B.Sc. Transportation Engineering Program

Course Outline Session 2021-2023

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-101 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 Engineering 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 L Engineering 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.

QT-101 Translation of the Holy Quran-I

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

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

TE-104 Introduction to Airport Engineering

Introduction to Airport Engineering: Planning, Design, and Management.
Regulatory Bodies and International Organizations
Introduction of airport components and aircraft characteristics
Types of Airports (Financing, Pricing and Demand Management)
Airport Site Characteristics,
Air Traffic Control
Analysis of Environmental Impact on Aircraft Operations
Management of Congestion and Queues
Airport Capacity and Configuration (Influence of Weather, Aircraft Mix and Other Operational Parameters on Capacity)
Delays at an Airport considering Supply and Demand Factors
Economic benefits and impacts of airports in the community

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-101 Islamic & Pak Studies – I

Islamic Studies

Islam and basic beliefs; Qualities of believers, Tawheed Fundamentals and types, Prophet-hood and its finality, The Day of Judgment, Characteristics of Ibad-ur-Rehman, Importance of intention (Niyya) in

human actions, Islam, Iman (belief), Ihsan (excellence) and the Hour, Sincerity to Allah, His Books, His Messengers, leaders of the Muslims and common people (Slaves of Allah)
Islamic teachings regarding social behavior; Etiquettes regarding seeking knowledge, Importance of good talk and silence, Prevention from inventing a lie, Brotherhood, Efforts 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 and suspicion etc., Backbiting. Importance of modesty (Al-Haya), Good behavior towards people, Fair speaking to the people, To control anger, Ihsan (excellence) with regards to everything
Prophetic life as a role model; Life of The Holy Prophet (Peace be
upon him) from prophet-hood to Hijra, Difficulties in preaching Islam in Makka and opposition of Quresh, Reasons of hijra (migration) to
Madina and impact of this migration.
History of the Holy Qur'ān; Revelation, Compilation, Significance.
Importance of hadith; Definition, Importance, Authenticity
Prophetic ethical behaviors; Significance of moral values in the light of the life of the Holy Prophet peace be upon him: Tolerance, Patience, Endurance, Generosity, Honesty
Islamic teachings regarding social behavior; Stress on fulfillment of uqud (obligations) and Sanctity of religious symbols
Islam and Halal & haram; Concept of Halal (lawful) and haram
(forbidden) in Islam, Halal and haram animals and food, Rules of hunting the animals for food, Lawful, unlawful and doubtful matters, Importance of lawful food, drink, clothing and nourishing
Islamic rules of purity and cleanliness; Importance of purity and cleanliness in the life, Rules of purity and cleanliness
Relationship with other religions; Respect of other religions and their
Believers, Relationship with Ah'l Al-Kitab (people of the Book), Social relationships with non-Muslims, The Covenant of Bani Israel (The children of Isreal) with Allah, Address of prophet Moses (peace be upon him) to his people.
Islam and ethics; Definition, importance and significance of Ethics, Concept of Ethics in the light of Qur'ān and Hadith
Islam and Modern Science; The Holy Qur'ān as s guide for the
modern scientific development, Importance of science education in the
modern age Introduction of Muslim scientists , Contribution of Muslim Scholars towards science

Pakistan Studies

Ideology of Pakistan; Definition and Explanation, with reference to Allama Iqbal and Quaid-i-Azam, Aims and Objectives of the creation of Pakistan.
Muslim Rule in South Asia; Arrival of Muhammad bin Qasim and
Successors.
Muslim Rule in South Asia; Tolerance, Religious Freedom and kind
treatment towards non-Muslims
Historical Background of Ideology of Pakistan; Services of Mujadid Alf Sani.
Reformative movement; Social and religious services of Shah Waliullah, Efforts for sectarian harmony, Syed Ahmad Shaheed: Biography, Creation of Islamic State, Opposition from Local tribes and Martydom at Balakot.
Sir Syed Ahmad Khan; Educational and Social services, Political aspect of Aligarh movement
Arise of Political consciousness among Muslims; Establishment of All India Muslim League (AIML): Objective and achievement
Pakistan Movement; Muslim Nationalism, Khilafat Movement, Non-cooperation Movement: Role of Ali

Brothers, Role of Mr.Ghandi, Failure and affects of Khilafat movement, Allahabad Address of Allama

Iqbal, Idea of independent Muslim State, Provincial Elections 1937, Establishment of Congress Ministries, Behavior towards Muslims, Lahore/ Pakistan Resolution of 23rd March 1940, Establishment of Pakistan

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-104 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)

Semester 03

IS-201 Islamic & Pak Studies-II

Islamic Studies

Characteristics of the righteous people; Al-Mohsineen and their reward, Explanation of Lahw al-Hadith and torment for its buyer, Stress on fear of Allah the Lord and the Judgment Day.
Advices of Luqman a wise man; Not to associate anyone with Allah, To establish Salat (prayer), To enjoin good, To forbid evil, To bear the difficulties, Not to speak to others with your face turned away, No Scientific study of the universe; Universal arguments on Allah as the
Creator, Conquering the Universet to walk proudly and lower your voice
Pillars of Islam; Shahada, Salat, Saum, Zakāt, Hajj
Striving in the cause of Allah; (Jihad) Importance and significance Kinds: Against one's soul: to control its ego and desires (The greatest Jihad), Against ignorance, Against Satan, Against the enemy, Against disbelievers by the Holy Qur'an etc.
Social manners; Obligations on a Muslim for a Muslim, Golden principal to and lead a satisfied life and to control one's greed, What is righteousness? What is sin?, Emphasis on the respect of human
Sentiments, Awareness of a meal blessed with auspiciousness, Manners of salam and greeting Muslims and non-Muslims, Manners regarding sneeze, eating, drinking, wearing cloths, putting on and
off shoes and walking with shoes, Restriction of trailing garments
arrogantly, Restriction of overspending
Qur'ān sciences; Miracles of the Holy Qur'an, Usul-e-Tafseer
History of Hadith; Compilation of Hadith, A Brief Introduction of Sihah Settah and its compilers.
Human Rights; Human rights, Rights of parents, Rights of relatives, ights of neighbours, Women rights, Privacy.
Islamic criminal law; Introduction to the criminal law of Islam, Concept of crime and punishment, Role of Islamic criminal law in
eliminate crimes in the society, Classification of crimes in Islamic, Criminal Law: Hudood and Tazirat, Qad'f (false accusation), Li'ān (accusation of a wife of zina), Zina (adultery, fornication), Drinking intoxicating liquors and narcotics, Theft, Dacoity & robbery, Rebellion, Murder, Retaliation, Apostasy
Prophetic life as a role model; The Holy Prophet peace be upon him,
as a role model, Life of the Holy Prophet peace be upon him, after migration.
Islam and ethics; Ethical behavior of the Prophets, Impact of belief on Ethics, Concept of worship and manners/ social relations in religion and their impact on ethics, Ethics and character building, significance of moral values, Charity, Tolerance, Simplicity, Respect of
mankind Social Etiquettes of meetings, eating & drinking and conversation, Right of people

Pakistan Studies

National Integration; Role of Ulema & Mashaikh in Pakistan, Movement, Role of Students, Women and Journalists in Pakistan Movement, initiatives of Muhammad Ali Jinnah to strengthen the State
Initial Problems of Pakistan and Efforts to
Resolve; Refugee Crisis, Water Disputes, Kashmir Issue, Distribution of Asserts.
Land of Pakistan; Geographical Importance of Pakistan, China-Pakistan Economic Corridor (CPEC), TAPI Gas Pipeline Project
Resources of Pakistan; Agriculture: Potential and Performance, industry: Problems and viable solutions
State and Constitution of Pakistan; Objectives Resolution 1949, Fundamental Rights in the Constitution of 1956 and 1962, Islamic Provisions of 1973 Constitution.
Foreign Policy of Pakistan; Definition and Concept of Foreign Policy, Determinants and Objectives of Foreign Policy
Relations with Neighboring Countries; India, China, Afghanistan, Iran
Relations with Muslim World; Pakistan and Saudi Arabia, Pakistan and Turkey.
Pakistan and Contemporary World; United Nations, America, Russia, Europe

Principles of Foreign Policy; Bilateralism, Non-Alignment, Peaceful Co-Existence, Nuclear Non-Proliferation.
Pakistan and Regional Organizations; SAARC, OIC, ECO, SCO

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

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
TE-224 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-224 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.
13. How to make final structural drawings with different specifications

MA-240 Numerical Analysis

Basic concepts: round-off errors, floating point arithmetic, Convergence.
Solution of non-linear equations: Simple iterations; Bisection method; Newton's method; Secant method; Method of false position.
Solution of linear simultaneous equations: Jacobi's method; Gauss-Seidle method;
Finite differences: Difference operators and tables; Newton's interpolating techniques for equally spaced data; Newton divided difference table and interpolation; Lagrange's formulation of interpolation.
Numerical differentiation: approximating the derivative.
Numerical integration: Review of integration concept and their physical significance for engineering; Trapezoidal and Simpson's rules.
Solution of differential equations : Euler's methods; Runge Kutta methods.
Computations: Numerical techniques in context of engineering applications and solutions of problems by using MATLAB.

MA-240 L Numerical Analysis

Introduction to MATLAB, working in the command window using MATLAB as a calculator, Elementary Math Built-in Functions
Creating Arrays, Creating a 1-Dimensional Array,
Creating a 2-Dimensional Array, the Zeros, ones and eye commands, Array Addressing.

Deleting elements & built-in-functions for handling arrays. Example of Matlab Applications.
Two dimensional plots.
The plot command, Plot of a function, plotting multiple plots in the same plot using the plot command, using the hold on figure and fplot command.
Mathematical operations with arrays, addition and subtraction, array multiplication, array division.
Element by element operations using array in MATLAB built in math functions. Examples of MATLAB applications.
Using script files and managing data, the MATLAB workspace and workspace window, disp command, the f printf command, the save and load command.
Relational operator and logical operators, examples of MATLAB applications.
Conditional statement then if-end structure, if else-end structure, if else if end structures. Examples of MATLAB applications.
Solving Worksheets and lab assignments.
Loops such as for and while loop, nested loops and nested conditional statements, the break command, examples of MATLAB applications.
Bisection Method, solving non-linear equations using Newtons method. examples of MATLAB applications.
Newtons Method, solving non-linear equations using Newtons method. examples of MATLAB applications.

HU-221 L Technical Writing and Presentation Skills

Introduction Technical Communication: What is technical communication? Factors to consider in technical communication, Examining your purpose, Determining how to provide content.
The Writing Process: Writing effective paragraphs for technology, Developing a clear pattern of organization.
Getting started with technical writing: Recognizing different audiences, Involving the audience. Making writing effective: Achieving parallelism in writing, Constructing effective sentences.
Memos
Letter Writing: E-Mails
Parts of a Formal/Technical Report: Title, Abstract, Outline/contents, Introduction, Body/procedures, Conclusion, Appendices, Use of illustrations (Tables and Figures)
Parts of a Research Report: Title, Abstract, Contents, Introduction, Literature review, Methodology, Analysis/Results, Discussion/interpretation, Conclusion, Recommendations, References
Report Defence: Presentation of reports.

TE-205 Engineering Economics

Principles of Engineering Economy, scarcity, alternatives, opportunity cost of each choice, normative and positive economic analysis, consumer and producer goods, types of markets, demand law, supply law, price equilibrium, circular flow diagram, stakeholders, theory of firms behaviour, cost terminologies, cost curves, breakeven analysis, time value of money, methods of calculating interest,
Methods of depreciation, project cost control, numerical & graphical representation of break even, internal rate of return, payback period, discrete and continuous compounding,
types of ownership, project feasibility analysis, macroeconomics, inflation, unemployment, economic forces. Sole Proprietorship, Partnership, Joint Stock Companies, Fund-raising for Joint Stock Companies,
Types of Banks, Site Selection for Factories, Types of Markets, Value, Utility, Competition and its types, Monopoly and its types, Supply Schedule, Demand Schedule, Forecasting Techniques.
Comparing and selecting alternatives: Development of causal cost and opportunity cost concepts, the development of economic study parameters and approaches to determining asset lives, present and annual worth and rate-of-return comparisons, and replacement analysis.
Analysis of public projects: The development and application of benefit-cost analysis techniques

Income tax and inflation Methods: For incorporating income tax and inflation into economic studies and application of the capital-cost-tax-factor, treatment of salvage value.
Break-even analysis: Principles of financial and operating leverage, development of linear break-even analysis and assessment of margin-of-profit and "dumping".
Risk analysis: Development and application of sensitivity analysis, hurdle rates and expected value for dealing with risk and uncertainty in economic studies.
Financial and accounting analysis: Determining the cost-of-capital; capital budgeting and ratio analysis; development of financial statements and depreciation methodologies. Concept of Energy Audit and Energy Conservation in Transport Sector

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

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

MA-356 Probability and Statistics

Presentation of Data: classification, tabulation, classes, graphical representation, histogram, frequency polygon, frequency curve and their types.

Measures of Central Tendency: means: Arithmetic mean, geometric mean, harmonic mean and their properties, weighted mean, median, quartiles, mode and their relations, merits and demerits of averages.

Measures of Dispersion: range, moments, skewness, quartile deviation, mean deviation, standard deviation, variance and its coefficients, Kurtosis.
Curve Fitting: goodness of fit, fitting a straight line, parabola, circle.
Simple Regression: Scattered diagram, linear regression, correlation.
Probability: Definition, sample space, events, laws of probability, conditional probability, dependent and independent events.
Random Variable: introduction, distribution function, discrete random variable and its probability distribution, continuous random variable and its probability density function, mathematical expectation of a random variable, moment generating functions.
Probability distribution: Binomial, Poisson, uniform, exponential and normal distribution functions and its approximation to Poisson distribution.

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-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-333 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-333 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.
14. Determination of the tensile strength of concrete by double punch test. (non-standard test)

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
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
Mgt-315 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-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
7. Use of rolling Thin Film Oven and Pressure Aging Vessel to determine Binder Aging (2 weeks)

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-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-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

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-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
TE-427 L Project Management 1. QM Software Application (3 weeks) 2. Primavera Project Management P6 R 8.3 or later (5 weeks) 3. Estimating and tendering for construction works, By Martin Brook, 5th edition (2 weeks) 4. Civil Engineering Contracts and Contract Documents, By Ivor H. Seeley. 5. 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