Course Contents for B.Sc. Mining Engineering Program

Department of Mining Engineering
University of Engineering & Technology, Lahore

2024 to onward

1st Semester

MA-113 Calculus & Analytic Geometry (3,0)

A review of differentiation: Geometrical interpretation of a derivative; Infinitesimal; Differential coefficient; Derivatives of higher order; Indeterminate forms and L. Hopital's rule; Asymptotes; Curvature; Approximation and error estimates.

Further techniques of Integration; Integration by reduction formula; Fundamental Theorem of Integral Calculus; Definite integral and its properties; Area enclosed between curves; Arc length; Volume of a solid; Volume of a solid of revolution; Area of surface of revolution; Moments; Centroids.

Cartesian, cylindrical and spherical coordinates; The ratio formula; Equations of a straight line in R^3; Direction ratios and direction cosines; Angle between two straight lines, Distance of a point from a line; Equations of a plane; Angle between two planes; The sphere; Directional derivatives.

The concept of limit, continuity and differentiation in functions of several variables; Geometric interpretation of partial derivatives; Total differential; Chain rule; Implicit differentiation; Maxima and minima of functions of two independent variables. Taylor's and Maclaurin's series for functions of two variables.

Double Integration; Fubini's Theorems; Change of order; Geometrical Interpretation of double integral; Applications to find volumes and areas.

Recommended Books:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch., published by Allied Book Centre, Urdu Bazar Lahore.
2. "Calculus" by Thomas & Finny published by Addison Wesley
3. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons,
4. "Calculus" by Howard Anton.
5. "Calculus" by Swokowski.

ME-122L Engineering Drawing (0,2)

Use of instruments, planning drawing sheets, lettering orthographic projection, 1st and 3rd angle, auxiliary projection, interpretation curves.

Freehand sketching, conversion from pictorial to orthographic and vice versa

Planning of a drawing sheet, projection of simple position, oblique and auxiliary planes

Lettering and dimensioning, principal requirements of a working drawing

Isometric and pictorial projections of solid figures, making of freehand sketches from solid objects and from orthographic projections,

Sections of solids, tangent planes to surfaces in contact, inter section of surfaces and inter penetration of surface and solids development of surfaces.

Screw thread systems, keys and cotters, couplings and simple bearing

Recommended Text Books:

1. A. C. Parkinson, First Year Engineering Drawing
2. N. D. Bhatt, Engineering Drawing and Graphics

Recommended Reference Books:

T. E. French, C. J. Viereck and R. J. Foster, Engineering Drawing and Graphic Technology

MinE-100 Geology (3,1)

Introduction to Geology and its branches; Origin of the earth and its place in universe. Interior of the earth and the chemical composition of the earth's crust; Mountain building and valley formation, drainage patterns and their types; Weathering and Erosion; Deformational structural features of rocks, dip, strike, faults, folds and joints; Mass wasting; Plate tectonics; Earthquakes and volcanism; Minerals and Rocks; Earth mineral resources and occurrence of economic minerals and dimension stones in Pakistan

Lab Outline

1. International geological symbols for rocks, structures and minerals
2. Measurement of dip and strike
3. Geological map reading
4. Moh's Scale Hardness
5. Identification of rock forming minerals
6. Study of wooden models of faults and folds etc.

Recommended Books

Charles Plummer, Diane Carlson, Lisa Hammersley, 2016, *Physical Geology, 15th Edition*, McGraw-Hill, NYC, USA.

Cronin, V. S. (Ed.), & Tasa, D. (Illus.). (2018). *Laboratory Manual in Physical Geology*, (11th ed.) New York: Pearson

CSC-100 Applications of Information and Communications Technologies (2,1)

Introduction to Computer Systems: Basic Definitions; Computer and Communication Technology; The applications of ICT - particularly for Engineers

Basic Operations and Components of a Generic Computer System: Basic operations: Input, Processing, Output, Storage; Basic components: Hardware, Software, Data, Users; Types of storage devices

Processing Data: Transforming data into information; How computers represent and process data; Processing Devices; CPU architectures

Internet Basics: The Internet; The Internet and the World Wide Web- browsers, HTML; URLs/ How DNS works; Email and other programs

Introduction to Embedded Systems: What is an Embedded System; Applications; Components; Programming Languages; Popular Development Platforms; Programming Languages

Networking Basics: Uses of networks; Common types of networks (LAN, WAN, MAN etc.); Introduction to OSI Model; Future of Networks

Database Management : Hierarchy of Data; Maintaining Data: Database Management Systems

Protecting your privacy, your computer and your data: Basic Security Concepts; Threats to users; Threats to hardware; Threats to Data

ICT Applications: Computer controlled system; Robotics; Expert Systems

ICT Applications: Computer aided manufacturing systems; Autonomous Vehicles; Management Information system (LMS, School Management System)

ICT Applications: Bioinformatics; Health care applications; Telemedicine and online health consultations;

ICT Applications: Digital Identity; Cyberbullying; Online harassment

Future Trends in ICT

Lab outlines to be given by CS department

ME-100L Workshop Practice (0,1)

1 .Machine Shop: Detailed study of centre lathe and accessories. Plain and Taper turning. Basic lath operations including turning, facing, simple screw cutting/treading, Knurling, Grooving (Drilling and Boring), cutting tools and their grinding. Brief introduction of shaper, milling Sharing and Surface Grinding Machine. Assigning of Practical Jobs.

2. Fitting and Fabrication Shop: The use and care of fitter's tools. Marking out of job. Practice in Metal filing. Sawing, Drilling, dieing, Tapping and reaming. Brief introduction and use of power Hack Saw, Arbor Press, Sheet Sharing Machine, Sheet Rolling Machine, Punching Machine and Drilling Machine. Assigning of practical jobs.

3. Carpentry Shop: The use and care of tools. Type of Timber, its defects and preservation methods practice in planning and sawing. Different types of wood joints. Study of sawing, planning, turning mortise and tenon machines. Assigning of practical jobs.

4. Electrical Shop: Electric shocks and treatment. The use and care of tools used by Electrician. Types and uses of cable and electrical accessories for house wiring, practice in simple house wiring, testing methods. Switch gear used on domestic installation and DB system. Earthing System. Assigning of Wiring arrangements practical.

Books recommended:

1. Workshop Technology part-1 by W.A.J Chapman.
2. Electrical Wring by Richter and Schwan
3. Wiring Manual by Pak Cables Limited

IS-102 Islamic Studies (3,0)

Islamic Studies

1.The Holy Quran

a.Significance of the Holy Quran

b. topics of the Holy Quran

c.Miracles (Ijaz) of the Holy Qur'an
d.Principles of interpretation (Tafseer)
e.Textual Study of Sura Al-Hujurat (Complete)
(Meanings of Arabic text, translation & explanation)
Focus: Impact of the teachings and commands mentioned in Sura Al-Hujurat on human life.
Main points of discussion

- Commands of Allah regarding meeting with the Holy Prophet peace be upon him.
- Reports from wicked person to be tested.
- Brotherhood, equality, effort to compose the quarrels of groups and reconciliation between them.
- Elimination of social evils such as to laugh at people in contempt, calling others by offensive nick names, suspicion and back biting.
- All people (mankind) are one and the most righteous gets most honour before Allah.
- Qualities of believers.
- Knowledge of Allah about the secrets of the heavens and the earth and out actions.

f) Textual study of Surah Al-Maida (Verse:1 to 6)
(Meaning of Arabic text, translation & explanation)
Focus: Impact of the teachings and commands mentioned in Sura Al- Maida on human life.
Main Points of Discussion:

- Stress on fulfillment of uqud (obligations)
- Concept of halal (lawful) and haram (forbidden) in Islam
- Halal and haram animals and food
- Symbols of Allah Almighty
- Emphasis on helping one another in righteousness and piety
- Rules of hunting the animals for food.
- Social relationship with non-Muslims
- Relationship between Muslims and Ahl Al-Kitab (people of the Book)
- Rules of purity and cleanliness

g) Textual Study of Sura Al-Fur'qan: verses: 63 to77, Al-Mominoon 1-11.
(Meaning of Arabic text, translation & explanation)
Focus: Impact of the teachings and commands mentioned in Sura Al-Fur'qan and al-Muminoon on human life.
Main Points of discussion: Characteristics of Ibad-ur-Rehman (Slaves of Allah) and true believers.
h) Subjective Study of Surah-al-Noor and other Surahs
Al-Baqra 178, 179, Al-Nisa: 92,93, Al-Maidah: 8, 31-34,38. Al-Noor: 1-31,60 Al- Ahzab 32,33,53,55,59.
Focus: Impact of the teachings and commands mentioned in surah Al-Noor and other surahs on human life
Main Points of discussion:

- Hudood. Zina (adultery, fornication),
- Qad'f (false accusation).
- Li'an (accusation of a wife of zina),
- Drinking intoxicating liquors, narcotics
- theft, Dacoity, Robbery, Murder, Apostasy and Rebellion
- Ifk story (slander)
- Privacy, Hijab (woman's veil)

2) Al-Hadith
a) The need & Importance of Hadith
b) Compilation of Hadith
c) Brief Introduction of Sihah Sittah
d) Textual study of Hadith: Arbaeen-e-Navavi by Imam Nawawi, Hadith: 1 to 42
(Meanings of Arabic text, translations and explanation)
Focus: Impact of teaching and commands mentioned in Ahadith on human life.
Main points of discussion:

- Importance of intention (Niyya) in human actions
- Islam, Iman (belief), Ihsan (excellence) and the Hour.
- Rejection of Innovation (Al-Bid'ah) in religion (Din)
- Lawful, unlawful and doubtful matters
- Sincerity to Allah, his books, his messengers, leaders of the Muslims and common people
- Protection of lives and property of people
- Obedience of the Holy Prophet peace be upon him
- Importance of lawful food, drink, clothing and nourishing
- True believer is who likes for his brother what he likes for himself.
- Honour of the blood of Muslims and others
- Respect of neighbours and guests

- Importance of good talk and silence
- Prohibition to become angry and furious
- Ihsan (excellence) with regards to everything
- Good behavior towards people
- All kinds of expectation, help and benefit from Allah
- Importance of modesty (Al-Haya)
- To stand firm on Islam
- A guideline for a Muslim
- Obligatory deeds, Charity and minor acts
- Proof and Oath
- Islamic brotherhood
- Pardoning of mistakes and forgetfulness

3) The study of articles of faith & pillars of Islam and Jihad.

Focus: Impact of basic articles of faith, pillars of Islam and Jihad on human life.

Main points of discussion

a) Six articles of faith.

b) Pillars of Islam

1. Shahada (Witness) Importance and philosophy of witness that no God but Allah and and Muhammad (peace be upon him) is His Messenger.

Tawheed: Fundamentals and types of Tawheed, Al-Baqarah 284-286, Arguments about Tawheed in the light of Surah Luqman

Prophet-hood and Finality of Prophet- hood, Al-Ahzab 6,21,40,56,58

2. Salat (Prayer) Imposition of prayer, orders and significance.
3. Saum (Fasting) Meaning of Fasting obligation of Fasting, significance, disbursement, phy and spiritual advantages.
4. Zakat: The Economic system of Islam, Importance of Zakat, Prohibition of Riba (Inter Comparison between Islamic, Economic system and socialism, Capitalism & Communism.
5. Hajj: Imposition of Hajj, commands and rites of Hajj, financial social and spiritual advantage of Hajj.

c) Jihad (Striving in the cause of Allah): Importance, significance and its kinds.

4-Seerah-Tun-Nabi

Focus: Impact of the life of the Holy Prophet peace be upon him on human life.

Main points of discussion:

a.Life of the Holy Prophet (Peace be upon him) at Makkah and Madina.

b. The Holy Prophet (Peace be upon him) as a Perfect Man.

c.Muhammadan Revolution.

5) Islam and Modern Science

Focus: Impact of the teaching regarding Modern Science on human life.

Main Points of discussion:

- The Holy Quran as a guide for the modern scientific development, Surah Al-Baqra: verse 164 Aal-e-Imran verses 190-191.
- Importance of science education in the modern age.
- Introduction of Muslim Scientists, contribution of Muslim Scholars towards science.

6) Islamic Ethics

Focus: Impact of the ethics on human life.

Definition, importance and significance of Ethics.

Concept of Ethics in the light of Holy Quran

Al-Baqra: 83, 169	Al-Tauba: 7	Yunus: 36,
Hood: 18	Al-Nah'l:112	Al-Mutaffifeen: 1,2,3

Main points of discussion:

- Kindness with parents, kindred, orphans and needy people.
- Fair speaking to the people
- Refrain from evil and shameful deeds
- Abstain from killing any person except by way of law
- Security of the orphan's property
- Full justice in measure and weight
- Prevention from inventing a lie
- Fraud and its bad effects.

Moral values in the light of Hadith

Bulugh-ul-Maram, Kitab-ul-Jamae, Babul Tarheeb Min Msav-al-Akhlaq

Ahadith No. 3, 4, 7, 14, 17

Main points of discussion:

- To control anger
- Oppression is darkness
- Telling a lie is sign of hypocracy
- Backbiting

Ethics and character building in the light of Seerah
Ethical behavior of the Holy Prophet (PBUH)
Significance of moral values
(i) Truth (ii) Honesty (iii) Taqwa
(iv) Brotherhood (v) Patience

Note: Ethics is an alternative subject for non-Muslim students.
Note: The Medium of Instruction is urdu / English

HU-111L Communication Skills (0,1)

Introduction to Communication Skills, Study Skills, Components of Communication, Non-Verbal Communication, Functional English, Public Speaking, Formal Presentations, Resume/CV Writing, Interview Skills.

2nd Semester

CS-103 Introduction of Computer Programming for Data Sciences (2,1)

This course serves as an introduction to computer programming. We will study and implement the standard introductory topics of Python. Besides that, we will learn the applications of programming to data science.

LAB OUTLINES

Various Programming codes

RECOMMENDED BOOKS:

1. Paul Deitel & Harvey Deitel, "Intro to Python® for Computer Science and Data Science: Learning to Program with AI, Big Data and the Cloud", Pearson Education, Inc. 2020.
2. Wes McKinney, "Python for Data Analysis", O'Reilly Media, Inc, 2018.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, Inc, 2017.

EE-197 Basic Electrical and Electronics Engineering (2,1)

D. C. Machines: Types of excitation, operation and characteristics of series, shunt and compound generators and motors, armature reaction, stators, selection of motors. Elementary transmission and distribution, DC and AC systems transmission voltages, elements of house wiring, its testing, distribution, switching and fusing from the utilization points of view.

A. C. Circuits: Series and parallel circuits and their combination, improvement of power factor by condensers, three-phase alternating currents, advantages over single-phase, vector diagrams for the balanced three-phase system. Earthing of apparatus.

Transformers: Basic principles, ratio of transformation, iron and copper losses, efficiency and regulation. Brief discussion and uses of instrument transformers and auto transformers, three-phase transformers, stars and delta connections, Scott connections. Constructional features, cooling and protection from fire hazards.

A.C. Generators: Construction and working principles of alternator frequency, simple EMF equation. Polyphase generation.

A.C. Motors: Concept of rotating field, polyphase induction motor, production of torque, slip, squirrel cage and slipring motors, starting of motors, construction of synchronous motor, production of torque and starting characteristics, selection of A.C. Motors, measuring instruments, basic principles of construction and operation of moving iron dynamometer and hot wire instruments, power and energy meters, elementary considerations.

Storage Batteries: Lead and nickel iron cells, charge and discharge, quantity and energy efficiencies.

Mine Electrification: Principles of mine electrical circuits and required power calculations. Design of electric cables and control devices

Lab Outline:

1. To draw vector diagrams of A.C circuits containing (a) resistance and inductance in series, (b) resistance and capacitance in series, and (c) resistance, inductance and capacitance in series.
2. To study the effect of variation of frequency on an L-R-C series resonant circuit.
3. To measure the resistance of different resistors by (a) Color code. (b) VOAM.
4. To measure the power in an inductive load by using one voltmeter and one ammeter method.
5. To determine the load characteristics and magnetic characteristics of a DC shunt generator.
6. Load characteristics curves of a series generator.
7. To find the voltage regulation of a single phase transformer.
8. To measure the power of resistive network.
9. To verify Ohms Law, Kirchoff's Voltage Law & Current Law
10. To verify Current Division Rule & Voltage Division Rule 60
11. To measure the magnitude of voltage, time period and frequency by oscilloscope

Recommended Text Books:

1. Admirality, Examples in Electrical Calculations
2. B. L. Theraja, Electrical Technology
3. Robert Stifenko, Coal Mining Technology: Theory and Practice

Recommended Reference Books:

1. Electrical Circuits. Schaum's Series.
2. Erwin, Circuit Analysis

CY-144 Physical and Industrial Chemistry (2,1)

Physico-chemical principles involved in chemical analysis, instrumental methods of analyses, Hyphenated techniques; Surface analysis techniques, Industrial catalysis; Electrochemical cells; reaction in cells, electrode potential; secondary cells, electroplating, electro-refining; pH – its significance and determination, fuel cells; Corrosion and protective coatings, water paints, oil paints, cellulose paint, varnishes, and lacquers; Boiler water, scale and sludge, measurement of hardness, softening of hard water; Lubrication and lubricants; Introduction to the chemistry of explosives and blasting agents**,** green explosives, Sustainable development goals (SDGs) in mining and geological engineering

Reference Books:

1. Jackowska, Krystyna and Krysiński, Paweł. Applied Electrochemistry: *Aspects in Material and Environmental Science*, De Gruyter, 2024.
2. Christian, G. D., Dasgupta, P. K., & Schug, K. A. (2013). *Analytical chemistry*. John Wiley & Sons.
3. Farrauto, R. J., Dorazio, L., & Bartholomew, C. H. (2016). *Introduction to catalysis and industrial catalytic processes*. John Wiley & Sons.
4. Ali, M. F., El Ali, B. M., & Speight, J. G. (2005). *Handbook of industrial chemistry*. McGraw-Hill Companies, New York.
5. Mang, T., & Dresel, W. (Eds.). (2007). *Lubricants and lubrication.* John Wiley & Sons.
6. Mesquita, M. J., Corazza, R. I., Souza, M. C. O., Gomes, G. N., Noronha, I., & Macedo, D. (2021). *Mining and sustainability. In Environmental Sustainability* (pp. 155-179). CRC Press.
7. Ali, M. F., El Ali, B. M., & Speight, J. G. (2005). *Handbook of industrial chemistry*. McGraw-Hill Companies, New York.

Lab Outline:

1.Standardization of hydrochloric acid by using 0.1 M sodium hydroxide.
2.Determination of viscosity and parachor value of various liquids by capillary flow viscometer.
3.Measurement of surface tension and rheochor value of liquid fuels by Stalagmometer method.
4.Quantitative determination of selected metal in the provided solutions using complexometric titration.
5.Quantitative determination of analyte i.e. silver in the provided solution using gravimetric titration.
6.Identification of cation and anion of an inorganic salt
7.Determination of water quality based on pH, hardness, electrical conductivity, and total dissolved solids.
8.Quantitative determination of iron in the provided iron ore
9.Quantitative determination of copper in the provided copper ore
10.Determination of moisture content in the material under investigation i.e. coal, cement, fertilizer, limestone/marble, and lime mortars, etc.
11.Determination of ash content in the material under investigation i.e. coal, cement, fertilizer, limestone/marble, and lime mortars, etc.
12.Determination of total acid number (TAN) of provided lubricant using potentiometric titration.

Reference Books:

1.Christian, G. D., Dasgupta, P. K., & Schug, K. A. (2013). Analytical chemistry. John Wiley & Sons.
2.Vogel, A. I. (1954). A textbook of macro and semi-micro qualitative inorganic analysis. London Longmans.
3.Gesser, H. D. (2002). Applied chemistry: a textbook for engineers and technologists. Kluwer Academic/Plenum Publishers.
4.Ali, M. F., El Ali, B. M., & Speight, J. G. (2005). Handbook of industrial chemistry. McGraw-Hill Companies, New York

Social Science Elective (2,0)

MinE-122 Stratigraphy and Structural Geology (2,1)

Introduction to stratigraphy and its importance in mining engineering, principles of stratigraphy, sedimentary structures and textures, stratigraphic nomenclature, sequence stratigraphy, stratigraphy and mineral deposits, applied stratigraphy in mining, stratigraphy of Pakistan.

Introduction to structural geology and its importance in mining engineering, stress and strain, rock deformation, geological maps and cross sections, structural analysis techniques, structural controls on mineralization, structural geology in resource evaluation and mine planning.

Lab Outline:

1. Learn how to use Brunton compass for measurement of dip and strike.
2. Learn how to calculate true dip and apparent dip.
3. Learn how to estimate thickness, distance, and depth of ore body, geologic body etc.
4. Learn how to determine the sequence of geological activities through relative dating.
5. Learn how to draw a stratigraphic column from borehole data and to correlate it with others.
6. Learn how to make a geologic profile & cross section from a topographic tour map.
7. Learn how to establish kind of structure of geologic body.
8. Learn how to determine throw and nature of faults.
9. Learn how to read a geological map and identify geological features on it.
10. Learn how to use stereographic projections in geological problems.
11. Learn how to use computer software in plotting poles and great circles of discontinuities in rock masses and identification of discontinuity sets through contouring of poles.
12. Learn how to use computer software in modelling rock bodies based on borehole data.

Books:

1. Nichols, G. (2009). Stratigraphy: Principles and Methods. John Wiley & Sons.
2. Boggs, S. Jr. (2010). Principles of Sedimentology and Stratigraphy. Pearson.
3. Catuneanu, O. (2006). Principles of Sequence Stratigraphy. Elsevier.
4. S. M. I. Shah, 2009. Stratigraphy of Pakistan, 22nd Memoir of Geological Survey of Pakistan
5. Fossen, H. (2016). Structural Geology. Cambridge University Press.
6. Twiss, R. J., & Moores, E. M. (2006). Structural Geology. W. H. Freeman.
7. G.H. Davis, S.J. Reynolds and C.F. Kluth, 2012. Structural Geology of Rocks and Regions, 3rd Ed.
8. Ragan, D. M. (2009). Structural Geology: An Introduction to Geometrical Techniques. Cambridge University Press.
9. Marshak, S. (2019). Essentials of Geology. W. W. Norton & Company.

MinE-121 Mining Engineering Fundamentals (3,0)

An introduction to the field of mining engineering and its economic importance, brief review and production of minerals in Pakistan, Prospecting and exploration, Development and exploitation, Drilling and boring, Explosive and blasting, Mine supports, Material handling, Mine Ventilation, Mine water and its disposal, Importance of safety aspects in mining, Mineral beneficiation, Mine sampling and valuation.

Field Trip:

Field visit to some mine sites is an essential part of this course.

Recommended Text Books:

1. R. S. Lewis and Clark, Elements of Mining, John Wiley and Sons.
2. H. L. Hartman, Introductory Mining Engineering. John Wiley and Sons.

Recommended Reference Books:

1. SME/AIME Mining Engineering Handbook Vol. I and II.
2. Directory of Mineral Deposits of Pakistan.

QT-101 Translation of the Holy Quran-I (1,0)

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to faith (*Imaniyāt*) & ethics (ایمانیات و اخلاقیات).
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1- Explain and understand the meanings of the Holy *Qur'ān* through its translation.

2- Identify the teachings and the guidance of the Holy *Qur'ān* regarding faith (*Imaniyāt*) & ethics (ایمانیات و اخلاقیات).

3- Evaluate the call of the Holy *Qur'ān* on faith (*Imaniyāt*) & ethics (ایمانیات و اخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Course Contents:

Translation of Part (*Parah*) 1, first ½ portion
Translation of Part (*Parah*) 1, second ½ portion
Translation of Part (*Parah*) 2, first ½ portion
Translation of Part (*Parah*) 2, second ½ portion
Translation of Part (*Parah*) 3, first ½ portion
Translation of Part (*Parah*) 3, second ½ portion
Translation of Part (*Parah*) 4, first ½ portion
Translation of Part (*Parah*) 4, second ½ portion
Translation of Part (*Parah*) 5, first ½ portion
Translation of Part (*Parah*) 5, second ½ portion
Translation of Part (*Parah*) 6, first ½ portion
Translation of Part (*Parah*) 6, second ½ portion
Translation of Part (*Parah*) 7, first ½ portion
Translation of Part (*Parah*) 7, second ½ portion
Translation of Part (*Parah*) 8, first ½ portion
Translation of Part (*Parah*) 8, second ½ portion

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن شاہ عبدالقادر دہلوی
2. فتح القرآن فتح محمد جالندھری
3. ترجمہ قرآن مجید حافظ نذر احمد
4. آسان ترجمہ قرآن سید شبیر حسین ضیا القرآن پیر کرم شاہ الازہری
5. احسن البیان مولانا محمد جونا گڑھی
6. ترجمہ
7. آسان ترجمہ قرآن مولانا محمد تقی عثمانی مولانا احمد سعید دہلوی
8. ترجمہ قرآن مولانا اشرف تھانوی
9. کشف الرحمٰن
10. ترجمہ تبیان القرآن مولانا غلام رسول سعیدی دارالسلام
11. مصباح القرآن ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن
13. ترجمہ قرآن سید ابو الاعلیٰ مودودی سید مقبول احمد دہلوی
14. قرآن مجید ،لفظی ترجمہ ڈاکٹر فرحت ہاشمی
15. مقبول القرآن
16. آسان ترجمہ قرآن محمد ظفر
17. The meaning of Glorious *Qur'ān* Marmaduke Pickthal
18. *Qur'ān* Translation English Abdullah Yousaf Ali
19. *Qur'ān* Translation English Dr. Mohammad Mahmood Ghali
20. *Qur'ān* Translation English Muhammad Asad

3rd Semester

MA-228 Differential Equations (3,0)

Formation of differential equations; Solution of various types of first order differential equations; Orthogonal trajectories, Application in physical problems. Linear differential equations of second order, Complementary function and particular integral. Solution of non-homogeneous linear differential equations of second order and higher by (i) the method of undetermined coefficients (ii) the method of variation of parameters and (iii) the method of power series; Application of second order differential equations; System of differential equations.

Laplace transform, Solution of initial value problems by Laplace transform. Convolution theorem and applications.

Formation of partial differential equations; Equations reducible to ordinary differential equations; Equations of the form Pp + Qq = R; Solution by the method of separation of variables. Wave, heat and Laplace equations.

Periodic functions. Even and odd functions. Fourier series of functions of period 2π and arbitrary period; Half range series. Partial differential equations and Fourier series. Sturm-Liouville problems.

The Runge Kutta method; Non-linear differential equations and stability.

Recommended Books:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch, published by Allied Book Centre, Urdu Bazar Lahore.
2. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons,
3. "Advanced Engineering Mathematics" by H.K. Dass, published by S. Chand & Company, New Dehli.
4. "Ordinary Differential Equations" by N.A. Shah, A-one publishers, Urdu Bazar, Lahore.
5. "Partial Differential Equations" by N.A. Shah, A-one publishers, Urdu Bazar, Lahore.

MA-235 Engineering Mechanics (2,1)

A review of vector algebra, scalar and vector products: Scalar triple product, Vector triple product; Differentiation and integration of vectors. Laws of triangle; Parallelogram and polygon forces; Parallel forces; Moments and couples; Friction; Resultant of coplanar forces; General conditions of equilibrium of coplanar forces. Funicular polygon, Common and parabolic category, Mechanical advantage and efficiency of simple machines. Motion along a straight line with uniform acceleration; Tangential and normal components of acceleration; Banking of tracks; Simple harmonic motion; Projectiles. Work and energy power; Momentum and conservation of momentum and energy. Mechanics practical, experiments illustrating principles of mechanics.

Recommended books:

1. "Vector Analysis" by N.A Shah,
2. "Engineering Mechanics" by Timoshoko & Young
3. "Mechanics" by Q.K Ghori.

CE-231 Fluid Mechanics-I (3,1)

Physical properties of fluids: Density, specific weight, specific volume, specific gravity, surface tension and compressibility.

Viscosity: Newton's equation of viscosity, units of viscosity, measurement of viscosity, dissipation of energy in lubricated bearings.

Fluid statics: Pressure, pressure-specific weight-height relationship.

Unit of pressure: Absolute and gauge pressure.

Measurement of pressure: Bourden Gauge, manometers and differential manometers. Forces on submerged plane and curved surface and their application

Flow types: Basic concepts about steady and unsteady flow. Laminar and turbulent flow. Uniform and non-uniform flow, Path lines, streamlines and stream tubes. Velocity and discharge. Equation of continuity, Bernoulli's Theorem, Impulse-momentum equation

Flow measurement: Measurements of velocity, pitot tube, measurement of discharge, venturimeter, orifices, notches and weirs. Concept of Vena-Contracta

Steady flow through pipes: Darcy Weisbach equation for flow in pipes, Chezy, Manning and Kutter's formula, Losses in pipe-lines, hydraulic and energy gradients, transmission of energy through pipes, Uniform flow through open channels. (Chezy's and Manning's formulae). Economical cross-section; rectangular, triangular and trapezoidal, Use of pumps and their characteristics

Lab Outline:

1. To determine the viscosity of given oil using a Redwood Viscometer.
2. To determine the viscosity of given oil using an Oil Flow Apparatus.

3. Determination of centre of gravity and metacentre of a floating body.
4. To determine the magnitude of hydrostatic thrust exerted on a submerged curved surface and to locate the centre of pressure.
5. To determine the coefficient of discharge of a Rectangular Notch and hence to calibrate it.
6. To determine the coefficient of discharge of a Triangular Notch and hence to calibrate it.
7. To determine the coefficient of discharge of a venturimeter and hence to calibrate it.
8. To determine the hydraulic coefficients for orifices of various shapes.

Recommended Text Books:

1. R. L. Daugherty, J. B. Franzini and E. J. Finnermore, Fluid Mechanics with Engineering Applications, McGraw Hill.
2. E. H. Lewitt, Hydraulics and Hydraulic Machinery, Pitman and Sons.

Recommended Reference Books:

1. A. C. Shaw and D. A. Johnson, Mechanics of Fluid, Longman.
2. Anthony Esposito, Fluid Power with Applications
3. R. W. Fox and Allan T. McDonald, Introduction to Fluid Mechanics. John Wiley and Sons.

ME-201 Applied Thermodynamics (2,1)

Thermodynamics, system, properties, state, thermodynamic equilibrium, state postulate, process, cycle, zeroth law of thermodynamics, energy, energy transfer, heat, work, properties of pure substances, phase change processes, use of property tables, ideal gas equation, specific heats, internal energy, enthalpy, first law of thermodynamics, first law of thermodynamics applied to closed systems, continuity equation, steady flow energy equation and steady flow engineering devices, second law of thermodynamics, reversible and irreversible processes, entropy
engines, engine classification, engine cycles, SI engines, CI engines, two stroke engines, four stroke engines, engine performance, compressors, reciprocating & rotary compressors, centrifugal & axial flow compressors, air motors, turbines, nozzles, psychrometry.

Lab Outline:

A minimum of eight experiments related to theory.

Recommended Books

1. Fundamentals of Engineering Thermodynamics, by Moran, Shapiro
2. Thermodynamics, An Engineering Approach, by Y.A. Cengel and M.A. Boles
3. Applied Thermodynamics for Engineering Technologists, by T.D. Eastop, A. McConkey
4. Fundamentals of Thermodynamics, by Sonntag, Borgnakke, Van Wylen
5. Basic Engineering Thermodynamic, by Rayner Joel

IS-202 Ideology and Constitution of Pakistan (3,0)

- Definition and explanation of Ideology, Historical Background with reference to Shah Wali Ullah, Sir Syed Ahmad Khan, Ali Gargh and other movements
- References from the Speeches and Statements of Allama Dr. Muhammad Iqbal and the Quaid I Azam Muhammad Ali Jinnah.
- The Role of Women and Students in Freedom Movement.
- Aims and Objectives of the creation of Pakistan: Sovereignty of Allah, Islamic Democracy, Balanced Economic System, Protection of Muslim Civilization and Culture, Protection of Minority Rights, Unity of Muslim World, Self Sufficiency and Rule of Law.

Ideological Awakening during 20th Century Colonial British India:

- Evolution of Two Nation Theory, Urdu-Hindi Controversy, Partition of Bengal, Simla Deputation.
- Establishment of All India Muslim League (AIML): Objectives, Organization and Achievements.
- Khilafat Movement and Non-Cooperation movement.
- 14 Points of Jinnah, Iqbal's Allahabad Address 1930 and Pakistan Resolution 1940.
- Emergence of the First Ideological Muslim State: Pakistan, Initial Problems and efforts to cope with, under the leadership of Quaid I Azam: The Governor General and Liaqat Ali Khan: The Prime Minister.

The Constitutions of Islamic Republic of Pakistan:

- Basic Concept of State and Constitution, Nationalism, Polity and Types of Governments (Parliamentary and Presidential), Organs of the State: The Legislature, The Executive and The Judiciary.
- Distribution of Powers in the Constitution: The Federal List, The Provincial List and The Concurrent List.

- Major Causes of Delay in the Process of Constitution Making in Pakistan: Geographical Position of East Pakistan and West Pakistan, Nature of the State (Islamic vs Secular), and Federalism.
- The First Constituent Assembly 1947-1954: Historical Address of the Quaid I Azam in the Inaugural Session on 11th August 1947. The Objectives Resolution 1949 and Basic Principles Committee's Reports.
- The Second Constituent Assembly and Parliamentary Constitution of 1956.
- The Presidential Constitution of 1962.
- The Constitution of 1973: Salient Features, Fundamental Rights (Articles 8-28), Principles of the State Policy (Articles 29-40), Responsibilities of the Pakistani Citizens (Article 5) and Islamic Provisions.
- Procedures of Amending the Constitution, Major Amendments in the Constitution of 1973 and their Impact on Pakistan's Polity.

Recommended Books

1. Ahmad, Jamil-ud-Din. (1960). "*Speeches and Writings of Mr. Jinnah*" Lahore: Sheikh Muhammad Ashraf.
2. Ahmed, Ishtiaq. (1987). "*The Concept of an Islamic State: An Analysis of the Ideological Controversy in Pakistan*" New York: Continuum International Publishing.
3. Ali, Ausaf. (1988). "*Broader Dimensions of the Ideology of Pakistan*" Karachi: Royal Book Company.
4. Ali, Chaudhri Muhammad. (1988). "*The Emergence of Pakistan*" 6th Edition, Lahore: Research Society of Pakistan, University of the Punjab.
5. Aziz, K. K. (2002). "*The Making of Pakistan: A Study in Nationalism*" Lahore: Sang-e-Meel Publications.
6. Binder, Leonard. (1963). "*Religion and Politics in Pakistan*" Los Angles: University of California Press.
7. Choudhary, G.W. (1969). "*Constitutional Development in Pakistan*" London: Longman.
8. Cohen, Stephen P. (2004). "*The Idea of Pakistan*" Washington, D.C: Brookings Institution Press.
9. Dani, Ahmad Hassan. (2007). *"History of Pakistan*" Lahore: Sang-e-Meel Publications.
10. Dar, Saeedud Din Ahmad. (2000). "*Ideology of Pakistan*" Islamabad: NIHCR.
11. Iqbal, Dr. Javed. (2011). *"Ideology of Pakistan"* Lahore: Sang-e-Meel Publications.
12. Khan, Hamid. (2009). "*Constitutional and Political History of Pakistan*" Second Edition, Karachi: Oxford University Press.
13. Lau, Martin. (2006). "*The Role of Islam in the Legal System of Pakistan*" Leiden; Boston: M Nijhoff.
14. Mahmood, Dr. Safdar. (1990). *"Constitutional Foundation of Pakistan"* Lahore: Jang Publishers.
15. Mazari, Sherbaz Khan. (1999). "*A Journey to Disillusionment*" London: Oxford University Press.
16. Mujahid, Sharif al. (2001). *"Ideology of Pakistan"* Islamabad: Islamic Research Institute Press.
17. Qureshi, I. H. (1965). "*The Struggle for Pakistan*" Karachi: Universty of Karachi.
18. Rizvi, Justice Syed Shabbar Raza. (2021). "*Reading: The Constitution of Pakistan*" Lahore: Manzoor Law Book House.
19. Sayeed. Khalid Bin. (1968). "*Pakistan: The Formative Phase 1857-1948*" London: Oxford University Press.
20. Waseem, Muhammad. (2021). "*Political Conflict in Pakistan*" London: Hurst and Company.

Note: The Medium of Instruction is urdu / English

HU-212 Civics and Community Engagement (2,0)

Introduction to Civics and Citizenship
• Definition of civics, citizenship, and civic engagement
• Historical evolution of civic participation
• Types of citizenship: active, participatory, digital etc.
• The relationships between democracy and citizenship
2. Civics and Citizenship
• Concepts of civics, citizenship, and civic engagement.
• Foundations of modern society and citizenship.
• Types of citizenship: active, participatory, digital, etc.
3. State, Government and Civil Society
• Structure and functions of government in Pakistan.
• The relationship between democracy and civil society.
• Right to vote and importance of political participation and representation.
4. Rights and Responsibilities
• Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973.

• Civic responsibilities and duties.
• Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.)
5. Community Engagement
• Concept, nature and characteristics of community.
• Community development and social cohesion

Approaches to effective community engagement.
• Case studies of successful community driven initiatives.
6. Advocacy and Activism
• Public discourse and public opinion.
• Role of advocacy in addressing social issues.
• Social action movements.
7. Digital Citizenship and Technology
• The use of digital platforms for civic engagement.
• Cyber ethics and responsible use of social media.
• Digital divides and disparities (access, usage, socioeconomic, geographic, etc.) and their impacts on citizenship.
8. Diversity, Inclusion and Social Justice:
• Understanding diversity in society (ethnic, cultural, economic, political etc.).
• Youth, women and minorities' engagement in social development.
• Addressing social inequalities and injustices in Pakistan.
• Promoting inclusive citizenship and equal rights for societal harmony and peaceful co-existence

Suggested practical activities (Optional)

As part of the overall learning requirements, the course may have one or a combination of the following practical activities:

1. Community Storytelling: Students can collect and share stories from community members. This could be done through oral histories, interviews, or multimedia presentations that capture the lived experiences and perspectives of diverse individuals.
2. Community Event Planning: Students can organize a community event or workshop that addresses a specific issue or fosters community interaction. This could be a health fair, environmental cleanup, cultural festival, or educational workshop.
3. Service-Learning: Students can collaborate with a local nonprofit organization or community group. They can actively contribute by volunteering their time and skills to address a particular community need, such as tutoring, mentoring, or supporting vulnerable populations.
4. Cultural Exchange Activities: Students can organize a cultural exchange event that celebrates the diversity within the community. This could include food tastings, performances, and presentations that promote cross-cultural understanding.

Suggested Instructional/ Reading Materials

"Civics Today: Citizenship, Economics, & You" by McGraw-Hill Education.
• "Citizenship in Diverse Societies" by Will Kymlicka and Wayne Norman.
• "Engaging Youth in Civic Life" by James Youniss and Peter Levine.
• "Digital Citizenship in Action: Empowering Students to Engage in Online Communities" by Kristen Mattson.
• "Globalization and Citizenship: In the Pursuit of a Cosmopolitan Education" by Graham Pike and David Selby.
• "Community Engagement: Principles, Strategies, and Practices" by Becky J. Feldpausch and Susan M. Omilian.
• "Creating Social Change: A Blueprint for a Better World" by Matthew Clarke and Marie-Monique Steckel

4th Semester

MA-234 Linear Algebra (3,0)

A review of matrices, determinants and Crammer's rule: Inverse of a matrix through elementary row operations; Solution of the system of linear equations; Euclidean spaces, Vector spaces, Subspaces, Spanning set, Linearly independent and dependent sets, Basis and dimension.

Linear transformations from Y^m to Y^n. Composition of transformations; Operators (Reflection, Projection, Rotation, Dilation and Contraction); Properties of linear transformations from Y^m to Y^n. General linear transformations; Kernel and range, Inverse linear transformation, Matrices of general linear transformation, Rank and nullity of linear transformation.

Eigenvalues and eigenvectors; Eigen-decomposition; Applications to relevant problems; Diagonalization; Orthogonal matrices. Normed spaces, Inner product spaces, Angle and orthogonality in inner product spaces, Orthogonal bases. Positive definite matrices; Least square problems. Similarity transformations, Jordan canonical form and singular value decomposition

MA-242 Engineering Statistics (3,0)

Introduction & role of statistics in engineering. Population & samples, Variables, Methods of displaying data sets, Stem & leaf display, Histogram, Histogram shapes, Boxplot, Bar chart, Pareto diagram, Dot diagram, Frequency distributions & their graphs, Outlier. Mean, Median, Quartile, Percentile, Range, Deviation from mean, Sample variance, Sample standard deviation, Coefficient of variation. Probability, Concepts & definitions, Basic theorems of probability, Law of total probability, Bayes theorem, Discrete and continuous random variables and their probability distributions, Density and distribution functions; Expectation. Mean & variance of discrete & continuous random variables, Binomial distribution, Poisson distribution, Normal distribution, t-distribution, Chi-square distribution, F-distribution. Sampling techniques and sampling distribution; Point estimation and interval estimation of parameters, Least square linear & polynomial regression, Linearization of nonlinear models, Correlation, Design of experiments, Analysis of variance.

Recommended Books:

1. Applied Statistics for Engineers & Scientists by Devore/Farnum, 3rd Ed. Thomas.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, 8th Ed. Pearson Educational International, 2007.
3. Probability and Statistics for Engineering and Sciences, 8th Ed. CENGAGE Learning.
4. Advanced Engineering Mathematics by Erwin Kreyszig, 11th Ed. John and Viley and Sons.
5. Applied Statistics and Probability for Engineers by Montgomery, Runger, 3rd Ed. John and Viley and Sons.
6. Probability and Random Variables and Stochastic Processes, Papoulis Athanasios, 3rd Ed. McGraw-Hill Inc.
7. Introduction to Statistical Theory by Muhammad Shehzad and Sher Muhammad, Ilmi Kitab Khana Urdu Bazar Lahore.

ME-202 Mechanics of Materials (2,0)

stress, strain, mechanical properties of materials, tension and compression test, stress-strain diagram, elastic and plastic deformation, stress-strain diagram for ductile and brittle materials, strain energy, resilience, toughness, hardness, creep, fatigue, Hooke's Law, Poisson's ratio, elastic modulus, shear modulus, bulk modulus, factor of safety, tensile and compressive loads and stresses, Hooke's law, thermal stresses, section properties: centroids, first moment, and second moments of areas of simple and composite structural shapes, section modulus, bending of beams, flexure formula, shear force and bending moment diagrams, torsion of circular bars, torsion formula, power transmission for solid and hollow shafts, deflection of beams , elastic curves, slope and displacement by integration

Recommended Books

1.Mechanics of Materials by Russell C. Hibbeler
2.Mechanics of Materials by Ferdinand Beer, E. Johnston, John DeWolf and David Mazurek
3.Strength of Materials by Andrew Pytel, Ferdinand L.Singer
Mechanical Engineering Design by Richard Budynas and Keith Nisbett

HU-200 Technical Report Writing (3,0)

Introduction to Technical Communication

A. Difference between technical writing and creative writing
B. Analyzing audience, objective, and occasion

C. Characteristics of technical writing
D. Writing that works: Accuracy, accessibility, and readability (format specification)

The Writing and Proofreading Process

A. Use of punctuation marks: Avoiding common mistakes in the use of punctuation marks
B. Sentence structure: How to avoid run on, comma splice and fragment errors
C. Recognizing and amending run-on sentences and comma splices (sample sentences from technical documents)
D. Avoiding common errors causing ambiguity in technical writing (redundancy, verbiage, and word choice).
E. Dangling participles
F. Identifying the use of parallel structure in documents, especially in bulleted and numbered lists, and headings

Paragraph Writing

A. Writing technical paragraphs: composing topic statements, supporting details, and concluding statements
B. Different types of paragraphs and use of transition signals
C. Exercises and class activities

Business Correspondence and Employability Skills

Writing Practice

A. Emails
B. Memorandums
C. Business letters
D. Cover letters
E. Résumé/ CV
F. Interview skills

Writing Technical Reports

A. Writing technical definitions
B. Writing technical descriptions and specifications
C. Writing technical instructions
D. Writing reviews

Introduction to Research Writing and Report Writing

A. Different types of reports written by engineers

- Proposals
- Feasibility reports
- Research reports
- Inspection reports
- Progress reports
- Field visit reports
- Material testing reports
- Failure reports

B. Structure of Formal Reports:

- Title page, Table of contents, List of illustrations, Abstract/Executive Summary
- Introduction, Literature Review, Methods, Results, Discussion, Conclusion, References
- Glossary, List of Abbreviations, Appendix, Index

C. Samples and reading material, and writing Practice

Writing Reports

A. Using and Describing Graphics (Tables, Graphs, Images)
B. Avoiding Plagiarism
C. Reference Styles
D. In-text Citation
E. IEEE reference style guide and EndNote

Publishing and Presenting Reports

A. Writing and publishing research articles
B. Presenting reports/posters at conferences

Report Defense

Presentation of Reports

MinE-241 Surveying (3,2)

Fundamental Concepts: Principles of Surface and underground survey practice including errors analysis and adjustments.

Basic Survey Measurements: Distance measurements, leveling, different methods and types of instruments including total station, Engineer level and GPS, angle and direction measurements; theory and practical uses of stadia surveying.

Surveying Operation: Triangulation, adjustment of traverse and triangulation network, location of details and area measurement, topographic maps.

Staking out of new points and map construction with AutoCAD

Lab Outline:

1. Distance measurement
2. Leveling (Establishing vertical control by differential leveling method)
3. Triangulation (Establishing horizontal control)
4. Traversing

(A) Total Station, Theodolite and GPS

(B) Other Suitable Methods

Field Trip:

A field surveying camp is advised for a good field practice.

Recommended Text Books:

1. Surveying by Davis and Foot
2. Surveying and Levelling by Kanetker Vol.1&2
3. Elementary Surveying an Introduction to Geomatics by Charles D. Ghilani

QT-201 Translation of the Holy Quran-II (1,0)

Translation of the Holy Quran-II

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to the worship (*Ibadāt*) & ethics (عبادات و اخلاقيات)
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1- Explain and understand the meanings of the Holy *Qur'ān* through its translation.

2- Identify the teachings and the guidance of the Holy *Qur'ān* regarding worship (*Ibadāt*) & ethics (عبادات و اخلاقيات).

3- Evaluate the call of the Holy *Qur'ān* on worship (*Ibadāt*) & ethics (عبادات و اخلاقيات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Translation of Part (*Parah*) 9, first ½ portion
Translation of Part (*Parah*) 9, second ½ portion
Translation of Part (*Parah*) 10, first ½ portion
Translation of Part (*Parah*) 10, second ½ portion
Translation of Part (*Parah*) 11, first ½ portion
Translation of Part (*Parah*) 11, second ½ portion
Translation of Part (*Parah*) 12, first ½ portion
Translation of Part (*Parah*) 12, second ½ portion
Translation of Part (*Parah*) 13, first ½ portion
Translation of Part (*Parah*) 13, second ½ portion
Translation of Part (*Parah*) 14, first ½ portion
Translation of Part (*Parah*) 14, second ½ portion
Translation of Part (*Parah*) 15, first ½ portion
Translation of Part (*Parah*) 15, second ½ portion
Translation of Part (*Parah*) 16, first ½ portion
Translation of Part (*Parah*) 16, second ½ portion

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن شاہ عبدالقادر دہلوی
2. فتح القرآن فتح محمد جالندھری
3. ترجمہ قرآن مجید حافظ نذر احمد
4. آسان ترجمہ قرآن سید شبیر حسین ضیا القرآن پیر کرم شاہ الازہری
5. احسن البیان مولانا محمد جونا گڑھی
6. ترجمہ
7. آسان ترجمہ قرآن مولانا محمد تقی عثمانی مولانا احمد سعید دہلوی
8. ترجمہ قرآن مولانا اشرف تھانوی
9. کشف الرحمٰن
10. ترجمہ تبیان القرآن مولانا غلام رسول سعیدی دار السلام
11. مصباح القرآن ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن
13. ترجمہ قرآن سید ابو الاعلیٰ مودودی سید مقبول احمد دہلوی
14.قرآن مجید،لفظی ترجمہ ڈاکٹر فرحت ہاشمی
15.مقبول القرآن
16- آسان ترجمہ قرآن محمد ظفر
17.The meaning of Glorious *Qur'ān* Marmaduke Pickthal
18. *Qur'ān* Translation English Abdullah Yousaf Ali
19. *Qur'ān* Translation English Dr. Mohammad Mahmood Ghali
20 .*Qur'ān* Translation English Muhammad Asad

5th Semester

MinE-350 Rock Mechanics (3,1)

Concept of stress and infinitesimal strain; Linear elasticity; Physical and mechanical properties of rocks; Rock failure theories; Rock mass classification schemes and their application in excavation design and support selection; Estimation and measurement of in-situ stresses; Design of openings in massive jointed and weak rocks; Stability analysis and design of rock slopes and pillars. Subsidence, its prediction, measurement and control.

Lab Outline:

1. UCS determination of rocks
2. Tri-axial tests
3. Brazillian Tests
4. Direct Shear Strength
5. Slake Durability tests
6. Point Load Index test
7. Schmidt Hammer Rebound Number determination tests
8. P and S wave determination
9. Determination of Rock Porosity and Permeability
10. Study of Creep Behavior of Rocks

Recommended Text Books:

1. Goodman, Introduction to Rock Mechanics, 1989, John Wiley Sons
2. Brady and Brown, Rock Mechanics, 3rd Ed. Reprint in 2006, Springer.
3. Hudson and Harrison, Engineering Rock Mechanics

Recommended Reference Books:

1. Hoek, Practical Rock Engineering (www.rocksciences.com)
2. Obert and Duvall, Rock Mechanics and the Design of Structure in Rock
3. Jaeger and Cook, Fundamentals of Rock Mechanics

MinE-354 Mineral Exploration and Reserve Estimation (3,1)

Introduction to processes of formation of mineral deposits. Gathering and presentation of geological data, Exploration geophysics (gravity, resistivity, magnetism, Electrical, and seismic methods) and geochemistry, sampling methods including core drilling. Reserve estimation by classical methods. Geostatistical ore reserve estimation.

Lab Outline:

1. Calculation of Sample Reduction error by Gy's Formula
2. Reserve estimation (Calculation of Tonnage and average grade)of an ore deposit by
    a. Polygonal Method
    b. Triangular Method
    c. Inverse distance interpolation method
    d. Contour Method
    e. Cross Sectional Method
    f. Geo-statistical Method
3. Resistivity surveys using resistivity measuring equipment.
4. Seismic surveys using seismograph

Recommended Text Books:

1. Anthony Evans, Introduction to Mineral Exploration, May 1995.
2. J.H Reedman, Techniques in Mineral Exploration
3. Isobel Clark, Practical Geo Statistics, 1979.

Recommended Reference Books:

1. Kearry, Mineral Exploration
2. Bateman, Economic Mineral Deposits
3. Peters, Mining Geology
4. McKinstry, Mining Geology
5. W.C. Peters, Exploration and Mining Geology, John Wiley & Sons, Inc., New York (1987)
6. Abid S. H. TLR on Mineral Exploration, 2000. Ministry of Education, Pakistan.

MA-346 Numerical Methods (3,0)

1.Solution of non-linear equations: Open methods, bracketing methods for locating roots, initial approximation and convergence criteria, Newton Raphson and Secant methods.
2.Solution of linear simultaneous equations: Jacobi's method; Gauss-Seidle method.
3.Finite differences: Difference operators and tables; Differences of polynomials.
4.Interpolation and polynomial approximation: Taylor series approximation, introduction to interpolation, Newton's polynomials, Newton's divided difference table and interpolation, Lagrange's interpolation, Chebyshev polynomials.
5.Numerical differentiation: approximating the derivative.
6.Numerical integration: Introduction to quadrature, trapezoidal, composite trapezoidal and Simpson's rules.
7.Solution of partial differential equations: Hyperbolic Equations, Parabolic Equations, Elliptic equations.
8.Computations: Numerical techniques in context of engineering applications and solutions of problems by using Matlab.

RECOMMENDED BOOKS:

1."Numerical Methods for Engineers" by S. C Chapra & R. P Canale, McGraw-Hill.
2."Numerical Methods using MATLAB" by John H. Mathews, Pearson Education.
3."Applied Numerical Methods for Engineers using MATLAB" by Robert J. Schilling & Sandra L. Harris, Brooks/Cole.
4."Numerical Methods for Engineers and Scientists" by D. Joe Hoffman

MinE-353 Mine Ventilation (3,1)

Introduction: Objectives of mine ventilation, air conditioning and control process.
Quality Control: Mine Gases: Nature of air, types, sources, properties and control of mine gases. Determination of dilution requirements. Mine Dusts: Types, sources, properties, effects and control, air borne dust.
Air Flows: Air flow in ducts and air ways. Nature of fluid flow, energy changes in fluid flow. Bernoulli's equation, head losses, and mine heads, Atkinson's equation, air power.
Heat and Humidity: Sources of heat in mines, physiological effects of heat and humidity on work capacity and efficiency of personnel.
Air Measurements: Temperature, atmospheric pressure, air density and air velocity.
Ventilation Survey: Mine resistances, series flow, parallel flow, natural splitting, controlled splitting
Principles of Natural Ventilation: Pressure source, characteristics, direction of intensity determination.
Ventilation Network Analysis: Iterative techniques for network analysis. Kirchoff laws
Economics of Air Flow: The basics of economic design, effect of air way characteristics on power consumption, design of air ways.
Mechanical Ventilation: Classification of mechanical ventilation devices, network analysis by computer, theory and design of fans, fan characteristics, fan laws, different types of fans.
Auxiliary Ventilation: Importance and methods of auxiliary ventilation, systems used for auxiliary ventilation.
Lab Outline:

1. a. Measurement of atmospheric pressure, dry and wet bulb temperatures of air using aneroid barometer and psychrometer.
   b. Determination of psychrometric and other properties of air from the measured data.
2. a. Determination of average air velocity in circular duct/ Tubing using pitot tube.
   b. Measurement of atmospheric pressure and temperature using aneroid barometer.

c. Finding expressions for volume and mass flow rates and calculating them from the measured data.

3. Determining true air velocity from a vane anemometer calibrating it against a pitot tube. Finding the state of flow / Reynolds number. Drawing the velocity profile.
4. Determining the effect of misalignment of a pitot tube and vane anemometer to an air stream.
5. Determining the characteristics of an axial fan with regard to the variation of pressure, power consumption and efficiency with quantity passed by the fan.
6. Determining the effect on characteristics of running two similar fans in series.
7. Determining the effect on characteristics of running two similar fans in parallel.
8. Determining the effect on characteristics of running two different fans in series.
9. Determining the effect on characteristics of running two different fans in parallel.
10. Determining the effect on characteristics of running two similar fans in series and a different fan in parallel to them.

11. Observing the smoke mixed helium gas layer on air in the layering apparatus in horizontal position.
12. Observing the smoke mixed helium gas layer on air in the layering apparatus in an ascentional air flow.
13. Observing the smoke mixed helium gas layer on air in the layering apparatus in a descentional air flow.

Recommended Text Books:

1. H. L. Hartman, Mine Ventilation and Air-conditioning, 1997.
2. McPherson, Subsurface Environmental Engineering. (Latest Edition)

Recommended Reference Books:

1. Pennman, Mine Ventilation
2. H. Rabia, Mine Environmental Engineering, (Latest Edition)
3. A. Roberts, Mine Ventilation
4. Abid S. H. TLR on Mine Ventilation. 2000. Ministry of Education, Pakistan.

Geo-E-353 Introduction to GIS and Remote Sensing (2,1)

GIS-Introduction, principles of GIS, Functional Subsystem, Raster Data Model, Vector Data Model, Attribute Data Model, Coordinate Systems Overview, Discrete Geo-referencing, Global Positioning Systems Overview, Projections and transformations, Maps as Representations of the World, Data Transformation, Visualization of spatial data, Layers and Projections, Map Design Overlay Analysis, Spatial analysis, Neighborhood functions, Network and overlay analysis, buffering, Spatial data Quality,

Introduction to Remote Sensing-Basics of Remote Sensing and photogrammetry, Data acquisition, image analysis, image classification, Sensor Systems, Platforms, Digital Image Processing, and Applications etc with Case studies with use of software's to solve the geological problems

6th Semester

MinE-352 Mine Power, Drainage and Material Handling (3,1)

Power: various source of power available at mine, Compressed air theory, Compressed air system design; Electric Power, Selection of Power Cables, power-factor correction, load flow analysis and power cost; Hydraulic power systems, its design and selection procedures.

Materials Handling: Belt conveyor: General applications of belt conveyors, design consideration, material characteristics, belt capacity, width, speed and idler selection, belt tension power calculation.

Haulage: Application of different surface and underground methods of haulage and the equipment used. Locomotive tractive-effort and duty cycle calculation, Power requirement calculations.

Hoisting: Hoisting equipment, Basic hoisting systems and their special application to different mine conditions, Hoisting calculations, Steel rope design and selection.

Drainage: Different types of pumps, their characteristics, and applications. Calculation of power requirements. Pumping system analyses.

Lab Outline:

1. Compressed air System Design
2. Electrical system design
3. Belt conveyor system design
4. Rail haulage and power system design
5. Rope system Design
6. Hoisting system design

Recommended Text Books:

1. Christopher J. Bise, Mining Engineering Analysis, 2nd Ed. ISBN 0-87335-221-1
2. Robert Stefanko, Coal Mining Technology: Theory and Practice, 1983
3. Howard L Hartman, Introductory Mining Engineering

Recommended Reference Books:

1. R.L. Peurifoy, Construction Planning Equipment and Methods, 3rd Ed.
2. SME Mining Engineering Handbook, Vol-I and II. 1992
3. Atlas Copco Manual

MGT-320 Project Management in Engineering (2,0)

Introduction of Project Management; Challenges to Effective Project Management; Fundamentals of Project Management; Nine Knowledge Areas of Project Management; Project Management Process Groups; Project Management Life Cycles; Project Scope Planning; Project Planning; Project Launching; Project Monitoring and Controlling; Project Management Infrastructure; Project Portfolio Management; Continuous Process Improvement.

Recommended Books:

- Wiley Pmbok Guide (2021). A Guide to The Project Management Body of Knowledge. (7th Edition).
- Robert, K. Wysocki (2013). Effective Project Management: Traditional, Agile, Extreme. (7th Edition).

MinE-365 Underground Mine Design (3,0)

Description and classification of mining methods, Selection of mining methods, Design of mine layout & mode of development, Design of panel layout, mode of location and sequence of recovery; Selection of equipment and machinery, Underground mining practices in Pakistan.

Coal Mining Methods: Room and Pillar Method; Long wall and short wall mining, Comparison of these methods

Field Trip:

Field visit to some mine sites is recommended as part of this course.

Recommended Text Books:

1. H. L. Hartman, Introductory Mining Engineering. John Wiley and Sons, 2nd Ed.
2. Peng, Coal Mine Ground Control
3. Hustrulid, Underground Mining Methods Handbook, AIME Publication, June 2001.

Recommended Reference Books:

1. R. S. Lewis and Clark, Elements of Mining, John Wiley and Sons.
2. SME/AIME Mining Engineering Handbook Vol. I and II, 1992.
3. Syd and Peng, Longwall Mining

MinE-366 Surface Mine Design (3,0)

Introduction, scope, and types of surface mining methods; Open pit terminology; Mine geometrical design; Optimal pit limits; Shovel truck mining, Dragline mining, Equipment selection, productivity modeling and production risk modeling; Quarrying; Surface coal mining and strip mining; Placer mining; Principles of mine planning and scheduling; Case histories

Field Trips:

Some mining field visits are essential part of this course.

Recommended Text Books:

1. E. P. PfLeider, Surface Mining
2. B. A. Kennedy, Surface Mining, SME 1990.
3. William Hustrulid and M. Kuchta, Open pit Mine Planning and Design, Vol. I, April 2006. 2nd Ed. Taylor & Francis
4. James W. Martin, Surface Mining Equipment

Recommended Reference Books:

1. B. A. Kennedy, Surface Mining, 2nd Ed., SME
2. W. Hustrulid and M.Kuchta, Open pit Mine Planning and Design, Vol. II (published by A.A. Balkema)
3. Abid S. H. TLR on Surface Hard Rock Mining, 2000. Ministry of Education, Pakistan.

MinE-364 Drilling and Blasting (3,1)

Rock Properties affecting drilling, drilling principles, drilling methods, their classification and choice. Drilling equipment and tools.

Explosive ingredients, chemistry of explosives, properties, classification and characteristics of commercial explosives and blasting agents.

Initiation system; Rock breakage theories; Principles of priming and loading, Fundamentals of surface and underground blast designs.

Controlled blasting techniques; Ground vibrations and air blast, safety in explosive handling and blasting.

Lab Outline:

1. Study of Drilling tools and equipment
2. Relevant Audio-visual programs demonstrating different safe blasting practices should be shown to the students.
3. Instructional tours may be arranged to visit various surface and underground mines to get the student familiar with various, initiation, priming, loading and other blasting practices.
4. Study the various inert (dummy) explosives and accessories manufactured by Wah Nobel Industries, write a short report on them indicating specifications, their uses etc.
5. Study the various inert explosives and inert accessories manufactured by Biafo industries and write a brief report stating their specification, uses etc.
6. Practice the recommended knots for detonating cord on inert detonating cord or nylon strings. This is to be studied and practiced on a field trip as well.
7. Study a Nonel detonator (inert) and various associated accessories and delays (inert) and practice its connection in class and also in the field.
8. Start a Nonel shock tube (actual) with the help of Nonel starter/initiator in the class and do the same with a remote Nonel initiator as well.
9. Study various instrumentation involved in electric initiation system and also practice the recommended wire splices.
10 Using inert electric detonators, determine the continuity and resistance of series, Parallel, and series-parallel circuits (use the firing line, connecting wire and bus wire in the circuit).
11 Practice with the help of detonators (inert) and primer (inert) the various proper techniques in making primers. Study them on field trips as well.
12. On a field trip, watch and practice general blasthole loading procedures.
13 Create mock ground vibrations and air blast in the class and monitor and take readings with the help of seismographs. Also monitor them in actual field conditions on a study tour.
14. Study the various components, and get familiar with the use of a lightening detector when storm is approaching.

Recommended Text Books:

1. Dick, Fletcher & D'Andrea, Explosives and Blasting Procedures Manual (IC 8925), 1995.

2. Explosive and Rock Blasting, Atlas Powder Company, 1987.
3. Stig O. Olofsson, Applied Explosive Technology for Construction and Mining
4. Blaster's Handbook, 18th Ed. ISEE, 2011.
5. "Drilling and Blasting of Rocks" by Cemal Balci.

Recommended Reference Books:

1. Gary B. Hemphill, Blasting Operation, McGraw Hill
2. Rune Gustafsson, Swedish Blasting Technique. Published by SPI, Gothenburg, Sweden
3. Tariq M. TLR on Explosives and Blasting. 2000. Ministry of Education, Pakistan.
4. "Blasting principle for open pit mining" by William Hurstrulid.

QT-301 Translation of the Holy Quran-III (1,0)

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to the Commands (*Ahkamāt*) & ethics (احکامات و اخلاقیات)
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1. Explain and understand the meanings of the Holy *Qur'ān* through its translation.
2. Identify the teachings and the guidance of the Holy *Qur'ān* regarding the Commands (*Ahkamāt*) & ethics (احکامات و اخلاقیات).
3. Evaluate the call of the Holy *Qur'ān* on the Commands (*Ahkamāt*) & ethics (احکامات و اخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Translation of Part (*Parah*) 17, first ½ portion
Translation of Part (*Parah*) 17, second ½ portion
Translation of Part (*Parah*) 18, first ½ portion
Translation of Part (*Parah*) 18, second ½ portion
Translation of Part (*Parah*) 19, first ½ portion
Translation of Part (*Parah*) 19, second ½ portion
Translation of Part (*Parah*) 20, first ½ portion
Translation of Part (*Parah*) 20,
Translation of Part (*Parah*) 21, first ½ portion
Translation of Part (*Parah*) 21, second ½ portion
Translation of Part (*Parah*) 22, first ½ portion
Translation of Part (*Parah*) 22, second ½ portion
Translation of Part (*Parah*) 23, first ½ portion
Translation of Part (*Parah*) 23, second ½ portion
Translation of Part (*Parah*) 24, first ½ portion
Translation of Part (*Parah*) 24, second ½ portion

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن شاہ عبدالقادر دہلوی
2. فتح القرآن فتح محمد جالندھری
3. ترجمہ قرآن مجید حافظ نذر احمد
4. آسان ترجمہ قرآن سید شبیر حسین ضیا القرآن پیر کرم شاہ الازہری
5. احسن البیان مولانا محمد جونا گڑھی
6. ترجمہ
7. آسان ترجمہ قرآن مولانا محمد تقی عثمانی مولانا احمد سعید دہلوی
8. ترجمہ قرآن مولانا اشرف تھانوی
9. کشف الرحمٰن
10. ترجمہ تبیان القرآن مولانا غلام رسول سعیدی دارالسلام
11. مصباح القرآن ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن
13. ترجمہ قرآن سید ابو الاعلیٰ مودودی سید مقبول احمد دہلوی
14. فہم القرآن،لفظی ترجمہ ڈاکٹر فرحت ہاشمی
15. مقبول القرآن
16. آسان ترجمہ قرآن محمد ظفر
17. The meaning of Glorious *Qur'ān*. Marmaduke Pickthal
18. *Qur'ān* Translation English Abdullah Yousaf Ali
19. *Qur'ān* Translation English Dr. Mohammad Mahmood Ghali
20. *Qur'ān* Translation English Muhammad Asad

MinE-367L Mine Design Lab (0,1)

•Introduction to Mine Design Principles
•Familiarization with the software tool
•Geological Data Interpretation for Mine Design
•Surface Mine Design Techniques
•Underground Mine Design Techniques
•Mine Planning and Scheduling
•Equipment Selection and Optimization
•Environmental Considerations in Mine Design
•Safety and Risk Assessment in Mine Design
•Cost Estimation and Economic Analysis
•Case Studies and Project Work

Recommended Textbooks:

1.Software Manual for the software selected.
2.Open Pit Mine Planning and Design by William A. Hustrulid and Mark Kuchta

7th Semester

$ Technical Elective-Breadth (3,0)

MGT-349 Entrepreneurship (2,0)

Contents will be provided by the concerned department.

MinE-471 Tunneling and Excavation Engineering (3,1)

Tunneling and Excavation Engineering

Classifications of underground openings/ excavations; Site investigation for tunneling & excavation projects; Geological aspects of Tunnel & Shaft-sinking Design; Fundamental Concepts of Rock Breaking; Design of shape & size of tunnels & Shafts; Excavation methods: Drill & Blast, Mechanical Excavation (Road Headers, Tunnel Boring Machines, TBM's & New Austrian Tunneling Method (NATM)); Tunneling & Shaft Sinking in problematic grounds.; Ground Treatment and Water Control Methods ; Support and reinforcement of tunnels; Ventilation during Construction of Underground Structures; Collection of design data and monitoring of Excavation during and after Construction.

Lab Outline:

1.Determination of Abrasiveness of Rock Using the CERCHAR Abrasivity Test;
2.Determination of Abrasiveness of Rock Using the LCPC Abrasivity Test;
3.Determination of NTNU/SINTEF Brittleness Value (S20) required for the determination of NTNU/SINTEF Drilling Rate Index (DRI) using Brittleness Value test;
4.Determination of NTNU/SINTEF Sievers' J-Value (SJ) required for the determination of NTNU/SINTEF Drilling Rate Index (DRI) using Sievers' J-Value miniature drill test;
5.Determination of NTNU/SINTEF Cutter Life Index (CLI) and Bit Wear Index (BWI) of rock samples;
6.Determination of Indentation Hardness Index (IHI) of rock sample using modified point load test apparatus;
7.Determination of brittleness of rock sample using Punch Penetration test.

MinE-474 Environmental Management in Mining (2,0)

Introduction to environment and the eco-system, Environmental and ecological impacts of mining, Environmental considerations at mine sites, Environmental management system in mining, Mine emergency preparedness and response, Introduction to environmental impact assessment in mining, Environmental pollution including air, water, and land pollutants, their prevention, sampling, and controls, Acid rock/acid mine-drainage sources and control, Solid and hazardous waste management, Introduction to various statutory and regulatory environmental controls on mining.

Special Topics may include, Mining and sustainability, Basics of mine conservation and reclamation, Corporate social responsibility in mining and the concept of responsible mining.

Recommended Books/Instructional Reading

1.Environmental impacts of mining (Monitoring, Restoration and Control) by M. Sengupta by Lewis Publishers (ISBN 0-87371-441-5).
2.SME Mining Engineering Handbook, Third Edition Edited by Peter Darling, (ISBN-978-0-87335-264-2)
3.Hardrock Mining and Beneficiation Environmental Management System Guide, by National Mining Association, Published by SME, USA.
4.Guidance for Governments: Environmental management and mining governance, Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF). (2021)
5.Mining and the Environment, by Dr. Karlheinz Spitz and John Trudinger, (ISBN-978-1-351-18366-6 (eBook)).
6.Guidebook for Evaluating Mining Project EIAs, by Environmental Law Alliance Worldwide (ELAW), (ISBN# 978-0-9821214-36).
7.Mine Wastes Characterization, Treatment, Environmental Impacts by Bernd G. Lottermoser, (ISBN-13 978-3-540-48629-9)

MinE-472 Mineral Processing (3,1)

Introduction: History, objectives, economic justification and future scope of mineral engineering.

Comminution: Theory and objectives, work index, primary and secondary crushing, grinding, discussion of process and important machines.
Libration Studies and Criteria of Mineral Separation: Libration through comminution, mesh of libration and optimum libration.
Sizing: Laboratory sizing and sieve analysis.
Industrial screening: Discussion of important screen types and screening practice. Industrial classification and uses of cyclones in the processing industry. Discussion of basic principles and mathematical derivations. Machines used most commonly in the industry.
Concentration Techniques: Detailed discussion of Gravity Separation, Electrical Separation, flotation technology and other latest methods covering theory, machines and applications.
Auxiliary Operations: Sampling, material handling, thickening dewatering and filtration, storage, tailings disposal, water management and environmental considerations.
Study of Mineral Processing flow-sheets
Lab Outline:

1. Sampling on a given lot of ore using Coning and Quartering and mechanical samplers
2. Use of jaw crushers for crushing limestone and gypsum
3. Use of Rolls for closed-sized crushing for iron ore and chromite
4. Use of ball-mill and rod-mill for grinding of a given ore sample
5. Wet and dry sieve analysis and graphical presentations of size distribution data.
6. Determination of Bond's Work Index using ball mill or Work Index equipment
7. Experimental determination of free and hindered settling ratios
8. Operation of air and water cyclones
9. Concentration of a given sample ore on Laboratory Jig
10. Concentration of a given sample ore on Shaking table
11. Float-Sink Analysis for a coal sample
12. Synthesis of xanthate collectors
13. Flotation of a given ore sample
14. Flotation of a coal sample from Pakistan
15. Flocculation of a sample using synthetic/ polymer flocculants
16. Dispersion of a sample using suitable dispersants
17. Removal of impurities using dry / wet magnetic separators from a sample of industrial mineral
18. Concentration of an ore using dry / wet magnetic separators
19. Removal of impurities from a given ore sample using electrostatic separator

Recommended Text Books:

1. B.A. Wills, Mineral Processing Technology, 7th Ed.
2. S. K. Jain, A. A. Balkema, Ore Processing

Recommended Reference Books:

1. Spotiswoods and Kelly, Mineral Processing
2. SME Mineral Processing Handbook

MinE-479 Final Year Design Project-I (0,3)

This capstone course requires students to work individually or in small teams to solve a significant engineering problem. The course is offered in two consecutive semesters in the final year. The project involves project statement, data collection, analysis and design to implement a solution to the engineering problem under the supervision of a faculty advisor. The students are required to write a comprehensive report of the project.

8th Semester

MinE-484 Mine Hazards, Safet and Health Management (3,0)

Mine Air Pollutants: Introduction to instruments used for mine gases, dust detection and measurement. Introduction to the Diesel Particulate Matter (DPM), DPM generation, monitoring, and control. Spontaneous Combustion and Mine Fires: Causes, effects and control of spontaneous combustion and underground mine fires, firefighting equipment, and procedures. Mine explosions: Occurrence and consequences of firedamp and coal dust explosions in mines, control of mine explosions, outbursts of coal and gas in mines. Mine Rescue: construction, types, and uses of various mine rescue and breathing apparatuses, organization of recovery and rescue work, opening of sealed areas, and mine emergency management. Mine Safety Management: Mine accidents causation, prevention and investigation. Protection against hazards in mines, mine safety instrumentation. Effective mine health and safety management techniques, concept, principles, and latest approach including incident rates and risk assessments. Ergonomics in mining. Miners' exposure to noise, noise control and other selected mine hazards, types, identification evaluation and control techniques. Occupational diseases in mining and their prevention.

Recommended Books/Instructional Reading

1. Mine Disaster and Mine Rescue by Madisetti Anant Ramlu.
2. Michael Karmis, 2009. Mine Health and Safety management. SME
3. J. Strang and P. M Wood, A Manual on Mine Rescue, Safety and Gas Detection.
4. World Health Organization. 1999. Hazard prevention and control in the work environment: airborne dust.
5. Western Canada Mine Rescue Manual, 1998. Ministry of Energy and Mines Office of the Chief Inspector of Mines.
6. Cooper Dominic, 2001. Improving safety culture: a practical guide.
7. MSHA health and safety notes and reports.
8. Hein Rich, Industrial Accident Prevention.
9. John Riley, Safety at Work.

MinE-487L Occupational Health and Safety (0,1)

Understanding the basic concepts of occupational hazards and safety in mining. Understanding the measurement and monitoring of instruments for mineral dust and DPM. Understanding the measurement and monitoring of various mine gases including CH_4, CO_2, O_2, CO, and NOx, etc. Operation and usage of self-rescuer. Operation and usage of oxygen breathing apparatus and oxygen mask. First aid to the injured. Review of historical mine accidents and case studies.

£ Technical Elective-Depth (3,0)

MinE-483 Mining Law (1,0)

The Mines Act, 1923.
The Coal Mines Regulations, 1926.
The Metalliferous Mines Regulations, 1926.
The Mining Board Rules, 1951.
Electricity rules relating to the mines.
Exemptions from the Provisions of The Mines Act, 1923.
The Consolidated Mines Rules, 1952.
The Competency Certificates Examination Rules, 1981.
The Central Rescue Station (Coal Mines) Rules, 1986.
Introduction to the Pakistan Mining Concession Rules, 2002.

MinE-489 Final Year Design Project-II (0,3)

This capstone course requires students to work in individually or in small teams to solve a significant engineering problem. The course is offered in two consecutive semesters in the final year. The project involves project statement, data collection, analysis and design to implement a solution to the engineering problem under the supervision of a faculty advisor. The students are required to write a comprehensive report of the project.

QT-401 Translation of the Holy Quran-IV (1,0)

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to the dealings and affairs (*Muamalāt*) & ethics (معاملات واخلاقیات)
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1. Explain and understand the meanings of the Holy *Qur'ān* through its translation.
2. Identify the teachings and the guidance of the Holy *Qur'ān* regarding the dealings and affairs (*Muamalāt*) & ethics (معاملات واخلاقیات).

3. Evaluate the call of the Holy *Qur'ān* on the dealings and affairs (*Muamalāt*) & ethics (معاملات واخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim

Translation of Part (*Parah*) 25, first ½ portion

Translation of Part (*Parah*) 25, second ½ portion

Translation of Part (*Parah*) 26, first ½ portion

Translation of Part (*Parah*) 26, second ½ portion

Translation of Part (*Parah*) 27, first ½ portion

Translation of Part (*Parah*) 27, second ½ portion

Translation of Part (*Parah*) 28, first ½ portion

Translation of Part (*Parah*) 28, second ½ portion

Translation of Part (*Parah*) 29, first ¼ portion

Translation of Part (*Parah*) 29, second ¼ portion

Translation of Part (*Parah*) 29, third ¼ portion

Translation of Part (*Parah*) 29, fourth ¼ portion

Translation of Part (*Parah*) 30, first ¼ portion

Translation of Part (*Parah*) 30, second ¼ portion

Translation of Part (*Parah*) 30, third ¼ portion

Translation of Part (*Parah*) 30, fourth ¼ portion

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن شاہ عبدالقادر دہلوی 2. فتح القرآن فتح محمد جالندھری 3. ترجمہ قرآن مجید حافظ نذر احمد

4. آسان ترجمہ قرآن سید شبیر حسین
ضیا القرآن پیر کرم شاہ الازہری

5. احسن البیان مولانا محمد جونا گڑھی

6. ترجمہ

7. آسان ترجمہ قرآن مولانا محمد تقی عثمانی
مولانا احمد سعید دہلوی

8. ترجمہ قرآن مولانا اشرف تھانوی

9. کشف الرحمٰن

10. ترجمہ تبیان القرآن مولانا غلام رسول سعیدی
دارالسلام

11. مصباح القرآن ڈاکٹر عبدالرحمٰن طاہر

12. معانی القرآن

13. ترجمہ قرآن سید ابو الاعلیٰ مودودی
سید مقبول احمد دہلوی

14.فہم القرآن،لفظی ترجمہ ڈاکٹر فرحت ہاشمی

15.مقبول القرآن

16. آسان ترجمہ قرآن محمد ظفر

17.The meaning of Glorious *Qur'ān* Marmaduke Pickthal

18. *Qur'ān* Translation English Abdullah Yousaf Ali

19. *Qur'ān* Translation English Dr. Mohammad Mahmood Ghali

20 *Qur'ān* Translation English Muhammad Asad

CSC-250 Applications of Artificial Intelligence (2,1)

- I, ML and their History, ML Tasks
- Setting up ML Environment; Quick Revision of Python - Introduction to the Tools and APIs for ML
- Unsupervised Learning: Clustering;
- Supervised Regression - Linear Regression
- Supervised Learning - Classification - Navie Bayes Classification
- Model Evaluation
- Model Optimization
- Feature Engineering and Feature Selection
- Machine Learning Models: Decision Tree, SVM (Support Vector Machines)
- Neural Networks Basics
- Introduction to Deep Learning and CNN (Convolutional Neural Network)
- Applications of CNN
- RNN (Recurrent Neural Networks) and Text NLP (Natural Language Processing)
- Project Selection
- Project Evaluation

#Social Sciences Elective Courses

MinE-102 Critical Thinking (2,0)

Course Overview

•Introduction

•Introduction to Critical Thinking

•Benefits of critical thinking in the workplace

•Critical thinking as a management skill

•What are the characteristics of a critical thinker?

•Other Types of Thinking

•5 Different thinking styles

•Module Reflection

•A Critical Thinker's Mindset

•Can you develop a critical thinker's mindset?

•The Critical Thinking Process

•Step 1 - Identifying the problem

•Step 2 - Gather and evaluate your information

•Step 3 - Generate alternative solutions

•Step 4 - Select and implement a solution

•Step 5 - Evaluate your solution

•Developing Critical Thinking Skills

•Asking questions

•Active listening

•Challenging assumptions

•Creative Thinking Techniques

•Brainstorming

•Imagining the opposite

•Mind mapping

•De Bono's thinking hats

•Root Cause Analysis Techniques

•Identifying the cause of a problem

•Ishikawa Diagram (Fishbone Diagram)

•5 Whys technique

•SWOT analysis

•Using Your REACH Profile to Support Critical Thinking

•Adapting your profile

•Presenting Your Recommendations

•Seeking approval from decision makers and Stakeholders

Reading Material

•Critical Thinking for Students Roy van den Brink-Budgen (4th Edition)

•Thinking, Fast and Slow Daniel Kahneman (2011)

MinE-103 Sociology for Engineers (2,0)

- Fundamental Concepts and Importance of Sociology for Engineers

What is sociology? Nature, Scope, and Importance of Sociology, Sociological Perspectives and Theories, Social Interactions, Social Groups/ Social Institutions & heir interface with Engineering Project/services, Sociology & Impact of Technology & Engineering Products/Projects on Society.

- Cultural Impacts of Engineering Projects on Society

Definition of Culture, Types of Culture & Elements of Culture, Culture & Power, Authority, Dominance Socialization and Personality, Role of Engineering Projects on Culture, social norms and values of Society, Cultural Infusion of Engineers in Society.

- Theoretical Perspective of Sociology: Diffusion and Innovation; Adoption and Adaptation; Social development; Community Development

Community Development & Social consequences of Industrialization, Development Processes of Societal Development, Cooperation and Conflict in Community Development in Engineering Context.

- Understanding of Societal & Ethical Norms and Values for Engineers

Engineering Ethics, Engineering product/services for Less privileged, Role of Engg & Technology in addressing Social inequality, Core Social Values/Norms affecting Engg Performance

- Organizational Social Responsibility (OSR) of Engineers

Extenttowhichdevelopmentintendstosensitizesocietalandunder-privileged needs

o Gender inclusiveness and balance

o Special and Disadvantaged Community of the Area o Planning for community inclusiveness

o Societal Obligation of Engineers

- Engineers, Society and Sustainability

  Social System and Concept of Sustainable Development Technology and Development, Population Dynamics in Pakistan, Causes and Consequences of Unplanned Urbanization, Community Development, Programs in Pakistan, Community Organization & Engineering Projects, Population, Technological & Industrial expansion and Development with focus on social/human/ethical dimensions.

- Industrial & Organizational Psychology

  Interpersonal Relations, Interpersonal Behavior, Formation of Personal Attitudes, Language and Communication, Motivations and Emotions, Impact of Technology on human feelings and level of Sensitivity

- Climate Change and Ecological Friendliness from Engineering Perspective

  Ecological Processes, Ecosystem and Energy, Impact of Engineering Projects on Eco System & Human Ecology, Industrial & Environmental impact on Population & General Masses, Technological Intervention,

Ecosystem and Physical Environment, Social Impact of Technology & Engineering Products & Services (Solid Waste Disposal, Pollution control etc)

- Social Approaches and Methodologies for Development Administration & Stakeholders Analysis:

  All Phases of the Project (pre, post and execution) Structured, Focused Group, Stakeholder Consultative Dialogues etc. Dynamics of Social Change, Sociology of Change and Industrial Development, Social Change due to Technology Driven Economic Growth.

- SIA (Social Impact Assessment):

  Base line and need-assessment, evaluation and impact assessment surveys of the development projects. Role of Engg & Technology for Creating Social Cohesiveness & Societal Integration. Technology Based change in Collective Behavior, Social Audit of Engineering Projects.

- Engineering Intervention for Social Stratification

  Factors of Social Stratification, Engineering Interventions for addressing Social Stratification, Social Mobilization through Technological Innovation.

Reading Material

Case Studies of Different Development Projects in Social Context

•Godhade, J. B., and S.T. Hunderkari. 2018. Social Responsibility of Engineers. International Journal of Academic Research and Development. Vol. 03; Special Issue. March, 2018.

•Nichols,S.P.andWeldon,W.F.2017. Professional Responsibility: The Role of Engineering in Society Center for Electro-mechanics, The University of Texas at Austin, USA.

•Aslaksen,E.W.2016. The Relationship between Engineers and Society: is it currently fulfilling its potential? Journal and Proceedings of the Royal Society of New SouthWales,Vol.148.Nos.455-456. Gumbooya Pty Lte, Allambie Heights, Australia.

•Bell, S. Engineers, Society and Sustainability. Synthesis Lectures on Engineers, Technology, and Society. Edited by Caroline Baillie, University of Western Australia. Morgan and Claypool Publishers

•Jamison,A.,Christensen,S.H.,andLars,B.2011.A Hybrid Imagination: Science and Technology in cultural perspective

•Vermaas,P.,Kroes,P.,Poet,l.,andHoukes,W.2011.APhilosophyofTechnology:FromTechnical Artefacts to Socio technical systems.

•Mitcham,C.,andMunoz,D.2010.HumanitarianEngineering.MorganandClaypoolPublishers.
Riley,D.2008.Engineering and Social Justice. Morgan and Claypool Publishers. •

•Bugliarello,G.1991.TheSocial Functions of Engineering: A Current Assessment, A Chapter in“ Engineering as A Social Enterprise. Sociology.

MinE-104 Social Psychology (2,0)

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

Suggested Instructional/Reading Materials

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

MinE-105 Sustainability and Social Responsibility (2,0)

Introduction to Sustainability and Social Responsibility

Definition of sustainability and social responsibility

Historical evolution of sustainability concepts

Importance of sustainability in addressing global challenges

Triple Bottom Line: People, Planet, Profit

Understanding the triple bottom line framework

Interconnectedness of social, environmental, and economic factors

Case studies illustrating successful implementation of the triple bottom line approach

Environmental Sustainability

Key environmental challenges: climate change, biodiversity loss, pollution

Sustainable resource management and conservation

Renewable energy and circular economy principles

Social Sustainability

Social equity, justice, and human rights

Stakeholder engagement and community development

Social impact assessment and ethical considerations

Economic Sustainability

Sustainable economic development models

Circular economy and resource efficiency

Green finance and sustainable investment practices

Corporate Social Responsibility (CSR)

Definition and evolution of CSR

Ethical considerations in business operations

CSR reporting and accountability mechanisms

Sustainable Supply Chains

Principles of sustainable supply chain management

Ethical sourcing and fair trade practices

Certification schemes and standards for sustainable supply chains

Sustainable Urbanization

Sustainable urban planning and design principles

Smart cities and resilient urban infrastructure

Community engagement in urban sustainability

Sustainable Consumption and Production

Consumer behavior and sustainable lifestyles

Eco-labeling and product certification schemes

Waste reduction and recycling initiatives

Ethical Leadership and Governance

Role of ethics in leadership and decision-making

Corporate governance and ethical business practices

Ethical dilemmas and resolution strategies

Case Studies and Best Practices

Analysis of real-world sustainability and social responsibility initiatives

Identification of key success factors and lessons learned

Group discussions and presentations on case study findings.

MinE-106 Circular Economy (2,0)

Introduction to Circular Economy

Definition and principles of circular economy

Historical context and evolution of circular economy concepts

Importance of circular economy in addressing global sustainability challenges

Circular Economy Frameworks and Models

Cradle-to-cradle vs. cradle-to-grave approaches

Circular economy strategies: reuse, recycle, remanufacture, and reduce

Circular economy principles in design, production, and consumption

Circular Economy in Resource Management

Sustainable resource extraction and utilization

Strategies for resource conservation and efficiency

Circular business models in resource-intensive industries

Waste Management and Material Flow

Challenges of waste generation and disposal in linear economies

Circular solutions for waste reduction, reuse, and recycling

Material flow analysis and optimization in circular systems

Circular Economy in Energy and Transportation

Renewable energy sources and circular energy systems

Sustainable transportation and mobility solutions

Circular economy applications in urban planning and infrastructure development

Circular Economy Metrics and Assessment

Key performance indicators (KPIs) for measuring circularity

Life cycle assessment (LCA) and environmental impact analysis

Tools and methodologies for evaluating circular economy performance

Circular Economy Policies and Regulations

Government policies and regulatory frameworks promoting circular economy

International agreements and initiatives supporting circularity

Challenges and opportunities for policy implementation and enforcement

Circular Economy in Agriculture and Food Systems

Sustainable agriculture practices and circular food production

Food waste reduction and valorization

Circular supply chains and distribution networks in the food industry

Circular Economy in Technology and Innovation

Role of innovation and technology in advancing circular economy goals

Circular design principles in product development and manufacturing

Case studies of innovative circular economy solutions in technology sectors

Circular Economy and Social Equity

Social dimensions of circular economy: inclusivity, equity, and justice

Community engagement and participatory approaches in circular initiatives

Circular economy strategies for poverty alleviation and sustainable development

Circular Economy Entrepreneurship

Entrepreneurial opportunities in the circular economy

Business models for circular startups and enterprises

Funding mechanisms and support networks for circular ventures

Case Studies and Best Practices

Analysis of successful circular economy projects and initiatives

Identification of key success factors and lessons learned

Group discussions and presentations on case study findings

MGT-105 Introduction to Economics (2,0)

Course contents will be provided by IBM Department

HU-213 Anthropology (2,0)

Course contents to be provided by Humanities Department

HU-214 Psychology (2,0)

Course contents will be provided by Humanities Department

HU-215 Social Work (2,0)

Course contents to be provided by Humanities Department

IME-371 Engineering Economics (2,0)

Introduction to Economics: Supple and demand theory, supply and demand equilibrium, micro-and macr-economic analysis.

Engineering Economics: Principles of engineering economy, engineering economy methodology, steps in an engineering economic analysis.

Cost and Value Concepts: Sunk and opportunity costs, fixed, variable and incremental costs, recurring and non-recurring costs, direct, indirect and overhead costs, standard costs, cash versus book costs, life cycle costs, value, market value, use value, fair value, book value, salvage value, value addition.

Comparing alternatives: Net present value, net present cost, cost benefit analysis, internal rate of return, payback period, levelised costs, break-even analysis, applicable to capital investment.

Margin of safety application in Master Production Scheduling

Depreciation: Types of depreciation, methods of computing depreciation, economic life of equipment and replacement decisions.

Product Costing: Sources of costing information: labor material, overheads, fixed cost, variable cost, absorption costing, marginal costing, standard costing.

Inventory Valuation Methods

Recommended Books:

Basics of Engineering Economy by Leland Blank and Anthony Tarquin, 6th Edition.

Fundamentals of Engineering Economics by Chan S. Park, 2nd Edition.

*Arts and Humanities Electives

MinE-203 Organizational Behavior (2,0)

The objective of this course is to make students understand and perform well within organizations.

Contents:

What is organizational behavior? Diversity in organizations; Attitudes and job satisfaction; Emotions and moods; Personality and Values; Perception and individual decision making; Motivation concepts; Motivation: from concepts to applications; Foundations of group behavior; Understanding work teams; Communication; Leadership; Power and politics; Conflict and negotiation; Foundations of organizational structure; Organizational culture; Human resource policies and practices; Organoiron changes and stress management

Recommended Book:

Organizational Behavior, 16th Edition. P. Robbins

MinE-204 Professional Ethics (2,0)

The aim of the course is to prepare students to become responsible moral agents and humane professionals, and informed and engaged citizens. To achieve this, the courses provide students with the conceptual tools to make autonomous, informed, comprehensive and coherent judgments about personal, professional, and public ethical issues. The course focuses on general ethics in connection with topics concerning welfare and social change, and practice of engineering as a professional discipline. The following topics will be covered in the course:

Introduction to Ethical Concepts; Ethics and Professionalism; Moral Reasoning and Code of Ethics; Moral Frame Works; Engineering as Social Experimentation; Commitment to Safety; Risk and Liability in Engineering; Workplace Responsibilities and rights; Honesty, Integrity and Reliability; Engineers as Employees; Environmental Ethics; Global Issues; Engineers and Technological Progress; Responsibility for Research Integrity; Fair Credit in Research and Publication; Credit and Intellectual Property in Engineering Practice; Professional behavioral case studies

Recommended Books

•Engineering Ethics: Concepts and Cases by Charles E. Harris Jr, 2018, 6th Ed., Cengage Learning, ISBN:978-1337554503

•Ethics in Engineering by Mike Martin, 2022, 5th Ed., McGraw Hill, ISBN: 9781260721744

•Attributes of Muslim Professionals in the Light of Quran & Sunnah by Akram Muhammad Zeki, 2021, Ilum Press, ISBN: 9789674911201

QT-101 Translation of the Holy Quran-II (1,0)

(Course contents are provided in the relevant semester as per proposed scheme)

QT-201 Translation of the Holy Quran-II (1,0)

(Course contents are provided in the relevant semester as per proposed scheme)

QT-301 Translation of the Holy Quran-III (1,0)

(Course contents are provided in the relevant semester as per proposed scheme)

QT-401 Translation of the Holy Quran-IV (1,0)

(Course contents are provided in the relevant semester as per proposed scheme)

$ Technical Elective Breadth:

MinE-411 Ground Control Engineering (3,0)

Design of openings (single and multiple) in massive rock, design of openings (single and multiple) in jointed rocks, Effect of geological structures on excavations, Rock mass classification and its applications, Rock support system design, Pillar design, Subsidence Engineering, Rock slope engineering, Monitoring and Instrumentation, Numerical modelling applications in ground control engineering, Ground control stability assessment.

Recommended Text Books:

1. Bieniawski, Strata Control, John Wiley & Sons, 1987
2. Syd S. Peng, Coal Mine Ground Control, John Wiley & Sons, 1978
3. Syd S. Peng, Surface Subsidence Engineering, Society for Mining Metallurgy; 1st edition (March 1, 1992)
4. Hoek and Bray, Rock Slope Engineering, CRC Press, 1981
5. Syd and Peng, Longwall Mining, John Wiley & Sons, 1984

Recommended Reference Books:

1. Holdings: Subsidence Engineer's Handbook, (Latest Edition)
2. FWA Rock Slope Engineering Course Manual.

MinE-420 Operations Research (3,0)

Introduction to Operations Research (OR);
Introduction to Foundation mathematics and statistics
Linear Programming (LP), LP and allocation of resources, LP definition, Linearity requirement;
Maximization Then Minimization problems;
Graphical LP Minimization solution, Introduction, Simplex method definition, formulating the Simplex model;
Linear Programming – Simplex Method for Maximizing;
Simplex maximizing example for similar limitations, Mixed limitations
Example containing mixed constraints, Minimization example for similar limitations;
Sensitivity Analysis: Changes in Objective Function, Changes in RHS, The Transportation Model;
Basic Assumptions;
Solution Methods: Feasible Solution: The Northwest Method, The Lowest Cost Method; Optimal Solution: The Stepping Stone Method, Modified; Distribution (MODI) Method.
The Assignment Model:- Basic Assumptions
Solution Methods:-Different Combinations Method, Short-Cut Method (Hungarian Method)

Recommended Books:

●Operations Research by H. A. Taha, Prentice Hall

MinE-441 Industrial Minerals (3,0)

Introduction to Industrial Minerals

Definition and classification of industrial minerals
Economic significance and global distribution
Historical perspectives and current trends

Geological Formation of Industrial Minerals

Geological processes and environments conducive to industrial mineral formation
Types of mineral deposits and their characteristics
Exploration techniques and geological mapping

Mining Methods for Industrial Minerals

Surface mining techniques
Underground mining methods
Dredging and solution mining

Processing Technologies

Crushing, grinding, and screening
Physical separation methods
Chemical processing techniques
Utilization of Industrial Minerals

Construction and Infrastructure
Industrial Minerals in Ceramics and Glass
Industrial Minerals in Chemicals and Pharmaceuticals
Industrial Minerals in Agriculture and Fertilizers
Industrial Minerals in Energy and Environmental Technologies
Sustainability and Environmental Considerations
Environmental regulations and permitting for industrial mineral extraction
Rehabilitation and reclamation of mining sites
Sustainable practices in mineral resource management
Case Studies and Industry Perspectives
Current status of industrial minerals of Pakistan and its global comparison
Available deposits
Mining
Beneficiation
Utilization
Marketing
Future Trends and Challenges

Textbook:

1.Mineral Resources and Development by Ganpat Singh Roonwal, K. Shahriar, Hojjatollah Ranjbar
2.Industrial Minerals & Rocks; Commodities, Markets, and Uses by Jessica Elzea Kogel
3.Mineral Directory of Pakistan – GSP Quetta

MinE-432 Minerals Marketing / Utilization (3,0)

Introduction to Minerals Marketing and Utilization
Definition and scope of minerals marketing/utilization
Importance of effective marketing and utilization strategies in the mining industry
Overview of key concepts and terminology
Minerals Markets and Supply Chain
Structure and dynamics of minerals markets
Supply chain management in the minerals industry
Market trends, drivers, and challenges
Market Analysis and Forecasting
Methods for market analysis and forecasting
Factors influencing mineral demand and pricing
Case studies on market analysis and forecasting techniques
Pricing Mechanisms and Strategies
Pricing mechanisms in minerals markets
Factors influencing mineral pricing
Pricing strategies for different minerals and products
Marketing of Major Minerals
Marketing strategies for major minerals (e.g., coal, iron ore, copper)
Case studies on successful mineral marketing campaigns
Specialty Minerals and High-Value Products
Marketing considerations for specialty minerals and high-value products
Niche markets and value-added products
Market segmentation and targeting strategies
Mineral Utilization in Construction Industry
Utilization of minerals in the construction sector
Trends in construction materials and technologies
Sustainable construction practices and their impact on mineral utilization

Mineral Utilization in Manufacturing Industry
Role of minerals in manufacturing processes
Utilization of minerals in automotive, aerospace, and electronics industries
Innovation and technological advancements in mineral utilization
Mineral Utilization in Energy Sector
Utilization of minerals in energy generation (e.g., coal, uranium)
Trends in renewable energy technologies and their mineral requirements
Challenges and opportunities in sustainable energy mineral utilization
Mineral Utilization in Agriculture and Food Industry
Role of minerals in agriculture and food production
Fertilizers, soil amendments, and mineral supplements
Sustainable agricultural practices and mineral utilization
Sustainable Minerals Marketing and Utilization
Ethical considerations in minerals marketing and utilization
Corporate social responsibility (CSR) in the minerals industry
Sustainable development goals (SDGs) and their relevance to minerals utilization

Case Studies and Industry Simulations

Analysis of real-world minerals marketing and utilization scenarios
Industry simulations to explore strategic decision-making in minerals marketing
Group discussions and presentations on case study findings

MinE-433 Cement Technology (3,0)

1.**Overview of Cement Production**

•Introduction to cement production processes, types of cement, and their properties
•Cement manufacturing stages and equipment
2.**Raw Materials Used for Cement Manufacturing**

•Types and properties of raw materials
•Exploration and extraction methods
•Quality control in raw material selection
3.**Quarry Operations, Layout, and Design**

•Overview of principles of quarry operations and layout considerations
•Designing quarry infrastructure for efficiency and safety
4.**Equipment and Fleet Selection for Cement Quarry Operations**

•Types of equipment used in quarry operations.
•Factors influencing equipment selection.
•Fleet management and optimization
5.**Loading and Haulage of Raw Material**

•Loading and haulage of material
•Safety considerations in material transport
6.**Raw Mix Design**

•Principles of raw material selection, blending, and optimization for raw mix design.

7.**Pyroprocessing and Cement Kiln**
•Overview of pyroprocessing stages in cement kilns, including preheating, calcination, and clinker formation.
8.**Heat transfer and thermodynamics in cement kilns**

•Mechanical aspects of cement plants, including coolers, and principles of cement grinding.
•Operation, control, and optimization techniques for cement kilns and grinding processes.
9.**Cement Storage and Handling, Material Transport and Conveying**

•Storage and handling of facilities for cement in cement plants
•Conveying methods and equipment

10.**Production Scheduling and Optimization Procedures of Cement Quarry Operations**

•Principles of production scheduling
•Factors influencing production scheduling in cement quarry operations.
•Optimization methodologies in cement quarry operations
•Data analysis techniques for optimization
11.**Sustainable Development and Responsible Mining**

•Environmental considerations in cement quarry operations

•Sustainable practices in mining and cement production

12.**Introduction to Software Tools Related to Mine Planning and Design**

•Overview of software tools for mine planning and design
•Applications of software tools in cement quarry operations.

MinE-440 Drilling Technology (3,0)

Drilling Technology
Objectives of the subject- various purposes of drilling a borehole; Brief introduction of the history and current state of the Rock drilling; The various facets of drilling engineering and operations; Basic rock drilling mechanism; working principles of various components of rig systems; Drilling methods; classification of methods; Field of drilling application; Mining purposes, sampling and core logging; Types of drill bit and their selection; Well drilling: On-shore, and off-shore drilling; Types of drilling fluids and their properties; Casing and cementing processes of wells; Factors affecting penetration rate; Drill cost calculations; Blowout control (BOP).

MinE-450 Mine Management (3,0)

1. **Management:** Definition and Essential elements of Management.
2. **From Scientific Management to Human Resource Management:** Principles and Characteristics of different Management theories.
3. **Mine Management:** Mine Engineer as Project Manager, Management tasks and responsibilities.
4. **Mine Organization:** Duties and Characteristics of functional Organization.
5. **Underground Mine Management and Surface Mine Management** – Matrix and Mixed Organization.
   - Effective Management: by objectives
   - EM by Productivity
   - EM by communication
   - EM by technical Staff
   - EM by safety and Training
6. **Project Planning and control:** Strategic Planning, project Network analysis
7. **Human and Performance**: Recruiting selection, training, development, compensation.
8. **Material Resource:** Measurement, Material Management, Market Management, Reserve/Sampling Calculations, Pricing.
9. **Project Budgeting:** Budgets and Controls, Budgeting Methods.

MinE-412 Engineering Geology (3,0)

1.**Introduction to Engineering Geology**
•Definition and scope of engineering geology in the context of mining.
•The role of engineering geology in site characterization and exploration.
•Geological processes, rock types, and their engineering significance.
•Soil formation, types, classification systems, and their influence on mining activities.
•Introduction to geological maps and engineering drawings
2.**Geological Structures and Mining Operations**
•Principles of geological structures and their impact on mining activities.

•Geological considerations for excavation design and stability assessments.
3.**Soil Mechanics Fundamentals**
•Basic soil properties: grain size, consistency, and classification.
•Soil behavior under different loading conditions and its significance in mining
4.**Geotechnical Applications in Mining Structures**
•Application of geotechnical principles in the design of open pits and underground excavations.
•Stability assessments and reinforcement strategies for mining structures.
5.**Soil Behavior and Engineering Applications**
•Soil-structure interaction and its impact on foundation design.
•Settlement analysis and considerations in foundation design for mining structures.
•Interpretation of laboratory test results for engineering design and decision-making.
Recommended Textbooks:
1.Engineering Geology by F.G. Bell
2.Principles of Geotechnical Engineering by Braja M. Das
3.General & Engineering Geology, by Bopche, and Agarwal
4.Soil Mechanics and Foundations by Muni Budhu
5.Soil Mechanics, by Craig.

MinE-460 Applications of Finite Element Analysis in Mining (3,0)

Basic concepts of FEM
Introduction to variational methods of approximation: Ritz Method, The Method of Weighted Residuals
One-dimensional second order and fourth order equations: discretization, variational formulation, FEM formulation, Assembly, Imposition of boundary conditions, Post-processing of the solution
Isoparameteric elements and numerical integration
Two-dimensional second order equations involving multivariable equations: Plane elasticity, incompressible fluid flow problems
Computer implementation of FEM solutions
Recommended Text Books:

1. J. N. Reddy, An Introduction to Finite Element Method
2. Zienkiewicz, Finite Element Method

Recommended Reference Books:
1. Cook, Concepts and Applications of Finite Element Method.

MinE-414 Applied Geotechnical Engineering (3,0)

•Shear Strength: Concept, parameters, Coulomb's law, shear strength of cohesive and non-cohesive soils. Factors affecting shear strength of soil and its applications in engineering. Laboratory and field tests for determination of shear strength.

•Stress Distribution in Soils: Geo-static stresses, Total stress and pore pressure, Effective stress, Vertical stresses induced due to structural loads; Westergaard and Boussinesq's theories. Pressure bulb, Stress distribution diagrams on horizontal and vertical planes. Stress at a point outside the loaded area, Newmark's influence charts, Fadum, Steinnbrenner charts.

•Settlement Analysis: Definition, total settlement, differential settlement, angular distortion, consolidation settlement, elastic or immediate settlement. Settlement calculations, Primary and secondary consolidation settlements, Immediate settlement of cohesive and non-cohesive soils, Causes of settlements and methods of controlling settlement, Limits of allowable total and differential settlement.

•Earth Pressures: Definition, pressure at rest, active and passive earth pressures, Coulomb's and Rankine's theories, Trial wedge and Culmann's method. Earth pressure diagrams for different configurations loading.

•Bearing Capacity of Soils: Definition of ultimate and safe bearing capacities, allowable bearing capacity, gross and net bearing capacities, Methods of obtaining bearing capacity: Presumptive values from codes; merits and demerits. From plate load test. Bearing capacity theories. Bearing capacity from SPT and CPT data.

•Introduction to Soil Improvement Slope Stability: Types of slopes, Factors affecting stability and remedies. Types of failure Methods of analysis; Swedish circular method, Taylor's slope stability number and Bishop's methods.

Suggested Books:

•Das, B.M. 2005. Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore.
•Atkinson, J. 2007. The Mechanics of Soils and Foundations, 2nd ed., Spon Press.
•Knappett, J. A. and R.F. Craig. 2012. Craig's Soil Mechanics, 8th ed., Spon Press.
•Smith, I. 2014. Smith's Elements of Soil Mechanics, 9th ed., John Wiley and Sons Ltd.

£Technical Electives Depth

MinE-421 Coal Technology (3,0)

The importance of coal for world economies, coal chemistry and classification, coal exploration protocols, coal resources of Pakistan. In-situ and ex-situ sampling techniques, sample preparation methods, common thermal and coking coal analysis methods, coal reporting basis. Introduction to coal preparation and its basic principles (Washability, efficiency of separation, yield maximizing), unit operations of coal preparation plant (size reduction, size separation, concentration, dewatering and waste disposal) and available technologies, coal preparation plant practices and process flowsheets, preliminary considerations and designing coal preparation plant, economic and environmental aspects. Coal combustion technologies, coal gasification and liquefaction, carbonization and coke production, coal-based chemicals and future coal utilization technologies.

Books:

1. Dave Osborne, 2013. The Coal Handbook Towards Cleaner Production, Woodhead Publishing Limited, Cambride, UK
2. J. W. Leanord & B. C. Hardinge, 1991. Coal Preparation, 5th Edition, Society for Mining, Metallurgy and Exploration Inc. USA
3. B. G. Miller, 2005. Coal Energy Systems, Elsevier Academic Press, London, UK.

MinE-422 Solution Mining Technology (3,0)

Introduction, scope and applications of solution mining

Physical and Chemical Amenabilities: Depth, hydrostatic pressure, permeability of the deposit, the chemical nature of mineralizations, their dissemination in the ore body in relation of natural flow channels

Laboratory and Field Testing: Selective dissolution of mineralizations, factors effecting economic viability, preferred directions of lixivant flows, lixivant containment and recovery issues, solution chemistry and side reactions, batch and column leach testing, geochemical conditions of the formation

Methods of Leaching and Equipment: Operating regimes (acidic or alkaline), well-field design, well-testing, production strategy, operating and performance parameters, process hydraulics, submersible pumps, filters, well-linings

Extraction Process: Ion-exchange: principles, resins, equipment. Solvent Extraction

Environmental Issues: Impact Assessment, waste treatment, land reclamation, prevention and treatment of contaminated water Case studies of sulfur, copper, uranium, gold and silver.

Recommended Text Books:

1. R. W. Barlett, Solution Mining: Leaching and Recovery of Materials, 2nd Ed. 1998
2. W. J. Shlitt, D. A. Shock, Insitu Uranium Leaching and Ground Restoration. Society of Mining and Metallurgy, 1979

Recommended Reference Books:

1. SME Mining Engineering Handbook, Hartman (Editor), AIME, 1994.

MinE-424 Extractive Metallurgy (3,0)

Introduction to Extractive Metallurgy
Definition and scope of extractive metallurgy
Historical development and significance of metallurgical processes
Overview of key concepts and terminology in extractive metallurgy
Mineralogy and Ore Characterization

Characteristics and properties of minerals and ores
Ore sampling, preparation, and characterization techniques
Relationship between mineralogy and metallurgical processing
Hydrometallurgical Processes
Principles of hydrometallurgy and leaching
Acid and alkaline leaching processes
Solvent extraction and ion exchange in hydrometallurgy
Pyrometallurgical Processes

Principles of pyrometallurgy and smelting
Roasting, smelting, and matte conversion processes
Refining techniques in pyrometallurgy
Electrometallurgical Processes

Principles of electrometallurgy and electrolysis
Electrowinning and electrorefining processes
Applications of electrometallurgy in metal production
Extractive Metallurgy of Common Metals

Extractive metallurgy of common metals (e.g., copper, iron, aluminum)
Processing of complex ores and concentrates
Case studies of metallurgical processes for specific metals
Environmental and Economic Considerations

Environmental impacts of extractive metallurgical processes
Sustainable practices and technologies in metallurgy
Economic factors influencing metallurgical process selection
Metallurgical Testing and Analysis

Laboratory techniques for metallurgical testing and analysis
Mineralogical and chemical analysis of ores and products
Interpretation of metallurgical test data
Process Optimization and Control

Principles of process optimization in extractive metallurgy
Control systems and instrumentation in metallurgical plants
Continuous improvement and quality control practices
Case Studies and Industry Applications

Analysis of real-world metallurgical processes and operations
Case studies of successful metallurgical projects and innovations
Group discussions and presentations on case study findings.

MinE-431 Rock Engineering (3,0)

1. Introduction to Rock Engineering

•Definition and scope of rock engineering
•Importance and applications in civil, mining, and geotechnical engineering
•Historical development and notable achievements in rock engineering
2.Rock and rock mass Properties
•Classification of rocks and rock masses

•Physical properties of rocks (density, porosity, permeability, etc.)
•Mechanical properties of rocks and rock masses (strength, elasticity, deformability, etc.)
•Geological factors influencing rock properties

3.Rock Mechanics

•**S**tress and strain in rocks
•Rock failure mechanisms
•Laboratory testing methods for rock mechanics

4.Slope Stability Analysis

•Types of rock slopes
•Methods for analyzing slope stability (limit equilibrium methods, numerical modeling)
•Factors affecting slope stability
•Mitigation measures for unstable rock slopes
•Case studies

5.Rock tunnelling

•Methods of rock excavation
•Factors influencing excavation design (Ground composition and Project related factors)
•Tunnelling techniques and considerations
•Case Studies

6.Mine Design

•Interactions between Rock Mechanics and Rock Engineering Systems
•Fundamental Principles of Excavation
•Mechanisms of Instability in Surface Excavations
•Mechanisms of Instability in Underground Excavations
•Geotechnical Considerations in Selecting Mining Methods
•Designing Pillars and Planning Extraction Sequences
•Establishing Stope Dimensions and Sequences Considering Geological and Geotechnical Conditions
•Geotechnical Factors in Pit Planning
•Support Systems for Longwall Faces
•Implementation of Caving Methods and Ground Reinforcement

7.Support Systems and Ground Control

•Rock Support Interaction
•Rock Support analysis
•Modes of Instability & Classification of Stabilization Methods
•Application and Evaluation of Stabilization Methods

Recommended Books

1. Engineering in Rocks for Slopes, Foundations and Tunnels by T. Ramamurthy
2.Practical Rock Engineering by Evert Hoek
3.Rock Mechanics Principles in Engineering Practice By John A. Hudson
4.Engineering Rock Mechanics; An Introduction to the Principles By John A. Hudson and John P. Harrison.

MinE-451 Sustainable Mining (3,0)

1. **Introduction to Sustainable Mining**
2. **The sustainable development Goals.**
3. **The Challenges of mining**
   - Environmental
   - Social
   - Economic
4. **Direct Impacts of Mining on Sustainable development Goals**

A. Sd6: clean water and sanitation
B. Sdg7: affordable and clean energy
C. Sdg8: good jobs and economic growth

D. Sdg9: industry, innovation, and infrastructure
E. Sdg13, climate action
F. Sdg15, ecosystem and biodiversity protection

5. **Role of Authorities for Sustainable Mining**
   - Who has a role to play

   A. The role of the mining companies
   B. The role of governments
   C. The role of the local population
   D. The role of consumers
   E. The role of the international community

6. **Impacts of Mining during the life of a mine**
   - Mineral exploration Phase
   - Mine development Phase
   - Mining Operations
   - Mine Closure

7. **Orienting legal frameworks towards sustainable development.**
   - The domestic legal framework
   - Mining contracts
   - International treaties, conventions and soft law
     - mineral waste,
     - water quality,
     - nature preservation,
     - biodiversity,
     - air pollution
     - and climate change
   - Voluntary standards
   - Customary rules

8. **Protection of Environment and people**
   - Trends and approaches in environmental regulation of mining,
   - Environmental and social impact assessment
   - Environmental monitoring and auditing
   - Community consultation, engagement and protection, Free, prior and informed consent, Engagement during the life of a mine, Access to information, Grievance mechanisms,

Managing mine closure, Mine closure in the life of a mine, Financing mine closure,

SUGGESTED INSTRUCTIONAL/ READING MATERIALS

•Sustainable Mining Practices (2005): A Global Perspective by Vasudevan Rajaram, Subijoy Dutta, Krishna Parameswaran,
•Mining, Materials, and the Sustainable Development Goals (SDGs): 2030 and Beyond by Cristian Parra, Brandon Lewis, Saleem H. Ali, 2020 Published
•SME, 2009. Sustainable management of mining operations. Edited by Botin, J. A.

Other Material

•Managing mining for sustainable development: A source book, UNDP Bangkok Regional Hub and Poverty-Environment Initiative Asia-Pacific of UNDP and UN Environment April 2018
•The Sustainable Development Goals challenging the Mining Industry: An article to understand the role and use of the Sustainable Development Goals in the mining industry by United Nations.
•Mapping Mining to the Sustainable Development Goals: An Atlas by UNDP.

MinE-438 Dimension Stones Mining (3,0)

1.Introduction to Dimension Stones:

•Overview of different types of dimension stones
•Geological characteristics and formation processes.
•Overview of different types of dimension stones.

•Geological characteristics and formation processes.
2.Dimension stone reserves in Pakistan

•KPK, GB, Baluchistan, and AJK
3.Site Selection and Exploration:

•Criteria for selecting suitable quarry sites.
•Exploration techniques to assess stone quality and quantity.
4.Mining Methods and Equipment:

•Surface and underground mining methods for dimension stones.
•Introduction to specialized equipment used in dimension stone mining.
5.Factors affecting selection of mining techniques/method.

•Geological Factors
•Technological factors
6.Safety and Environmental Considerations:

•Safety protocols in dimension stone quarries.
•Environmental impact assessment and mitigation measures.
7.Extraction Techniques:

•Quarrying and block extraction techniques, including drill and blast, plug and feathers, Diamond wire saw, expansive cement.

•Procedure for Transporting of blocks to processing units.

8.Dimension Stone Processing and uses:
•Cutting and shaping methods.
•Polishing and finishing process**es.**
9.Quality Control and Standards:

•Evaluation of dimensional accuracy and surface finish.
•Compliance with industry standards and specifications.
10.Market and Economic Aspects:

•Understanding the global dimension stone market.
•Economic factors influencing the industry.
11.Case Studies and Field Visits:
•Analysis of successful dimension stone mining operations.
•Field visits to operational quarries and processing units.
Suggested Books:

•"Dimension Stone: Use in Building Construction" by Antony G. Cooper
•Trade Development of Pakistan. Report on Marble and Granite
•SMEDA, 2012. Report on Marble and Granites.
•Natural Stone: Weathering Phenomena, Conservation Strategies and Case Studies" by Eric Doehne and Clifford A. Price
Other helping material:.
•Case studies

MinE-434 Coal Mining (3,0)
1.Geological Foundations of Coal Mining

a. Coal Formation Processes
b. Types of Coal and Characteristics
c. Geological Conditions Impacting Mining
2. Advanced Mining Techniques

a. Surface Mining Innovations

b. Underground Mining Technologies
c. Comparative Analysis of Mining Techniques

3.Economic Considerations in Coal Mining Operations

a. Economic Drivers in Mining
b. Financial Modeling for Mining Projects (Thar coal Case study)
c. Application of discounted cash flow analysis in mine planning.
d. Optimizing production schedules for economic efficiency

4.Mine Planning and Design

a. Overview of mine planning as a multidisciplinary process.
b. Strategic / Long-term Mine Planning
c. Tactical / short to medium-term operation planning
d. Learning from historical cases of both successful and challenging mining projects

5. Hydrogeological Conditions

a. Hydrogeological characteristics of coals and coal-bearing sequences
b. Understanding the necessity and methods of dewatering during mining.
c. Mitigation strategies for potential hydrogeological impacts

6. Safety Standards and Regulations

d. Global Safety Standards in Mining
e. Queensland Specific Safety Protocols (Thar coal case study)
f. Risk Assessments and Management
g. Emergency Response Planning

Reading Material

•SME Elements of Practical Coal Mining by S.M. Cassidy, (Latest Edition)
•SME Coal Preparation Edt. By J.D. Leonard and R.D. Mitchell, (Latest Edition)
•Coal Mining Technology: Theory and Practice by R. Stefanko and C.J. Bise, (Latest Edition)
•Coal Geology and Coal Technology by Colin R. Ward, (Latest Edition)
•Coal Geology by Larry Thomas, (Latest Edition).

MinE-425 Mining and Processing of Rare Earth Elements (3,0)

Introduction to Rare Earth Elements
Definition and classification of rare earth elements (REEs)
Occurrence, distribution, and geological characteristics of REE deposits
Importance of REEs in modern technology and industry

Rare Earth Mining Methods
Overview of mining methods for REE extraction
Surface mining, underground mining, and in-situ leaching techniques
Selection criteria for mining method based on deposit characteristics

Mining & Processing of Rare Earth Minerals
Principles of mineral processing for rare earth minerals
Ore beneficiation techniques: gravity separation, magnetic separation, flotation
Hydrometallurgical and pyrometallurgical processes for REE extraction

Rare Earth Concentration and Extraction
Concentration methods for rare earth minerals
Solvent extraction, ion exchange, and precipitation techniques
Recovery of individual rare earth elements from concentrates

Environmental Considerations in REE Mining and Processing
Environmental impacts of rare earth mining and processing
Mitigation strategies for air, water, and soil pollution
Sustainable practices and regulations governing REE operations

Case Studies of Rare Earth Mining Projects

Analysis of real-world rare earth mining projects and operations
Environmental and social challenges faced by REE mining companies
Lessons learned and best practices in REE mining and processing
Laboratory Testing and Analysis
Laboratory techniques for rare earth mineral analysis
Characterization of rare earth ores and concentrates
Interpretation of laboratory results for process optimization
Process Optimization and Control
Principles of process optimization in rare earth processing plants
Control systems and instrumentation for monitoring and controlling REE extraction processes
Continuous improvement and quality control practices
Rare Earth Utilization and Applications
Applications of rare earth elements in various industries (e.g., electronics, renewable energy, healthcare)
Market trends and demand drivers for different REEs
Future prospects and emerging technologies for rare earth utilization
Social Responsibility and Community Engagement
Stakeholder engagement and community relations in rare earth mining projects
Corporate social responsibility (CSR) initiatives in the REE industry
Indigenous rights and land-use agreements in REE mining regions
Sustainable Development and Ethical Considerations
Sustainable development principles and frameworks in rare earth mining
Ethical considerations in REE supply chains
Responsible sourcing and traceability initiatives for REEs
Industry Perspectives and Future Directions
Guest lectures from industry professionals in the rare earth sector
Discussion on industry trends, challenges, and opportunities
Group presentations on future directions and innovations in rare earth mining and processing.
Recommended Books

•The Science of Rare Earth Elements Concepts and Applications By Frank R. Spellmans
•Rare Earths Industry: Technological, Economic, and Environmental Implications" by Ismar Borges de Lima
•Rare Earth Elements: A Brief Review" by Hongmin Zhu
•Rare Earths: Science, Technology, Production and Use" edited by Karl A. Gschneidner Jr., Jean-Claude G. Bünzli, and Vitalij K. Pecharsky

MinE-436 Placer Mining & Processing (3,0)

Introduction to Placer Mining:
o Definition and characteristics of placer deposits
o Historical overview of placer mining
o Importance and economic significance of placer mining
• Exploration and Evaluation of Placer Deposits:
o Methods for identifying and locating placer deposits
o Sampling techniques for placer deposits
o Geological and geophysical methods for evaluating placer deposits
• Placer Mining Methods:
o Overview of different placer mining methods (e.g., panning, sluicing, dredging, hydraulic mining)
o Equipment and machinery used in placer mining operations
o Environmental considerations and regulations in placer mining
• Placer Deposit Evaluation and Resource Estimation:
o Resource estimation techniques for placer deposits
o Factors affecting placer deposit grade and tonnage
o Estimation of recoverable reserves in placer deposits
• Placer Mining Operations and Techniques:
o Planning and design of placer mining operations
o Extraction and recovery methods for different types of placer deposits
o Processing techniques for separating valuable minerals from placer materials

• Environmental and Social Impacts of Placer Mining:
o Environmental considerations and mitigation measures in placer mining
o Social and community impacts of placer mining operations
o Reclamation and rehabilitation of placer mining sites
• Case Studies and Field Trips:
o Analysis of real-world placer mining projects
o Field trips to operational placer mining sites for practical exposure
• Safety and Risk Management in Placer Mining:
o Occupational health and safety considerations in placer mining
o Risk assessment and management in placer mining operations
o Emergency response and rescue procedures in placer mining
• Regulatory Framework and Legal Aspects:
o Laws and regulations governing placer mining activities
o Permitting and licensing requirements for placer mining operations
o Compliance with environmental and safety regulations
• Future Trends and Innovations in Placer Mining:
O Emerging technologies and advancements in placer mining
O Sustainable practices and innovations in placer mining operations
Potential challenges and opportunities in the future of placer mining
Recommended Books:

Introductory Mining Engineering by Hartman
o"Placer Mining: A Guide to Environmental Impact Assessment" by Michael G. Moncur
oPlacer Mining in the Western United States" by William B. Clark:
oPlacer Mining for Gold in California.

MinE-451 Mine System Analysis (3,0)

Environmental Pollution, Solid and Hazardous waste management, Sources of acid mine water draining and its control. Noise pollution, sources at mine site and its control, Environmental pollution control laws and regulations, Pollution sampling and measuring techniques. Ecological impact and reclamation of mined land. Vibration and air blasts caused due to blasting and its control and Acid Mine Drainage.

Text Books
a)Fletcher & D'Andrea, Explosives and Blasting Procedures Manual (IC 8925).
b)Mining and its impact on the environment by Fred G. Bell and Laurance J. Donnelly, Publisher Taylor and Francis. (ISBN 0-415- 28644-1 (hbk)
c)Environmental impacts of mining (Monitoring, Restoration and Control) by M. Sengupta by Lewis Publishers (ISBN 0-87371-441-5).
d)Mining environment (Problems and Remedies) by O.P Singh (ISBN 81- 89233-16-5).

MinE-440 Mine Automation and Digitization (3,0)

1.**Introduction to Mine Digitization and Automation**
•Definition and scope of mine digitization in the mining industry.
•Overview of key technologies (sensors, data analytics, automation systems).
•Impact of digitization and automation on the mining industry (productivity, safety, sustainability).
•Ethical considerations and challenges associated with automation in mining.
2**.Data Acquisition and Management**
•Sensor technologies and data collection methods in mining operations.
•Data communication protocols and infrastructure (wired, wireless, cloud-based).
•Data management systems (SCADA, databases) and their functionalities.
•Big data analytics in mining: principles, applications, and tools.
•Hands-on session: Utilizing software for data visualization and basic analysis.
3.Automation Systems in Mining
•Principles of mine automation and its role in improving safety and efficiency.
•Types of automation (fixed, mobile, autonomous).
•Automated drilling, blasting, and loading technologies.

•Autonomous haulage systems (trucks, conveyors) and their operational principles.
•Remote operation centers and telepresence applications in mining.
•Case studies: Analyzing successful implementations of automation technologies in different mining environments.

4.Designing Mine Automation Strategies

•Strategies for designing and implementing automation in various mining processes.
•Considerations for human-machine interaction and collaboration.
•Integration of automation technologies with existing mining infrastructure.
•Systems engineering principles for designing and implementing automated systems.
•Safety considerations and risk assessment for automated mining operations.
•Maintenance and support strategies for automated equipment.

5.Internet of Things (IoT) in Mining

•Integration of IoT devices in mining operations.
•Real-time monitoring and control using IoT for enhanced decision-making.

6.Remote Sensing and GIS Applications

•Principles of remote sensing and GIS in mine digitization.
•Applications for geological mapping, monitoring, and resource management.

7.Emerging Technologies in Mine Digitization

•Emerging technologies in mining (artificial intelligence, machine learning, robotics).
•The impact of digitization and automation on future workforce skills and training needs.
•Sustainability considerations in the context of mine digitization and automation.

Recommended Textbooks:

1.Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist
2.Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig
3.Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms by Nikolaus Correll, Bradley Hayes.

MinE-452 Commercial Explosive Handling and Storage (3,0)

Explosive classification based on their chemistry, strength and use; General purpose and permissible explosives used in mining; Explosive storage and Commercial explosive magazines; Commercial explosives handling laws; Explosives transportation; Licensing; Environmental hazards of blasting

Approval of course for B.Sc. Civil Engineering program for session 2024 onwards.

MinE-170A Geology for Engineers (2,0) Pre-Requisites: NIL

The fundamentals of general/structural geology, importance of geology for civil engineers, introduction to engineering geology, engineering properties of geological materials and rocks and their correlation with civil engineering projects, classification of rock masses, discontinuities of rocks and determination of shear strength of rock discontinuity, determination of elastic properties of rocks, wave propagation through rocks

Subsurface investigation: drilling, sampling and in-situ testing of subsurface geological materials, collection of geophysical data, planning, and supervision of geophysical investigations, behavior of subsurface geological materials under static and dynamic structures, definition and importance of damping for the design of civil engineering structures, introduction to tectonic plates, causes of earthquake, determination of shear wave modulus, and construction of response spectrum

Stability of rock slope: various types of rock failures and factors affecting the stability of rock slopes, analysis and calculation of safety factors, causes of landslides and remedial measures

Engineering geology of dams: identification and determination of geological parameters required in dam design and selection of dam sites, case histories of dam sites in Pakistan.

Engineering geology of tunnels: geological survey prior to tunneling lining of tunnels and its selection, selection of tunnel site and its requirements, case histories

Ground subsidence: effect of alteration of fluid levels, mines

MinE-101 Applied Geology (2,1) Prerequisite Nil

Introduction to Geology and its branches; Origin of the earth and its place in universe. Interior of the earth and the chemical composition of the earth's crust; Mountain building and valley formation, drainage patterns and their types; Weathering and Erosion; Deformational structural features of rocks, dip, strike, faults, folds and joints; Mass wasting; Plate tectonics; Earthquakes and volcanism; Minerals and Rocks; Earth mineral resources and occurrence of economic minerals and dimension stones in Pakistan

Lab Outline 1. International geological symbols for rocks, structures and minerals 2. Measurement of dip and strike 3. Geological map reading 4. Moh's Scale Hardness 5. Identification of rock forming minerals 6. Study of wooden models of faults and folds etc. Recommended Books Charles Plummer, Diane Carlson, Lisa Hammersley, 2016, Physical Geology, 15th Edition, McGraw-Hill, NYC, USA. Cronin, V. S. (Ed.), & Tasa, D. (Illus.). (2018). Laboratory Manual in Physical Geology, (11th ed.) New York: Pearson