S. Mackay, "Instrumentation and Control System", Newness, 2003.
4. W. Boyes, "Instrumentation Reference Book", Elsevier, 2003

Paper III

Course Code: NS 423

Statistical Methods and Estimation

Credit Hours: 2(2,0)

Pre-requisites: -

Objective

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.

Recommended Books

1. J. Medhi "Statistical Methods", New Age Publishers, 2005.
2. K. Lange, "Statistical Methods", Springer, 2002.
3. D. C. Montgomery and G. C. Runger, "Applied Statistics and Probability for Engineers", John Wiley & Sons, 2001.

4. N. A. Weiss, "Introductory Statistics", Addison Wesley, 1995.

Paper IV

Course Code: MME 424

Powder Metallurgy

Credit Hours: 2(2,0)

Pre-requisites: Mineral Processing, Manufacturing Processes

Objective

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, Dies for powder compaction, 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.

Recommended Books

1. R. M. German, "A - Z of Powder Metallurgy", Elsevier Science, 2006.
2. W. G. West and Leander F. Pease, "Fundamentals of Powder Metallurgy", Metal Powder Industries Federation, 2002.
3. R. M. German, "Sintering Theory and Practice", Metal Powder Industries Federation, 1996.
4. A. J. Yule and J. D. Dunkley, "Atomization of Melts for Powder Production and Spray Deposition", Clarendon Press, 1994.
5. R. M. German, "Powder Metallurgy Science", Metal Powder Industries Federation, 1984.
6. G. H. Gessinger, "Powder Metallurgy of Super alloys", Butterworth-Heinemann 1984.
7. I. H. Khan book, K. A. Qureshi, J.I. Minhas, "Fundamentals of Powder Metallurgy", Institute of Chemical Engineering and Technology, University of the Punjab, Lahore, Pakistan, 1988

Paper V

Course Code: MME 416

Research Project

Credit Hours: 3(3,0)

The students shall perform experimental investigation on some particular research topics assigned to them and prepare the required project thesis in the final year (7th and 8th semester) for submission and for Viva-Voce Examination.