B.Sc. Transportation Engineering Program

Course Contents Session 2024 onwards

Revised Course Code, Name and Outline
Semester 01
MA-113 Calculus and Analytic Geometry A review of differentiation; Geometrical interpretation of a derivative; Infinitesimal; Differential coefficient; Derivatives of higher order; Indeterminate forms and L. Hospital'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 R3; 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.
CY-101 Applied Chemistry Organic chemistry: Functional groups, Main types of organic reactions, Electrophilic aromatic substitution reactions Inorganic Chemistry: Acids and Bases, Relative strengths of acids and bases, Ostwald's dilution law, Coordination Chemistry, Complexation reactions, Physical Chemistry: Solutions, Ideal and non-ideal solution, Characterization using colligative properties, Depression of solvent freezing point, Elevation of solvent boiling point, Osmotic pressure, Electrochemistry, Galvanic cells, Fuel cells
HU-102 Functional English Speaking; Group discussions, Role play activities, Extempore, impromptu, and public speaking, Argumentation sessions, Interview Skills, English for everyday situation, Communication with people in the classroom and in real situation in class excursion project, Skills to Speak accurately and clearly, improving pronunciation and fluency, Vocabulary Extending Program. (VEP), Skills to pathway of language proficiency, abroad studies and job getting skills. Reading; Comprehension techniques, reading activities, Book and article reviews, Vocabulary, Introduction to communication, Building Vocabulary, Sentence construction., Picture Vocabulary for better understanding. Writing; Mechanics of writing, Basic sentence structure, Paragraph writing, Composition techniques, Correction of errors, Precis Letter writing practice. Listening: Listening skills, listening interviews of renowned speakers, watching movies/documentaries, Translation, Pronunciation, Development of the accent, avoiding spelling mistakes and mispronunciations, Everyday communication - introduction, Shopping Meeting friends, Traveling, visiting a doctor Telephone communication, Negotiation, At the movie Theatre, At the office, Meeting relative.... etc., Audio - Video lesson plan covering topics form Real life situation.
CS-103 Introduction to Computer Programming for data science Working with the MATLAB user interface Entering commands and creating variables Analyzing vectors and matrices

Visualizing vector and matrix data
Working with data files
Working with data types
Automating commands with scripts
Writing programs with branching and loops
Writing functions

CS-103 L Introduction to Computer Programming for data science

Computer labs to cover each content in the theory part.

TE-102 Surveying-I

Introduction to land surveying: definitions, branches and their application. Reconnaissance
Chain Surveying: Type of tapes, chains, and methods of chain surveying
Leveling: Reduction of levels, temporary and permanent adjustments of level, precise leveling
Theodolite: Types, use, and adjustments. Traversing with compass and theodolite. Tachometry with staff and sub tense bar
Plane Table Surveying: Parts and accessories, Methods of plane table survey, two and three-point problems
Contouring: Methods and applications
Area and Volumes: Computation by various methods, cross section and L-section of roads, Layout of buildings and structures

TE-102 L Surveying-I

1. Building measurements using measuring tape
2. Measurement of distance by pacing
3. Direct ranging and chaining of a line
4. Indirect ranging of a line
5. Measurement of horizontal distance along sloping ground
6. Chain survey
7. Study of prismatic compass
8. Study of tilting level
9. Measurement of ceiling height using Auto level
10. Study of Theodolite, its temporary and permanent adjustments
11. Measurement of angle by repetition method and reiteration method of a scheme
12. Plane table survey

PHY-122 Basic Mechanics

Mechanics, fundamental concept of space, time, mass, velocity and acceleration, units of measurement, law of motion, law of gravitation & numerical calculations
Vector addition of forces, addition of a system of coplanar forces: scalar &cartesian vector notation
Coplanar force resultant using law of parallelogram, triangle law, polygon law, simple case of resultant and resolution of forces in space, dot product
Three-dimensional force system, equation of equilibrium, analytical and graphical formulations, and related examples
Constraints & statical determinacy & equilibrium of two force and three force bodies
Second moment of area, principal axes and radius of gyration, work, work done by varying forces.

PHY-122 Basic Mechanics

1. To determine the areas and volumes of the given objects in different in Systems of Units

2. To determine the reaction of the simply supported beam model experimentally and analytically (2 weeks)
3. To determine the tension developed in various parts of a hanging rope loaded at a single point by experimental and analytical methods (2 weeks)
4. To determine the center of mass of various figures, cut out the wooden plank by experiment & calculations. (2 weeks)
5. To verify the principle of moment.
6. To verify law of friction between solid bodies and to find the coefficient of friction between wood and other materials.

Semester 02

HU-111L Communication Skills

Introduction to Communication Skills Lecture contents: Communication Principles, Process of communication, Importance of good communication skills in business environments, Communication in business organizations; Internal-operational, External-operational, Personal, Challenge of communication in the global market.
Study Skills: Brain storming, Time-management, Effective reading strategies, Note-taking, Organization, Summarizing.
Components of Communication: Context, Sender-Encoder, Message, Medium, Receiver-decoder, Feedback.
Non-Verbal Communication: Appearance and dress codes, Body language, Silence, time and space, Importance of listening in communication.
Functional English: Role-play/Speaking activities.
Public Speaking: Difference between speaking and writing, reading texts of good public speeches and analysis of their components, Listening to famous public speeches, Exercise in public speaking.
Formal Presentations: Difference between informal and formal presentations, Modes of formal presentation; Extemporaneous, Prepared, Reading out form a written text, Combination of the above-mentioned methods, Purpose of oral presentations; Entertain, Persuade, Inform, Sell, Mechanics of Presentations; Organization, Preparation (including A V As), Rehearsals, Presentations, Teacher shall mode presentations both, with and without A V As.
Resume/CV Writing: Cover Letters, Resumes, CVs
interview Skills.

TE-106 Construction and Pavement Materials

Material's Engineering Concepts
Aggregates (types, petrography, sources, gradations, properties etc.)
Bitumen (existence, composition, manufacturing)
Polymers/rubber, adhesives, cutbacks, emulsion, foamed bitumen, etc.
Steel (types, composition, properties etc.)
Bricks (earthing, manufacturing, dimensions, properties etc)
Portland Cement, Concrete, Admixtures
Sustainable materials: RAP, Fly ash, blast furnace slag and renewable waste.

TE-106 L Construction and Pavement Materials

1. To determine the Dimension, density, and Water Absorption of A-Class bricks
2. To determine the Crushing Strength of A-Class bricks
3. To determine the Flakiness and Elongation Index of Aggregates
4. To determine the Specific gravity of Aggregates
5. To Perform the sieve analysis on Fine and Coarse Aggregates (2 weeks)
6. To determine the Specific gravity of bitumen
7. To determine the Penetration of bitumen

8. To determine the Softening Point of bitumen
9. To determine the yield strength and Ultimate strength of deformed steel bar (2 weeks)
10. To determine the Fineness modulus of Ordinary Portland Cement

TE103 L Engineering Drawings and Graphics

1. Lettering and dimensioning, graphic symbols
2. Free hand sketches and isometric views
3. Method of sections including assembly sections
4. Orthographic projection, orthogonal projections of simple solids in simple position, oblique and auxiliary planes
5. Isometric and pictorial projections of solid figures, making of free hand sketches from solid objects and from orthographic projections. Intersection of surfaces. Development of surfaces (2 weeks)
6. Preparation of plans/profiles and sections of highways, railway, and runways (2 weeks)
7. Learn the AutoCAD Civil 3D user interface and RIBBON Commands
8. Create and edit parcels, points and group of points and print reports
9. Create and edit alignments
10. Create sites, profiles, and cross sections

Geo-E-110 Physical Geology

Introduction to various branches of geology, origin of geology, origin of earth and its place in universe, interior of earth and chemical composition of earth crust, mountain building and valley formation, drainage pattern and their types, weathering and erosion, theory of plate tectonic, earthquake and volcanism, introduction to rock and mineral occurrence of economical minerals deposits of Pakistan.

Geo-E-110 L Physical Geology

Examination and interpretation of geological maps. Logging of rock core for engineering purposes. Testing of rocks for their elastic properties. Identification of rocks and their physical properties.

IS-102 Islamic Studies/ Ethics

Course Code: IS-102
Title: Islamic Studies
Contact Hrs: 3
Credit Hrs: 3+0
For all undergraduate programs of UET in First Year

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 1042
- 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 ﷺ 1043

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

TE-105 Information and Communication Technology in Transport

Introduction to Information and communication flow system
Knowledge about the types, functioning, structure (formation), appearance and use of Information and communication technologies.
Intelligent transport system technologies and their application in transportation

Traffic signals including pedestrian signals, VMS, loop detectors, digital maps, and sensors.
ICT and ITS for all modes of transportation such as Roadways, railways, airways, and waterways.
Internet of things (IoT) and their application in Transportation systems
Information collection and storage tools
Central ICT's information (Operating System, real time information and Database Concepts)
Fundamentals of GIS, GPS and remote sensing

TE-105 L Information and Communication Technology in Transport

1. Visualize and observe all sorts of ICT and ITS technologies.
2. Recognize applications of ICT used by different transportation departments.
3. Smart cities and mobility integration; A case study of safe city Lahore.
4. Observe different installed and operational ICT and ITS technologies in Lahore.
5. Application of GPS to find location through smart phones, handheld GPS, smart phone apps to book a parking or seat in a bus/train, phone to call for Uber/Careem, plan complete trip through integrated modes. (3 weeks)
6. Overview of transportation related algorithms
7. Development of shortest path algorithm. (2 weeks)
8. Introduction to ArcGIS (2 weeks)

ME-100L Workshop Practice

Machine Shop: Detailed study of center 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. 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.

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.

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.

QT-101 Translation of the Holy Quran-I

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

10. Translation of Part (Parah) 5, second ½ portion 11. Translation of Part (Parah) 6, first ½ portion 12. Translation of Part (Parah) 6, second ½ portion 13. Translation of Part (Parah) 7, first ½ portion 14. Translation of Part (Parah) 7, second ½ portion 15. Translation of Part (Parah) 8, first ½ portion 16. Translation of Part (Parah) 8, second ½ portion
Semester 03
IS-202 Ideology and Constitution of Pakistan

Subject Title: Ideology and Constitution of Pakistan
Course Code: IS-202
Credit Hours: 3+0
Contact Hours: 3 per week
Subject Domain: General Education
Subject Knowledge: Humanities and Social Sciences

For all undergraduate programs of UET in Second Year

PART-I: Ideology and Constitution of Pakistan

Ideology of Pakistan:

- 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.

1045

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

TE-212 Mechanics of Solids

Types of stresses and strains, stress-strain behaviour of ductile and brittle materials. Statically determinate and indeterminate problems, compound bars. Temperature stresses.
Bending moment and shear force diagrams for determinate beams for general loading. Principle of superposition, relationship between load, shear force and bending moment.
Theory of simple bending, distribution of bending and shear stresses in beams of symmetrical sections. Differential equation of beam deflection and deflection of beams using the double integration, Singular Functions moment area and conjugate beam methods. Strain energy due to direct loads, shear and bending. Castiglioni's theorems and their application to find deflections and rotations.
Combined bending and axial stresses. Columns, types of columns, stability of columns, Euler and other formulae for elastic critical load, eccentrically loaded short columns.
Torsion of solid and hollow circular sections. Strain energy due to torsion and impact loads.

TE-212 L Mechanics of Solids

1. To prepare layout of Strength of Materials Lab
2. Study of small instruments
3. To perform direct shear test on plain steel bars and punching shear test on plates
4. To carry out compression test on wooden cubes when load is applied parallel and perpendicular to grains
5. To perform tension test on hot rolled deformed steel bars
6. To perform impact test on different steel samples
7. To perform bending test on wooden beam
8. To perform hardness test on given steel specimen using Rockwell hardness testing machine
9. To verify laws of shearing force and bending moment on a beam.
10. To Plot load deflection curve for a wire and hence determine the value of Elasticity.

11. To investigate the relationship between shear stress and shear strain for a rubber, to determine modulus of rigidity of the material.
12. To perform torsion test on different samples

TE-213 Surveying-II

Introduction to advanced surveying and its application. Triangulation, trilateration, field procedures and application. EDM. Strength of figure, computation and plotting
Theory of Errors and Weights, quality of observations, weighted observations, distribution and adjustment of errors. Most probable value
Tunnel Surveying: Use of gyroscope
Hydrographic Surveying: Horizontal and vertical controls, submarine surface contours. Discharge measurement, reservoir capacity calculation
Field Astronomy, Solar and stellar observations for position and azimuth determination
Photogrammetry: Introduction, definition and application of aerial and terrestrial photogrammetry.
Mapping. Introduction to Satellite Remote Sensing (SRS)

TE-213 L Surveying-II

1. To find distance between the survey stations by tachometry
2. Measurement of a base line by conventional method
3. Computation of independent coordinates of the survey station of the scheme
4. Contouring of a hill (2 weeks)
5. To find the height of an inaccessible point
6. To plot the circular curve by tangential method
7. To plot the circular curve by two theodolite methods
8. To plot the circular curve by offsets from long chord methods
9. Use of Total Station in surveying (2 weeks)
10. Use of GPS in surveying

MA-228 Differential Equation

A review of differentiation, geometrical interpretation of a derivative, infinitesimal, differential coefficient, error analysis
Derivative of higher order, indeterminate for s and L. hospital's rule, asymptotes introduction to Taylor Series
Curvature, approximation, and error estimates. The concept of limit, continuity, and differentiation in functions of several variables. Geometric interpretation of partial derivatives
Total differential. Chain rule. Implicit differentiation
Product and quotient of complex numbers in polar form. Properties of complex numbers. Logarithm of complex numbers. De Moivres Theorem
Review of matrices, determinants and inverse of a matrix. System of linear equations, Eigenvalues & Eigenvectors
Area enclosed between curves, Arc length, Volume of a solid, Volume of a solid revolution
Area of a surface of revolution, Moments, Centroids, Cartesian, Cylindrical and Spherical coordinates

EE-299 Electrical Systems for Transport Infrastructure

Brief introduction of electricity, charge, voltage, current, power, energy & battery and its types. Calculations of power & energy for electrical gadgets & households, simple billing calculations.
Electricity supply: definition & characteristics of AC & DC voltages and their currents and their applications
Resistors, colour coding of resistors and its types. Parallel and series resistance-based circuits. Use of node-voltage analysis to analyse series-parallel network of resistors

Very brief discussion on introduction to microcontrollers and their applications. Use of Arduino (or a simpler microcontroller) to control lights with desired timing. Use of various sensors to measure speed of moving objects.
Introduction to Automatic Fare Collection. Identify key elements involved in the process (central database, information etched on customer's cards, sensors to read this information, communication between these sensors and central database). Make information flow diagram.
Electricity wiring system and safety, importance of electricity safety, shock current, common sources of hazards, safe practice.
RL & RC and RLC circuit AC circuit systems, definition of single-phase and three-phase systems, voltage and current relationship b/w the circuit systems.
Electricity supply: electricity utilities & functional roles. Electricity generation sources, hydropower generation process, transmission process, distribution process to users.
Power factor: definition and relevance, active power, reactive power & apparent power
Thevenin's theorem. Maximum power transfer theorem.

EE-299 L Electrical Systems for Transport Infrastructure

1. Utilize resistor color codes to determine value of resistance. Set up a circuit with a single resistance, and measure voltage and current, and calculate power.
2. Verify voltage division rule in series circuits and current division rule in parallel circuits.
3. To measure the resistance of a series-parallel mixed circuit, and verify with theoretical calculations.
4. Introduction to Proteus (or LTSpice) for simulation of resistance-based circuits.
5. Introduction to Arduino. Blink the on-board LED light.
6. Use of Arduino to control lighting of three external LEDs to generate traffic signals.
7. Lab project: Use Arduino to measure speed of moving object, by using IR sensor to measure the time duration for which the moving object interrupts the passage of light (instructor may choose a different sensor and/or microcontroller for this purpose).
8. Lab project continued (lab project may be continued to a third week if students are unable to finish it by second week).
9. Use oscilloscope to observe sinusoidal signals. Measure amplitude and time-period. Relate amplitude with RMS value measured using DMM.
10. Simulation of single-phase and three-phase circuits in Proteus (or LTSpice). Measure amplitude, time-period and RMS value.
11. Simulation of RC, RL and RLC circuits in Proteus (or LTSpice). If time allows, also perform hardware-based measurements.
12. Introduction to 555 timer IC. Simulation in Proteus (or LTSpice) to generate desired timing signal using 555 timer IC.

QT-201 Translation of the Holy Quran-II

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

HU-212 Civics and Community Engagement

Week	Main Topic	Lecture Contents
1	Introduction to Civics and Community	a) Definitions of civics, citizenship, and civic engagement b) Historical evolution of civic participation and community development
2	Introduction to Citizenship	a) Types and characteristics of effective citizenship: active, participatory, corporate, and digital, etc. b) Attributes of a responsible citizen c) Relationships between democracy and citizenship
3+4	State, Government, and Civil Society	a) Structure and functions of government in Pakistan b) The relationship between democracy, dictatorship, and civil society c) Right to vote and importance of political participation and representation
5	Rights of Pakistani Citizens under the Constitution	Overview of fundamental rights and liberties of citizens under the Constitution of Pakistan 1973
6+7	Sustainable Development Goals, Social Issues and Media	a) Sustainable Development Goals (SDGs) b) Social issues in Pakistan c) Role of media d) Islamophobia, media, and multiculturalism
8	Assessment Week	
9	Civic Responsibilities/Duties	a) Civic responsibilities/duties (family and society)

		b) Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, and civility, etc.)
10+11	Community Engagement and Approaches to Effective Community Engagement	a) Concept, nature, and characteristics of community b) Community development and social cohesion c) Approaches to effective community engagement. d) Case studies of successful community driven initiatives
12	Advocacy and Activism	a) Public discourse and public opinion b) Role of advocacy in addressing social issues c) Protesting peacefully and effectively d) Social action movements
13	Digital Citizenship and Technology	a) The use of digital platforms for civic engagement b) Cyber ethics and responsible use of social media c) Cyberbullying d) Digital divide and disparities (access, usage, socioeconomic, geographic, etc.) and their impact on citizenship
14	Environment and Society	Climate action
15	Diversity Inclusion and Social Justice	a) Understanding diversity in society (ethnic, cultural, economic, and political, etc.) b) Children's rights, safety, and literacy c) Youth, women, and minority engagement in social development d) Animal rights e) Addressing social inequalities and injustices in Pakistan f) Promoting inclusive citizenship and equal rights for societal harmony and peaceful co-existence

Semester 04

TE-203 Geotechnical Engineering-I

Introduction: Importance of mechanics of soils in Transportation Engineering, Difficulties in predicting the behaviour of soils as a construction and load bearing material, Formation and type of soils.
Index Properties of Soil: Phase diagrams of soil, Phase relations of soil: water content, void ratio, porosity, degree of saturation, air content, percentage air voids, unit weights and specific gravity, Weight-Volume relationships and their derivations, Consistency of soils, States of consistency and Atterberg's limits, Determination of Atterberg's limits and consistency indices, Grain Size distribution of soils: particle size distribution curves, sieve analysis, Stoke's law, hydrometer analysis.
Soil Classification: Particle size classification systems, AASHTO classification system, Unified soil classification system, Identification and classification of expansive soils, Collapsible and dispersion soils
Geotechnical Investigation: Soil exploration, purpose and methods of soil exploration. Probing, test trenches and pits, auger boring, wash boring, rotary drilling, and geophysical methods, soil samplers, disturbed and undisturbed samples. Introductions to geotechnical report writing.
Permeability of Soil: Permeability, Darcy's law, Factors affecting permeability, Permeability of stratified soils, Laboratory and field determination of permeability. Capillary and its effects
Seepage in Soils: Seepage, Hydraulic potential, Hydraulic gradient, and seepage pressure, Quick sand condition and critical hydraulic gradients, Sand boiling, Liquefaction, Piping. Filters Introduction to Flow nets.
Compaction: Definition, compaction fundamentals, Moisture-Density relationship, Laboratory compaction methods: standard and modified Proctor tests, Factors affecting compaction, measurements of in-situ density.
Consolidation: Settlement and its types, Consolidation and its importance, Mechanics of consolidation, Spring water analogy, Theory of one-dimensional consolidation: assumptions and validity, Laboratory consolidation tests, Graphical representation of data, Compression index, Coefficient of compressibility, Time factor, Calculation of voids ratio and coefficient of volume change, Degree of consolidation, Primary and secondary consolidation, Normally and pre-consolidated clays, Determination of pre-consolidation pressure and over consolidation ratio.

TE-203 L Geotechnical Engineering-I

1. To determine moisture content of a given soil sample by Oven drying method
2. To determine moisture content of a given soil sample by Speedy moisture meter (CED)
3. To determine specific gravity of a given soil sample
4. To perform grain size analysis of a given soil sample using nest of sieves
5. To perform grain size analysis of a given soil sample using hydrometer
6. To determine liquid limit of a given soil sample
7. To determine plastic limit of a given soil sample
8. To determine shrinkage limit of a given soil sample
9. To determine in-situ density of a soil deposit using core cutter
10. To determine in-situ density of a soil deposit using sand cone apparatus
11. To determine lab density of a given soil sample by standard compaction test
12. To determine lab density of a given soil sample by modified compaction test
13. To determine permeability of given soil sample by constant head method
14. To determine permeability of given soil sample by variable head method
15. To perform consolidation test on a given soil sample

MA-346 Numerical Method

- Basic concepts: round-off errors, floating point arithmetic, Convergence.

- Solution of non-linear equations: Iteration, bracketing methods for locating roots, initial approximation and convergence criteria, Newton Raphson and Secant methods.

- Solution of linear simultaneous equations: Jacobi's method; Gauss-Seidle method;

- Finite differences: Difference operators and their tables; Differences of polynomials;

- Interpolation and polynomial approximation: Taylor series approximation, introduction to interpolation, construction of polynomials using Newton's forward and backward differences, Lagrange's polynomial for unequally spaced data, Chebyshev polynomials.

- Curve fitting: Least squares line, curve fitting, interpolation by spline functions.

- Numerical differentiation: approximating the derivative.

- Numerical integration: Introduction to quadrature, trapezoidal, composite trapezoidal, 1/3 and 3/8 Simpson's rules.

- Solution of differential equations: Taylor series method, Euler's methods, Runge Kutta methods.

- Solution of partial differential equations: Hyperbolic Equations, Parabolic Equations, Elliptic equations.

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.

5. "A First Course in Numerical Analysis with FORTRAN and C." by Saeed Akhtar Bhatti.

HU-200 Technical Report Writing

Week	Main Topic	Contents
1	**Introduction to Technical Communication**	A. Analyzing: 1. Audience 2. Objective 3. Format 4. Style 5. Occasion B. Characteristics of technical writing C. Writing that works: Accuracy, accessibility, and readability (format specifications)
2+3	**Making Writing Effective** **Understanding the Writing and Proofreading Process**	A. Achieving parallelism in writing B. Grammar, spelling, and punctuation C. Editing and proofreading in the writing process D. Elements of clear writing 1. Directness 2. Brevity 3. Sentence structure 4. Sentence length 5. Specific and concrete words 6. Coherence and cohesion E. Pitfalls to avoid 1. Hackneyed phrases 2. Slang 3. E-language 4. Passive voice 5. Sexist language

		6. Sentence structure: Avoiding run on, comma splice and fragment errors (sample sentences from technical documents) 7. Avoiding common errors causing ambiguity in technical writing (redundancy, verbiage, and word choice) 8. Dangling participles
4	**Paragraph Writing**	A. Writing technical paragraphs: composing topic statements, supporting details, and concluding statements B. Different types of technical paragraphs and use of transition signals C. Exercises and class activities
5+6+7	**Business Correspondence and Employability Skills** **Writing Practice**	A. Emails B. Minutes of the meeting C. Memorandums D. Business letters E. Cover letters F. Résumé/ CV G. E-portfolio
8	**Writing Technical Reports**	A. Writing technical definitions B. Writing technical descriptions and specifications C. Writing technical instructions D. Writing product reviews
	Midterm Exam	
10+11+12	**Introduction to Research Writing and Report Writing**	A. Different types of reports 1. Proposals 2. Feasibility reports 3. Research reports 4. Inspection reports 5. Progress reports 6. Field visit reports 7. Material testing reports 8. 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, reading material, and writing practice
13	**Writing Reports**	A. Using and Describing Graphics (Tables, Graphs, Images) B. Avoiding Plagiarism C. Reference Styles: APA, MLA, IEEE D. In-text Citation E. IEEE reference style guide and EndNote
14	**Publishing and Presenting Reports**	A. Writing and publishing research articles B. Presenting reports/posters at conferences
15+16	**Report Defence**	Presentation of Reports

Mgt-105 Introduction to Economics

Basic Principles of Economics; Scarcity and Choice; Microeconomics Versus Macroeconomics; Market Forces of Demand and Supply; Price Elasticity; Production Function and Costs of Production;

Theory of Consumer Behavior; Theory of Firm and Market Structure: Competitive Market; Monopoly; Measuring a Nations' Income; Production and Growth; The Markets for the Factors of Production (Labor Market); Supply Side Vs Demand Side Policies; Economic Cycles; Inflation Policy Measure to Tackle Inflation; Balance of Payment; The Influence of Monetary and Fiscal Policy.

Recommended Books:

• Mankiw. N.G., (2017). Principles Of Macroeconomics (8th Edition). Cengage
• Froyen, R.T., (2022). Macroeconomics, Theories and Policies (10th Edition), Pearson.
• Schiller. R. B., (2015). The Macro Economy Today (14th Edition), Mcgraw Hill.

TE-206 Traffic Engineering - I

Introduction to Traffic Engineering
Road User and Vehicle Characteristics
Traffic Data Collection and Reduction Methodologies
Volume Studies and Characteristics
Speed, Travel Time, and Delay Studies
Highway Traffic Safety: Studies, Statistics, and Programs
Traffic signage and its design
Road markings, theory, and practices
Concept of Traffic Round about
Parking studies
Traffic Calming Techniques
Conflicts and road accident
Road Safety audits
Intelligent Transportation System (ITS)

TE-206 L Traffic Engineering - I

1. OD Survey and graphical presentation of the data (3 weeks)
2. Determining the retroreflection of sign sheeting
3. Determining the Traffic volume at a junction and presenting the data (2 weeks)
4. Measuring the spot speed, time mean speed and space mean speed of vehicles (2 weeks)
5. Testing Road Marking Materials
6. Intelligent Transportation System (ITS) using GIS; Vehicle Tracking System, Vehicle Navigation System, Car following analysis, GIS in trip reporting, Traffic control and routing (3 weeks)

TE-208 Automotive Engineering

Workshop Safety
Environmental and Hazardous Materials
Fasteners and Thread Repair
Hand Tools
Power Tools and Shop Equipment
Vehicle Lifting and Hoisting
Measuring Systems and Tools
Service Information
Gasoline, Alternative Fuels, and Diesel Fuels
Diesel Engine Operation and Diagnosis
Coolant
Cooling System Operation and Diagnosis
Engine Oil
Lubrication System Operation and Diagnosis
Engine Starting and Charging Systems
Ignition System Operation and Diagnosis

Emission Control Devices Operation and Diagnosis
Turbocharging and Supercharging
Engine Condition Diagnosis
In-Vehicle Engine Service
Engine Removal and Disassembly
Engine Cleaning and Crack Detection
Cylinder Head and Valve Guide Service
Valve and Seat Service
Camshafts and Valve Trains
Engine Blocks
Crankshafts, Balance Shafts, and Bearings
Gaskets and Sealants
Balancing and Blueprinting
Engine Assembly and Dynamometer Testing
Engine Installation and Break-In

TE-208 L Automotive Engineering

1. Vehicle Identification and Emission Ratings
2. To study the gasoline engine operation
3. To study engine blocks, cylinders, and valves
4. To study different types of gasoline engine models
5. Engine size measurement and conversion
6. To study the diesel engine operation
7. To study the working of diesel injectors
8. To study the working mechanism of turbocharged diesel engine
9. To study the working mechanism of cooling system
10. Gasoline Engine Operation, Parts, and Specifications
11. Pistons, Rings, and Connection Rods
12. To study the operation of coolant pump
13. To study the operation of coolant exchange machine
14. To study the operation of lubrication system
15. To study the working of oil pump
16. To study the working mechanism of intake and exhaust system
17. To study the braking system

Semester 05
MA-343 Applied Probability and Statistics Frequency distribution. Mean, Median, Mode and other measures of central tendency. Standard deviation and other measures of dispersion, C oefficient of dispersion. Random experiments; Sample space; Definition of probability; Addition and product rules of probability; Bayer's theorem. Discrete and continuous random variables; Discrete and continuous probability distributions. Simple random processes and their probability distributions. Approximation and application of normal distribution in Engineering. Central limit theorem; Simulation of random variables; Markov processes. Methods of least squares, Curve fitting, Linear Regression.
EnE-307 Environmental Engineering Introduction to the environmental Engineering. Water consumption for various purposes, Estimation demands for water supply, variation in demand. Fire demand. Forecasting population. Water distribution system. Use of Hazen William formula for design purpose. Distribution network design service Reservoirs. Different types of pipes and pipe material. Pipe joints, service connection, valves and other appurtenances. Water survey: tracing leakages. Relationship of sewerage and water supply system. Sewerage System Quantity and quality of sanitary sewage. Storm sewage. Sewer hydraulics. Design of sewer system: Material and construction of sewers. Sewer appurtenances and sewage pumping. Air Pollution, Air Pollutants and Meteorological Conditions affecting Air pollution, atmospheric Dispersion Model, Vehicular Air Pollutions. Noise Pollution, Sound Power, Sound levels, Sound Intensity, Ambient Noise Standards, Noise Level During Festivals. Sampling and Analysis of Air and Water Pollutants, Water Pollution Control, Preliminary and Primary Treatment Processes, Biological Treatment, Drinking Water treatment.
EnE-307 L Environmental Engineering 1. To familiarize with laboratory equipment and lab configuration 2. Sterilization and disinfection of lab equipment by Autoclave 3. To determine the physical properties (Color, Taste and Odor) of water by visual inspection 4. To determine the physical properties of water by using pH meter and turbidity meter 5. To determine physical parameters of water by using Electric conductivity meter and TDS meter 6. To determine total hardness, magnesium hardness and calcium hardness of given water samples by EDTA titration method 7. To estimate the microbiological contamination (coliform) in water sample by using Paqualab 8. To estimate the fecal coliform in ground and surface water sample by using Paqualab

TE-314 Railway Engineering - I

Introduction to Railways and History of Rail
Rail Resistances
Railway Gauge
Railway Ballast
Rail Fastenings
Railway Switches
Rolling Stock
Station Layout
Railway Ticketing System
Railway Signals
Electric and Magnetic Levitation Trains
Train Dynamics and Energy electrification
Rail systems integration
Train control systems
Rolling Resistance
Railway Infrastructure, Rolling stock and Crew Management

TE-315 Pavement Analysis and Design

Introduction to pavement
Pavement design philosophy
Principle of pavement design
Pavement design methodologies
Traffic Loading and Volume.
Mechanistic and Empirical Design of pavements
Stresses, Strains and deflection analysis in Pavements.
Design of Overlays
Bituminous Material Characterization (Rheology)
Asphalt mixtures (HMA/SMA)
Asphalt Plant Operations
Reclaimed Asphalt Pavement (RAP)

TE-315 L Pavement Analysis and Design

1. Determination of Flash and Fire Point of asphalt binder
2. Determination of Ductility of Asphalt binder
3. Asphalt Mixtures Design Using Marshall Method (3 weeks)
4. Asphalt Mixtures Design Using Superpave Method (3 weeks)
5. Determination of Viscosity using Rotational Viscometer
6. Determination of Stiffness using Bending Beam Rheometer

Use of rolling Thin Film Oven and Pressure Aging Vessel to determine Binder Aging (2 weeks)

TE-318 Waterway Transportation

Water as a mode of transportation
Difference between Ocean and Sea
Natural Phenomena: Wind, Wave, Cyclones and Coriolis effect
Tides and its types: Spring vs Neap
Nautical Mile, Knot, Latitude and Longitude
Beaufort Scale
Concepts of Water Buoyancy, Density, Mass, Volume and Salinity
Ships: Key Parts/Components, Types

Harbors, Ports and Docks: Definitions and Types
Breakwaters
Locks
Channel, Basin and Births
Appurtenances of a Harbour
Dredging/Dredgers and Disposals
Navigational Aids
Shore Protection Works
Cofferdams and Caissons

TE-324 Structural Analysis

Introduction to structures and analysis. Types of structures, structural idealization, and loads. Redundancy and stability of structures.
Analysis of Determinate in Jointed Structures: by method of joints, method of sections, method of moment and shears and graphical method.
Analysis of Statically Determinate Rigid Jointed Plane Frames: Shear force, bending moment and axial force diagrams for these structures.
Moving Loads: Influence lines for reactions, shear force and bending moment in statically determinate beams and panelled girders, influence lines for member forces in pin jointed frames. Calculation of maximum stress function (reaction, shear bending moment, axial force) in these structures.
Three Hinged Arches. Cables and Suspension Bridges: Basic considerations in analysis and design. Moving loads on three hinged arches and suspension bridge.
Moment Distribution Method.

TE-324 L Structural Analysis

1. To Determine the Reactions of Simply Supported Beam Under Various Loading
2. To Determine the Forces in Three Members of a Roof Truss
3. To determine the elastic critical load of metal column for different end condition.
4. Installation of ETABS and introduction to user interface, working environment and basic commands
5. How to create new model with different specification
6. How to define material, section properties, section modifiers, diaphragm, and mass source
7. Introduction to different types of loads, cases, combination according to different codes
8. How to assign Restrains, diaphragms, section properties and different types of loads
9. How to check the final model for analysis, analyze the model, interpret the results from analysis like reaction, shear force diagram and torsion etc.
10. Introduction to the design of frames of concrete and steel with the specification of ACI and AISC, respectively
11. How to design different types of structure
12. Introduction to the tools available for the detailing of the drawing for different types of structure.

How to make final structural drawings with different specifications

QT-301 Translation of the Holy Quran-III

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

Semester 06
Mgt-316-A Professional Ethics and Engineering Entrepreneurship Morals and ethics, comparison of ethics and engineering ethics, ethics at personal and student level, The concept of professions, The importance of ethics in science and engineering, The role of codes of ethics, Professional responsibilities of engineers, The concept of morality, The importance of core values, Moral/ethical dilemmas and hierarchy of moral values, Factors affecting moral responsibility, and degrees of responsibility, Overview of ethical theories and applications, Basics of ethical analyses and decision-making, The importance if intention, Truth (personal and social), The concept of whistleblowing, Ethical leadership in engineering and society, Conflicts of interests, Ethics in the workplace, Fairness (personal and social), Ethics in the electronic and digital age, Responsible conduct of research, Intellectual property and society, Sustainable engineering Evolution of the concept of entrepreneur, Characteristics of an entrepreneur, Distinction between an entrepreneur and a Manager, Economic Development, Factors affecting entrepreneurial growth (economic, Non-Economic and Government factors), Critical factors for starting a new enterprise. Ingredients for a successful new business. Self-assessment and feedback, Personal entrepreneurial competencies. Goal setting. Creativity and sources of new business ideas, the difference between ideas and opportunity and creativity. Assessing business opportunities in Pakistan. Screening and evaluating opportunities Product planning and development process. Creating parallel competition by developing a similar product or service, Product life cycle, finding sponsorship. Acquiring a going concern, E-Commerce and business start-up and growth. Marketing as a philosophy, marketing management: Creating a marketing plan, Analyze the environmental situation and the market opportunity, setting marketing objective, formulating a marketing strategy. The business plan as selling document, reasons for writing a business plan your company.
TE-316 Geometric Design for Transportation Facilities

Elements of Highway Cross Section
Factors Affecting Selection of Highway Route
Transferring Topographic Data to Computers
Alignment and Profile of Highways
Design Controls and Guidelines
Basic Freeway Segments and Multilane Highways
Two-Lane Highways
Capacity and level of service
Elements of Intersection Design and Layout
Intersection Design Objectives and Considerations
A Basic Starting Point: Sizing the Intersection
Signing and Marking for Freeways and The Intersection
Geometric Design of off-street and on street Parking

TE-316 L Geometric Design for Transportation Facilities

1. To design and draw Horizontal Curve at any section on a highway (2 weeks)
2. To design and draw vertical Curve at any section on a highway (2 weeks)
3. Design of an alternate route alignment using 3D Civil
4. To complete a Plan and Profile of Roads using Civil 3D
5. Design of a Typical Round-about (2 weeks)
6. Topographic Survey and Contouring for Highways (2 weeks)

Design of Parking lot (2 weeks)

TE-327 Transportation Planning

Relation among socio-economic, land use and integrated-transportation systems.
National, regional, and local development plans for integrated-road, railways, water and airways facilities.
Nature, types, and purposes of planning surveys. Techniques for conducting various planning surveys such as land use, socio-economic and housing, health, education, industry, commerce, facility, and services.
Role of integrated-public transport in urban development. Basic components of public transport service.
Public transportation system performance: capacity, productivity, operation, efficiency, and utilization.
Regulations of public transport. General principles of route planning. Route location, stop location. Formation of route, schedules, vehicle and labor schedules. Route evaluation. Control of operations. Fare system and structures. Vehicle operating costs estimation. Measures to assist efficient operation of urban/public transport.
Transportation Planning Process: Travel Demand Forecasting, including trip generation, trip distribution, modal split, and network assignment.
Planning Law: Legislation relating to city and regional planning in Pakistan including various acts, orders, ordinances, and bylaws concerning Area Development Schemes, Land Acquisition, Housing, Building Control, Transport, and Environmental Protection. BRT, MRTS, MBA etc.
Transportation planning related software like; VIPER, CUBE, TRANPLAN, TRASCAD, SIDRA,

TRIPS etc.

TE-329 Pipeway Engineering

Introduction to Pipeline Systems
Piping and Piping Components
Geotechnical Investigation for pipeline systems,
Hydraulic Design and Mechanical Design

Pipeline Construction
Operation and Maintenance of piping system
Stress Analysis for Pipelines
Pressure Design of Piping System
Two-Phase and Arctic Pipeline Design

TE-312 Traffic Engineering - II

Fundamental Concepts for Uninterrupted Flow Facilities
Basic Freeway Segments and Multilane Highways Intersection Channelization
Basic Principles of Intersection Signalization
Design: Pre-timed Signals
Actuated Signals
Analysis of Signalized Intersections
Synchronization of traffic signals
Intelligent Transportation Systems in Support of Traffic Management and Control
Signal Coordination for Arterials and Networks: Under saturated Conditions
Signal Coordination for Arterials and Networks: Oversaturated Conditions
Analysis of Streets in a Multimodal Context
Planning, Design, and Operation of Streets
Traffic Impact Analysis
Microsimulation
Queuing theory
Route assignment
Study of delays and congestions
Applications of Geomatics Engineering in Transportation

TE-312 L Traffic Engineering - II

1. Determination of Level of Service (3 weeks)
2. Design of Signalized Intersection (3 weeks)
3. Optimization of Traffic Control (2 weeks)
4. Synchronization of traffic signals in an urban area and determining delay.
5. To determine the time space diagram for junctions
6. Multimodal demand modelling, traffic-related optimization using VISSUM (2 weeks)

TE-311 Geotechnical Engineering - II

Shear Strength: Concept, Shear strength parameters of soils, shear strength of cohesive and cohesion less soils, Mohr-Coulomb failure criterion, Laboratory measurement of shear strength parameters: shear box test, unconfined compression test, vane shear test and tri-axial shear test. Factors affecting shear strength of soil and its applications in engineering.
Stress Distribution in Soils: Geo-static stresses, Total stress and pore pressure, Effective stress, Vertical stresses induced due to structural loads; Westergaurd 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, Immediate settlement of cohesive and non-cohesive soils, Causes of settlements and methods of controlling settlement, Limits of allowable total and differential settlement.

Earth Pressure: Definition, pressure at rest, active and passive earth pressures, Coulomb's and Rankin's theories. Trial wedge and Culmann's method. Earth pressure diagrams for different configurations loading.
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.
Introduction to various Soil Improvement Techniques; Chemical stabilization, Mechanical Stabilization, Soil reinforcement
Introduction to Bearing Capacity of Soils: Definition of ultimate and safe bearing capacities, allowable bearing capacity, gross and net bearing capacities, Presumptive values from codes (merits and demerits), Plate load test, Brief of Bearing capacity theories,
Introduction to Foundation Engineering: Shallow and Deep Foundations.

TE-311 L Geotechnical Engineering - II

1. To perform Standard Penetration Test (SPT) in the field and collect soil samples
2. To classify the collected soil samples
3. To perform unconfined compression test on the collected soil samples
4. To perform direct shear test on the collected soil samples
5. To perform consolidation test on the collected soil samples
6. To perform tri-axial compression test on the collected soil samples
7. To determine bearing capacity and settlement using SPT and laboratory data
8. To perform CBR test on a given soil sample
9. To perform field CBR test in the field
10. Preparation of samples of raw and improved soils (using lime, cement, and bitumen) for conducting unconfined compression test
11. To perform unconfined compression test (7 days)
12. To perform unconfined compression test (14 days)
13. To perform unconfined compression test (21 days)
14. To perform unconfined compression test (28 days)

To perform CBR test on improved soils (using lime, cement and bitumen)

Semester 07

TE-401 Bridge and Tunnel for Transportation Engineering

1. Highway and railway bridge structures and components
2. Project inception, funding and design standards
3. Bridge inspection and site survey
4. Geotechnical investigation for bridge structures
5. Design loads, internal forces and load distributions
6. Design methods and Load rating
7. Managing the design process
8. Contract documents
9. Bridge management systems

Tunnel

1. Definition, purpose and Classification of Tunnels
2. Geotechnical Investigation for tunnels, Analysis and Design of tunnels, Alignment of Tunnels Drilling
3. Blasting
4. Tunneling; Shafts
5. Ventilation, lighting and Drainage of Tunnels
6. Tunnel Lining

7. Safety in Tunnels

Case Histories

TE-423 Airport Engineering

Layout of Components of Airport (Runway, Taxiway, Apron, Hanger, Terminal Building)
Runway Orientation
Design of Runways and Taxiways
Geometric and Structural Design of Airside Pavements
Design of Runway Drainage Systems
Design of Ground Access and Parking
Design and Operation of Passenger Terminal Area
Design of Aircraft Movement System
Design of Hangers and Apron

TE-424 Pavement Drainage system and Design

Components of Pavement drainage system.
Planning, design and estimation of drainage system.
- Flow of water through soil
- Quantity and rate of sub-surface flow
- Permeability of soil

Drainage problems in road sections and its effects.
Evaluation and analysis of highway drainage system.
Rehabilitation of existing surface drainage system.
Sub-surface drainage structures and maintenance
Use of drainage layers, filters, separation layers and geotextiles
Sustainable drainage
Modeling Variably Saturated Flow
Mn Drain system (different segments)
Drainage design using DRIP software

TE-424 L Pavement Drainage system and Design

1. Study of drainage materials; aggregate, geotextiles and subgrade materials
2. Preparation of filter materials
3. Design of filter materials for pavement structure; Aggregate
4. Design of filter materials for pavement structure; Geotextile
5. Design of filter materials for pavement structure; Pipes
6. Estimation of Inflows; surface infiltration
7. Estimation of Inflows; groundwater seepage
8. Estimation of Inflows; meltwater of ice lenses
9. Estimation of total Inflows; design inflow
10. Determination of drainage capacity; steady state flow
11. Determination of drainage capacity; unsteady state flow
12. Study of different type of pipes used for pavement system
13. Design of drainage system

TE-433 Plain and Reinforced Concrete

Plain Concrete: Constituent materials of concrete and their properties. Hydration of cement. Properties of fresh and hardened concrete and factors affecting them. Curing of concrete and its significance. Testing of concrete for various properties including physical tests, strength tests. Crushing or ultimate strain. Modulus of elasticity of concrete: types, tests, determination, and significance. Design of normal concrete mixes, factors affecting the workability of the fresh and strength and durability of the hardened

concrete. Alkali aggregate reaction, carbonation, and sulfate attack. Additives and admixtures for concrete. Cracks in concrete.

Mechanics of Reinforced Concrete: Basics of composite action of steel and concrete. Stress-strain curves of steel and concrete. Actual, simplified, and equivalent stress blocks.

Behavior of reinforced concrete members including columns, beams, and slabs at working and ultimate loads. Specifications, codes of practice and design loads.

Analysis design and detailing of: Simply supported rectangular and T-beams by ultimate strength design method, simply supported and continuous one way and two-way slabs. Reinforced concrete members for axial compression and tension. ACI Code provisions for design of columns. Shear and diagonal tension in concrete, design and detailing of flexural members for shear. Design of Continuous beam.

TE-433 L Plain and Reinforced Concrete

1. Standard test method for the determination of the normal consistency of the hydraulic cement
2. Standard test method for the determination of the initial and final setting time of the hydraulic cement by Vicat needle apparatus.
3. Determination of the compressive strength of hydraulic cement mortars
4. Determination of the fineness modulus of the coarse and fine aggregate from different sources.
5. Standard test method for the determination of bulk density (i.e., unit weight and the voids in aggregates)
6. Standard test method for the determination of relative density (specific gravity) and water absorption of different aggregates
7. Determination of the aggregate impact value of different coarse aggregate samples.
8. Preparing a concrete-mix and casting various samples required for different tests.
9. Standard test method for the slump of hydraulic cement concrete.
10. To perform the compacting factor test.
11. Test method for the compressive strength of cylindrical & cubical concrete specimens.
12. Test method for the flexural strength of concrete using simple beam with third-point loading
13. Standard test method for the determination of the splitting tensile strength of cylindrical concrete specimen.

Determination of the tensile strength of concrete by double punch test. (non-standard test)

TE-425 Ports and Harbour Management

Introduction: Modern trends in Water Transportation, Elements of Water Transportation, Water Transportation Planning Environmental. Impact Statement (EIS) Port Authorities, Bodies and Associations

Ports and Harbours: Requirements of a Good Port, Ports Development, Definitions, Harbours, Requirements of a Harbour its Classification Based on Utility and Location, Harbour Site Investigation and Site Analysis Marine Surveys, Topographic Survey of Marine Area,

Design of Ports and Harbours: Design criteria, Selection of Site and Planning of Harbours and ports, Location of Harbour or ports, Planning a Harbour or ports, Ship Characteristics -- Considerations in Harbour/ports design, i.e., size, depth, entrance.

Harbour Works: Breakwaters, Types of Breakwaters, Composite Breakwater, Vertical Wall Breakwaters, Jetty, Dock Fenders, Classification of Fenders, Piers, Wharves, Dolphins, Trestle Moles, Mooring Accessories and Off-shore Moorings.

Docks and repair facilities: Harbour Docks, Uses of Wet Docks, Design of Wet Docks, Repair Docks, Marine Railways, Lift Docks, Graving or Dry Docks, Masonry Dry Dock, Keel and Bilge Blocking, Timber Graving Docks, Construction of Dry Docks, Gates for Graving Docks, Pumping Plant, Floating Docks, Slipways.

Port Facilities: Port Development, Port Planning, Port Building Facilities, Transit Sheds, Warehouses, Other Port Facilities, Cargo Handling Facilities, Bulk Cargo Handling Facilities, Container Handling Terminal Facilities, Cargo Carriers, Container Terminal Planning, Marinas, Services for Shipping Terminals, Inland Port Facilities Planning.

Ports and Harbours Management: Port management information system (PMIS), data collection and forecasting, stakeholder relations management in ports, and the evaluation of port development plans and projects.

Transportation Informatics in Ports and Harbours

Coastal Protection: Sea Wall, Revetment, Bulkhead, Cathodic Protection

QT-401 Translation of the Holy Quran

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
Mid Semester Exam
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

Semester 08

TE-427 Project Management

Project Planning
Project Costing and Budgeting Review
Critical Path Method
Project Monitoring
Project Control
Project Completion
Project Crashing
Resource Management
Type of Contracts and contract documents
Implementation of contract documents
PPRA Rules and Regulations
Estimating and tendering for construction works

QM Software Application
Primavera Project Management P6 R 8.3 or later
Estimating and tendering for construction works, By Martin Brook, 5th edition
Civil Engineering Contracts and Contract Documents, By Ivor H. Seeley.
Manual of Contract Documents for Highway Works, By Bill Money and Geoff Hodgson

TE-438 Pavement Evaluation and Rehabilitation

Introduction to Pavement evaluation techniques
Pavement Management system
Introduction to Asset Management; The Challenge of Managing Transportation Assets; Key issues; Related Terminologies;
Pavement Distresses, identification tools and rating
Pavement Evaluation Mechanism and modern tools
Pavement Rehabilitation and Maintenance
Pavement Maintenance Process
Non-destructive testing, equipment and data analysis
Highway construction, Operations and Machinery
Overlay design by AASHTO design procedure
Use of GIS in Pavement evaluation and Rehabilitation

TE-438 L Pavement Evaluation and Rehabilitation

1. Back calculation of net structural number using a software (2 weeks)
2. Determination of Serviceability Index or Condition Index of in-service pavement (2 weeks)
3. Measuring the riding quality of a pavement (PI or IRI)
4. Measuring the surface roughness index using British Pendulum number
5. Determination of Shear Modulus using dynamic Shear Rheometer
6. Determination of rutting resistance of asphalt mixtures
7. Determination of fatigue resistance of asphalt mixtures
8. Evaluation of laboratory compaction through gyratory compactor
9. Comparison of Marshall and gyratory prepared samples and its properties (3 weeks)

TE-439 Sea Freight and Logistics

Layouts of Harbours and Ports
Types of freight for different modes
Sea Freight and Logistics: Definitions, Historical Background and Importance in Transportation
Intermodal Containerization
Twenty-foot & Forty-foot Equivalent Units (TEUs and FEUs)
Types of Intermodal Containers
Dimensions and Types of Freight Containers
Global Sea Freight Routes
Energy Efficiency – Comparison with other modes
Emissions – Comparison with other modes
Types of cranes to handle freight
Apron, Transit Sheds and Ware Houses
Container Terminals
Capacity to handle freight
Supply Chain in Waterway Logistics

TE-429 Railway Engineering - II

Railway Transportation System
Railway Transportation System
Week 3 Railroad track design and maintenance
Railroad track design and maintenance
Railroad track design and maintenance
Railway Construction management
Railway Construction management

Rail car and locomotive design and maintenance
Advance Railway signaling
Railroad transportation logistics
Railroad transportation logistics
Network planning and operations
Concept of Tramway, Metro and Monorail
Suburban railway
Highspeed trains, system and operations
Railway safety

TE-449 Transportation Informatics

Intelligent Transportation system and their applications
Intelligent solutions and transportation
Programming fundamentals and data Structures
Big data management and Analysis in transportation
Control theory for transportation engineering
Cloud computing
Knowledge discovery in databases
Design of intelligent system
Machine learning
Expert system and knowledge management

TE-449 L Transportation Informatics

1. Study of informatics (how to use data, information, and knowledge for improvement) of Railways. 2 weeks
2. Study of informatics (how to use data, information, and knowledge for improvement) of Airways 2 weeks
3. Study of informatics (how to use data, information, and knowledge for improvement) of Roadways 2 weeks
4. Study of informatics (how to use data, information, and knowledge for improvement) of Waterways 2 weeks
5. Visit of control rooms Railways (Orange line) 1 week
6. Visit of control rooms Road's ways (Metro) 1 week
7. Visit to Safe City 1 week
8. Case study; to apply ITS systems to solve real world problem. 4 weeks

TE-428L Occupational Health and Safety

Module-1

Develop an OHS Policy for an organisation

Theoretical Background:

Health and safety foundations: Reasons/benefits and barriers for good practices of health and safety, Elements of OHS Management System

Module-2

Devise strategies for promoting positive health and safety culture at workplace

Theoretical Background:

Fostering a safety culture: Four principles of safety- RAMP, Safety ethics and rules, Roles and responsibilities towards safety and security, Building positive attitude towards safety, Safety/security cultures in academic institutions and chemical industry

Module-3-4

a) Identify and communicate the hazards at various workplace

Theoretical Background:

Recognizing and communicating hazards: Hazards and Risk, Types of hazards:, Hazard identification techniques

Finding hazard information: Material safety data sheets, safety data sheets and The GHS

- Module-5

Design Safety Posters and Signs for a workplace

Theoretical Background:

Learning the language of safety/security: Signs, symbols and labels

Module-6-7-8

1. Carry out the Area OH&S Risk Assessment and suggest risk control measures.
2. Carry out the Task/Activity Risk Assessment and develop a safe system of work
3. Carry out the fire risk assessment

Theoretical Background:

Assessing and Minimizing the Risks from Hazards: Risk Concept and Terminology,

Risk assessment procedure, Risk Metric's, Risk Estimation and Acceptability Criteria, Principles of risk prevention, Selection and implementation of appropriate Risk controls, Hierarchy of controls

Module-9

Develop the emergency response plan for Fire and Carry out the Fire Drill.

Theoretical Background:

Fundamentals of Fire, Preparing for Emergency Response: Fire, Chemical Spill, First Aid

Module-10

Conduct the laboratory safety Inspection and give recommendations based on 5-S method

Theoretical Background:

Chemical Management: Inspections, storage, wastes and security, Electrical Safety, Housekeeping, Work Equipment Safety Monitoring, Review and Auditing Health and Safety