

CT-312 PROJECT MANAGEMENT

Total Contact Hours:64	T	P	C
Theory: 64	2	0	2

AIMS:

1. Understand the managerial concepts and points in the execution of a building project.
2. Understand the Public Works Account and Report Writing.

COURSE CONTENTS

- 1. Introduction** **4 hours**
 - 1.1 Objectives and functions of Project Management.
 - 1.2 Construction stages-planning stage, designing stage, tendering stage and execution stage.
 - 1.3 Types of civil engineering project.
 - 1.4 Classification of works-original, major, minor & petty work, annual repair and special repair works.
- 2. Construction Team** **2 hours**
 - 2.1 Parties/Professionals - scope of duties & responsibilities.
- 3. Organization Aspects** **6 hours**
 - 3.1 Forms of organizations-line staff, direct and functional organization, their features, merits and demerits
 - 3.2 Organizational structure of different engineering departments-duties of various officers/officials, power of sanction of various officers.
 - 3.3 Classes of Establishment in works department.
- 4. Methods of Execution of Works** **4 hours**
 - 4.1 Departmental execution of works - daily labor, day work and piece work
 - 4.2 Contract
 - 4.2.1 Definitions-contract, tender.
 - 4.2.2 Types of contracts-Lump sum contract, item rate contract, cost plus fee contract, cost plus percentage contract, labor contract, Negotiated rate contract, turn-key contract and package contract etc.
 - 4.2.3 Merits and limitations of each contract system.
 - 4.3 Work order-difference between work order and contract.
- 5. Tendering** **8 hours**
 - 5.1 Pre-requisite for tendering-administrative approval, technical sanction, Budget provision and allocation of funds.

- 5.2 Invitation of tenders- by negotiation, selective tenders and public notice.
 - 5.3. Tender notices - Characteristics, instruction on calling tender.
 - 5.4 Tender documents-components, special condition of tender. Guarantees form tender, tender fee.
 - 5.5 Submission of tenders/bids-instruction to bidders.
 - 5.6 Earnest money, security deposit.
 - 5.7 Opening of tenders, scrutiny of tenders, comparative statement, acceptance of tenders, Bid bond, performance bond, and insurance bond.
 - 5.8 Award and commencement of work, possession of site.
 - 5.9 Mobilization advance, secured advance, retention money.
 - 5.10 Conditions of contract agreement-penalty, Liquidated damages, time of completion, Extension of time, termination of contract, Arbitration Delays.
- 6. Preliminary Planning 4 hours**
- 6.1 Preliminary aspects of planning-investigation, feasibility report, collection of data and preparation of project report.
- 7. Construction Planning 6 hours**
- 7.1 Construction activities.
 - 7.2 Construction schedule, rate of executing work, time calculations.
 - 7.3 Material, labour and equipment schedule.
 - 7.4 Procurement of labor, material and equipment.
 - 7.5 Planning by bar chart/time and progress chart and its limitations.
 - 7.6 Project planning with net work analysis (C.P.M)-term used advantages of C.P.M.
 - 7.7 Steps in C.P.M method-preparation of net work, critical path, determination of net work time.
 - 7.8 Review of network and crash programming
 - 7.9 Preparation of work progress charts.
 - 7.10 Site organization of a construction job.
- 8. Inspection and Quality Control 4 hours**
- 8.1 Duties of inspecting officers-Assistant Engineer, Executive Engineer etc
 - 8.2 Duties of sub-engineer-regarding works, stores and accounts, Handing over and taking over charge.
 - 8.3 Site order book-principles of supervision.
 - 8.4 Quality control-enforcement of specifications, sampling and testing materials.
- 9. Work Records and Payment 8 hours**
- 9.1 Measurement book, standard measurement book, rules to be followed in recording measurements, preparation of abstract of payment in measurement book, irregularities in M.B.
 - 9.2 Muster-roll, preparation, daily labor report, casual labor.

- 9.3 Preparations of bills, running bills, final bills, deductions to be made from bills checking of bills.
- 9.4 Mode of payment-bills, vouchers, first and final bill, interim payment, final payment, advance payment, secured advance payment, bill forms, Hand receipt, imprest, recoverable payments.
- 9.5 Terms-competent authority, controlling officer, Disbursing officer, Divisional officer, contingencies of work, deposit work, supervision charges, issue rate, market rate, storage rate and charges, suspense account.
- 9.6 Major expenditure heads-major head, minor head, sub head and detailed head.

10. Stores 6 hours

- 10.1 Classification of stores - stock, tools and plants, Road metal and materials charged direct to the work.
- 10.2 Stock-sub-heads of stock receipts and issue of stock, stock account, Register of stock receipts and issues, shortages and surpluses of stock, monthly stock account.
- 10.3 Material at site account, Road metal account.
- 10.4 Tools and plants-sub heads of tools and plants, Issues and receipts of T & P, T & P account, verification of tools and plants (Shortage and surplus).
- 10.5 Principles of storing materials, Location of T & P protection of stores, store room record, bin card, ordering procedure of store.
- 10.6 Indenting of materials-instruction for preparation of indents, specifications, and supply procedures in works departments.

11. Safety in Construction 4 hours

- 11.1 Safety measures for;
 - 1.1.1. Excavation
 - 1.1.2. Scaffolding, Formwork, and Ladder.
 - 1.1.3. Drilling & Blasting.
 - 1.1.4. Demolition.
 - 1.1.5. Hot bituminous works.
 - 1.1.6. Fire safety in building.

12. Report Writing 8 hours

- 12.1 Introduction importance, Types of report.
- 12.2 General principles of report writing.
- 12.3 Functional design of report, opening statement outline, main body, specific recommendations.
- 12.4 Collection of data documentary source, field investigation, interview and questionnaire.
- 12.5 Rough draft, submission of report, letter of transmittal.

REFERENCE BOOKS

- 1. Construction Management and Accounts by Vazirani.
- 2. Estimating and costing by B. N. Dutta.
- 3. Professional practice by Vazirani.

Instructional Objectives

- 1. Understand Management, Functioning of Civil Engineering Projects**
 - 1.1 Explain the objectives and functions of project management
 - 1.2 Explain the different stages and activities involved in construction projects
 - 1.3 State the types of civil engineering projects
 - 1.4 State the classification of works

- 2. Understand the Need And Importance Of Each Member Of Construction Team**
 - 2.1 List the parties/persons involved in a construction project
 - 2.2 Explain the importance and role of each member of construction team

- 3. Understand Organization and Organizational Structure Of Government Engineering Departments**
 - 3.1 Explain that organizations giving merits and demerits of each
 - 3.2 List the engineering departments of government
 - 3.3 Draw organizational chart of C&W department Irrigation & power department, public Health Engineering department
 - 3.4 List the duties of different officers of works departments
 - 3.5 State the power of sanction of various officers of works departments
 - 3.6 Explain the classes of establishments in works department

- 4. Understand the Methods of Execution Of Works**
 - 4.1 State methods of departmental execution of works i.e. daily Labor, piece work and day work
 - 4.2 Define terms contract, tender
 - 4.3 Explain the various contracting systems for construction works
 - 4.4 List the merits and limitations of each contracting system
 - 4.5 Distinguish between work order and contract

- 5. Understand the Procedures of Fixing Agencies for Execution of Works**
 - 5.1 Define terms budget provision, administrative approval, Technical sanction and Allocation of funds
 - 5.2 State the pre-requisites for tendering
 - 5.3 State the methods of invitation of tender
 - 5.4 Draft a tender notice
 - 5.5 Prepare tender documents
 - 5.6 Explain the need of earnest money and security deposit
 - 5.7 Lists the steps involved in fixing up the agency through tender system
 - 5.8 Discuss the instruction to bidders/contractor for filling tenders/bids
 - 5.9 Prepare comparative statement and selection of contractor from tenders

5.10 Explain the conditions of contract such as penalty, Arbitration, Time of completions and Extension of time

6. Understand Various Aspects of Preliminary Planning

- 6.1 Explain the importance of preliminary planning
- 6.2 Explain difference between feasibility report and project report
- 6.3 Explain the data to be collected and aspects to be considered in feasibility report
- 6.4 List aspects to be considered during preparation of project report

7. Understand the Principles of Planning and Organizing a Construction Project

- 7.1 State the objectives of scheduling
- 7.2 Break down the constructions work in to activities
- 7.3 Explain the procedure of making constructions schedule i.e. sequencing and time computation of each activity
- 7.4 State the need for material, equipments and Labor schedule
- 7.5 Explain methods of procurement of Labor, materials and equipments
- 7.6 Prepare bar chart and explain its limitation
- 7.7 Explain the advantages of project planning by network analysis (only with critical path method)
- 7.8 Plan and draw i.e. network for a construction project
- 7.9 Calculate net work time, critical path, free float and total float
- 7.10 Draw progress charts for a construction project

8. Understand the Principles of Inspection and Quality Control

- 8.1 Explain the need for inspection of works
- 8.2 List the duties of various inspecting officers
- 8.3 Explain the duties of sub-engineer regarding works, store and account
- 8.4 Explain the use of site order book
- 8.5 Explain the principles of supervision
- 8.6 Explain need and methods of quality control
- 8.7 List the points to be considered in enforcing specifications
- 8.8 State the necessity for sampling and testing of materials

9. Understand the Procedures of Measurements and Payments

- 9.1 State the importance of measurement book
- 9.2 List the rules to be followed in recording measurement
- 9.3 Record measurements in M.B and prepare abstract of payment in M.B
- 9.4 List the mode of payment to contractors
- 9.5 Identify the types of bills to be used
- 9.6 Prepare works bills of payment, surveying bills, final bills
- 9.7 Prepare muster roll. Daily labor report etc
- 9.8 Explain terms, Hand receipt, imprest, recoverable payment, competent authority, controlling officer, Disbursing officer, Divisional officer, cogence of work, deposit

work, supervision charges, suspense account, market rates, storage rate and charges, major head, minor head, sub head, Detailed head

10. Understand Store Management

- 10.1 Explain need for store in a project
- 10.2 State the classification of stores
- 10.3 State the classification of the items held in general stock
- 10.4 Explain the principles of storing materials and T&P in store
- 10.5 Prepare the register of store issuer and receipt
- 10.6 State the need for materials at site account
- 10.7 Explain the verification procedures of stores
- 10.8 Explain the procedure of taking delivery from stores
- 10.9 Explain procedure involved in indenting of materials

11. Understand the Safety Measures to Be Adopted in Construction

- 11.1 Explain the importance of safety precautions in construction industries
- 11.2 List the safety measures to be adopted in (a) excavation (b) scaffolding form work and Ladder (c) Dulling and blasting (d) Demolition (e) Hot bituminous works

12. Understand the Principles Involved in Report Writing

- 12.1 Explain the importance of report writing
- 12.2 List the types of report
- 12.3 Explain the general procedure of report writing
- 12.4 Explain methods of collecting data for a technical report
- 12.5 Explain the essential parts of a report
- 12.6 Draft technical reports

CT-322 QUANTITY SURVEYING-II

T	P	C
0	6	2

Total Contact Hours:192

Theory:	Nil
Practical:	192

AIM: Understand the estimating of multi-storied building, R. C. C. Bridge and steel truss including bar scheduling.

List of Practical/Exercises

192 hours

1. Complete estimate of a small two storied R. C. C. frame structure building (of given drawing) including bar scheduling and abstract of cost.
2. Complete estimate of R. C. C. bridge (high level multispan bridge) including bar scheduling and abstract of cost.
3. Complete estimate of a steel truss (20 m, span) including its abstract of cost.
4. Complete estimate of R. C. C. under ground water tank and overhead water tank.
5. Use of LOTUS in quantity surveying.

Note: The above exercises must span over a period of 192 hours and the number of assignments (Projects) should match with this duration.

REFERENCE BOOKS

1. Rasul Manual No: 4 on Estimating.
2. Estimating & Costing by M. A. Aziz.
3. Estimating and costing by B. N. Dutta.

CT-333 PUBLIC HEALTH ENGINEERING-II

T	P	C
2	3	3

Total Contact Hours 160

Theory	64
Practical	96

AIM: Understand the construction and maintenance of sewer, process of ~~c~~Collection, conveyance and disposal of sewage.

COURSE CONTENTS

- 1. Introduction** **4 hours**
 - 1.1 Definition and terminology of sanitary Engineering.
 - 1.2 System of sewerage disposal.
 - 1.3 Cesspool drainage, conservancy system and water carriage system, their comparison.
 - 1.4 Types of sewerage systems and their suitability

- 2. Quantity of Sewage** **4 hours**
 - 2.1 Quantity of discharge in sewer, dry weather flow, variation in quantity of dry weather flow.
 - 2.2 Quantity of storm water flow-run off co-efficient, time of concentration impervious factor, hydraulic formula for velocity of flow.

- 3. House Drainage** **4 hours**
 - 3.1 Requirement.
 - 3.2 Shapes & construction of different type of drains.
 - 3.3 House drain slopes & connection with main sewer.
 - 3.4 One & two pipe system of drainage and their comparison.

- 4. Sewer Design** **6 hours**
 - 4.1 Section of sewers and their suitability, standard practices for design of sewer.
 - 4.2 Self cleansing velocity, non sitting-non scouring velocity.
 - 4.3 Numerical problems.

- 5. Alignment & Layout** **4 hours**
 - 5.1 General layout of sewers.
 - 5.2 Location of sewer line-(Longitudinal & X-Section showing sewer lines.
 - 5.3 Shapes of sewers & their suitability gradient fixing, bedding, handling, lowering, laying, jointing)n testing & back filling.
 - 5.4 Setting out alignment.

- 6. Sewer Appurtenance** **4 hours**
- 6.1 Brief description, location, function and construction of:- Man holes, drop-man holes, catch basins, inlets, clean out, lamp hole, flushing tanks regulators, grease, & oil traps, inverted siphon, trestle & pier.
- 7. Ventilation Of Sewer** **4 hours**
- 7.1 Introduction
- 7.2 Methods of ventilation
- 7.3 Vents & venting (single & two pipe system, circuit venting, local vents, distance of vent connection).
- 8. Pumping Sewage** **4 hours**
- 8.1 Necessity of pumping sewage.
- 8.2 Requirements of pumping station.
- 8.3 Types of sewage to be pumping.
- 9. Composition of Sewage** **4 hours**
- 9.1 Organic & inorganic method.
- 9.2 Mineral matter.
- 9.3 Categories of mineral matter (milden, algae, fungi, protozoa, germs, aerobic & non aerobic bacteria, facultative bacteria, enzymes their types & sources.
- 9.4 An aerobic/aerobic decomposition.
- 10. Properties of Sewage** **4 hours**
- 10.1 Physical properties.
- 10.2 Chemical properties.
- 10.3 Biological properties.
- 10.4 Sampling of sewage.
- 11. Test for Sewage** **4 hours**
- 11.1 Physical test.
- 11.2 Chemical test- (Chlorine, facts grease & oils, nitrogen, oxygen, PH, value, & total solid).
- 12. Biological Oxygen Demand** **4 hours**
- 12.1 Measuring & definition of B.O.D.
- 12.2 Tests for B.O.D.
- 12.3 Importance & limitation of B.O.D.
- 12.4 Relative stability
- 12.5 Numerical problems on B.O.D.

- 13. Biochemistry** **2 hours**
- 13.1 Proteins, Carbohydrate, & Standard Solution
 - 13.2 Acidity & sewer & notation of acidity
 - 13.3 Chemical coagulation.
- 14. Sewage Treatment and Disposal** **8 hours**
- 14.1 Preliminary treatment.
 - 14.2 Brief description & function of following units: Screen, skimming tanks, grit chamber, plain sedimentation tanks.
 - 14.3 Simple problems on the design of sedimentation tanks.
 - 14.4 Secondary treatment, Description of Intermittent fillers, contact beds, trickling filters activated sludge process, sludge digestion, sludge drying, sludge disposal.
 - 14.5 Misc. treatment Septic tank, Inhofe tank.
 - 14.6 Sewage disposal Dilution, disposal on lands, oxidation, pond, oxidation ditch, aerated lagoon, anaerobia lagoons.
- 15. Solid Waste Disposal** **4 hours**
- 15.1 Methods of disposal - uncontrolled dumping, tipping/ sanitary land fill, incineration, compositing.

Reference Books

1. Water Supply & Sanitary Engineering by S.C.Rangwala.
2. Water Supply and Sewerage by E.W.Steel
3. Water Supply & Sanitary Engineering by G.J.Kulkari.
4. Public Health Engineering by Duggal.
5. Asul Manual on Sanitary Engineering.

CT-333 PUBLIC HEALTH ENGINEERING-II

INSTRUCTIONAL OBJECTIVES

- 1. Understand Basic Facts about Sanitary Engineering**
 - 1.1 Define terms; Sewage, Sanitary Sewage, Domestic Sewage, Industrial sewage, storm or rain sewage, sewerage works, sewage treatment, sewage disposal
 - 1.2 State types of sewer (sanitary sewer, storm sewer, combined sewer, lateral sewer, house sewer, and sub main sewer, main or trunk sewer, out fall sewer, relief sewer)
 - 1.3 Compare systems of sewage disposal, conservancy system, water carriage system and cesspool drainage system
 - 1.4 State types of sewerage system and their suitability
 - 1.5 Compare the sewerage systems with each other

- 2. Understand the Main Constituents of Sewage for Calculating Quantity**
 - 2.1 State Quantity of discharge in sewer Dry weathering flow
 - 2.2 State the factors on which dry weather flow depends
 - 2.3 Explain the variation in quantity of dry weather flow
 - 2.4 Define terms run off co-efficient time of concentration, rain fall intensity, and impervious factor
 - 2.5 State the Hydraulic formula for velocity of flow
 - 2.6 Estimate the quantity of storm water flow using empirical formula

- 3. Understand the Fundamentals and Its Requirements of House Drainage**
 - 3.1 State the aims of buildings drainage and its requirement
 - 3.2 Describe with sketches the shapes and construction of different types of drains
 - 3.3 State House drains slopes & connection with main sewer
 - 3.4 Compare one and two pipe system of drainage

- 4. Understand the Principles of Sewer Design**
 - 4.1 Describe with sketches the sections of sewer and their suitability
 - 4.2 State the main constituents of sewage for calculating Design flow
 - 4.3 State self cleansing velocity
 - 4.4 State the steps of standard practice for design of sewer
 - 4.5 Work out simple problems on design of sewers

- 5. Understand the Procedure for Laying Out and Alignment of Sewer**
 - 5.1 Define Alignment & Layout of sewer
 - 5.2 State the shapes and material used for sewers
 - 5.3 State suitability factors governing alignment of sewer
 - 5.4 Describe the procedure of setting out alignment

- 5.5 Explain the steps, gradient fixing, bedding, handling, lowering, laying, jointing testing & back filling of sewer
- 6. Understand the Various Types of Sewer Appurtenance**
- 6.1 Describe the location, construction and function of Main holes, drop man holed, catch basins, inlets, clean out, lamp hole, flushing tanks, regulators, grease and oil traps, inverted siphon, trestle & pier
- 7. Understand the Methods and Systems of Sewer Ventilation**
- 7.1 State the necessity of ventilating
- 7.2 Explain the methods of ventilation
- 7.3 Explain the vents, venting, single pipe system & two pipe system circuit venting, local vents, distance of vent connection
- 8. Understand the Function and Requirements of Pumping Station**
- 8.1 State the necessity for pumping station
- 8.2 Explain the components parts with function of pumping station and factors influencing its location
- 8.3 State the types of sewage to be pumped
- 9. Understand the Composition of Sewage**
- 9.1 State organic/in-organic method
- 9.2 State mineral matter
- 9.3 Describe categories of mineral matter (mildew, algae, fungi, protozoa, germs, facultative bacteria, enzymes, their types & sources)
- 9.4 State an-aerobic & aerobic decomposition
- 10. Know About the Properties and Sampling of Sewage**
- 10.1 State the physical properties of sewage
- 10.2 State the chemical & Biological properties of sewage
- 10.3 State the method of sampling of sewage
- 11. Understand the Tests to Analyze Sewage**
- 11.1 State the significance of the following tests to analyze sewage
- 11.1.1 Physical test
- 11.1.2 Chemical test including (chlorine, fats, grease and oil, nitrogen, oxygen, value)
- 11.1.3 Biological tests
- 11.2 Explain the tests enlisted above.
- 12. Understand the Tests for Measuring B.O.D under Aerobic Condition**
- 12.1 Define B.O.D.
- 12.2 Explain the tests for measuring B.O.D

- 12.3 State the significance & limitations of B.O.D test
- 12.4 State relative stability
- 12.5 Work out simple problems on B.O.D

13. Understand the Bio-Chemistry of Sewage

- 13.1 Explain the terms, proteins, carbohydrate standard solution, and notation of acidity.
- 13.2 Explain chemical coagulation.

14. Understand the Primary and Secondary Treatment of Sewage

- 14.1 State the objects of sewage treatment
- 14.2 Draw flow-diagram to show different stages of sewage treatment
- 14.3 State the stages of preliminary treatment system
- 14.4 Describe with sketch the function of following units
 - 14.4.1 Screen
 - 14.4.2 Skimming tanks
 - 14.4.3 Grit Chamber
 - 14.4.4 Plain sedimentation tanks
 - 14.4.5 Detritus tank
- 14.5 Determine the dimensions of sedimentation tank of given data
- 14.6 State the stages of secondary treatment
- 14.7 Describe with sketch the following treatment works
 - 14.7.1 Intermittent filters
 - 14.7.2 Contact beds
 - 14.7.3 Intermittent sand filters
 - 14.7.4 Activated sludge process
 - 14.7.5 Sludge digestion
 - 14.7.6 Sludge drying
 - 14.7.7 Sludge disposal
- 14.8 Explain with sketches the disposal of sewage by Imhoff and septic tanks

15. Understand the Methods of Disposal of Solid Waste

- 15.1 State the classification of solid wastes
- 15.2 Explain the methods of disposal of solid waste
- 15.3 Explain the methods of composting
- 15.4 List the equipments required for preparation of composting such as storage hoppers, grinders, conveyors and also give their brief working

CT-333 PUBLIC HEALTH ENGINEERING-II

LIST OF PRACTICALS/EXERCISES

1. Visit and study of sewerage scheme of campus and sketching of the scheme.
2. Solution of problem on impervious factor, run off and storm water discharge using Kutter's and Manning's formula
3. Drawing detailed layout of a sewerage scheme for a particular town.
4. Demonstration for excavation of trenches of a small sewer line with proper grade.
5. Jointing & testing concrete sewers in trenches .
6. Demonstration of fittings vents pipes to a water closet.
7. Visiting venting system of campus sewerage scheme and sketching layout of one pipe system.
8. Sketching to illustrate drainage and vent-pipes in a multi-storied building.
9. Drawing of different sections of drains.
10. Drawing sketches of various sewer appurtenance (catch basins clean out, lamp hole, manhole, lamp man holes, flushing, tanks, inlet, regulator, grease and oil trap, inverted siphon, Trestle and pier.
11. Visit of any sewage pumping station and submission of report on its working.
12. Demonstration on the use of cleaning equipment and safety measures for preventing accidents during cleaning of sewers.
13. Numerical on simple design of sewers from given data.
14. Sketches and study of various tanks used for preliminary treatment of sewerage.
15. Flow - diagram of sewage treatment plant.
16. Drawing sketches of contact filters, trickling filters.
17. Drawing and study of the activated sludge plant.
18. Drawing and study of a typical septic tank.
19. Visit to sewage treatment plant. Discussion and submission of report on various treatment methods.

CT-344 HYDRAULICS AND IRRIGATION

T	P	C
3	3	4

Total Contact Hours 192

Theory	96
Practical	96

AIMS:

1. Apply the fundamental principles of hydraulic to Civil Engg projects.
2. Gain knowledge about the principles involved in irrigation engineering.
3. Apply principles of irrigation engineering and study irrigation system of Pakistan.

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| <p>1. Introduction</p> <p>1.1 Introduction to the subject</p> <p>1.2 Physical properties of fluids; Density, specific weight, specific volume, specific gravity, surface tension, viscosity and capillary action.</p> | 3 hours |
| <p>2. Fluid Pressure and Its Measurement</p> <p>2.1 Pressure, intensity of pressure and pressure head, Pascal's law.</p> <p>2.2 Atmospheric pressure-Gage pressure-Absolute pressure</p> <p>2.3 Measurement of fluid pressure. Piezometer tube and simple Manometer.</p> | 3 hours |
| <p>3. Hydrostatics</p> <p>3.1 Pressure on immersed surface.</p> <p>3.2 Total pressure on a horizontal and vertical immersed surface.</p> <p>3.3 Center of pressure Resultant pressure Center of pressure of vertically immersed surface.</p> | 6 hours |
| <p>4. Floating Bodies' Equilibrium</p> <p>4.1 Buoyancy & Floatation-Buoyant force-Center of Buoyancy</p> <p>4.2 Metacentre-Metacentric Height</p> <p>4.3 Kinds of Equilibrium of a floating body</p> | 3 hours |
| <p>5. Hydro Kinematic</p> <p>5.1 Discharge-Equation of continuity of a liquid flow</p> <p>5.2 Types of flow lines-path lines and stream lines</p> <p>5.3 Types of flow in a pipe, steady and unsteady flow, uniform and non-uniform flow, Turbulent flow</p> | 3 hours |
| <p>6. Hydrodynamics</p> <p>6.1 Introduction</p> <p>6.2 Kinds of energy of flowing liquid</p> | 6 hours |

6.3	Total Head of Flowing liquid	
6.4	Bernoulli's Theorem definition, formula.	
6.5	Practical Application of Bernoulli's Equation, Venturimeter & Pitot tube	
7.	Flow through Pipes	3 hours
7.1	Introduction	
7.2	Loss of Head in pipes & Darcy's formula	
7.3	Chezy's Formula for loss of head in pipe	
7.4	Hydraulic Gradient and total energy lines	
8.	Flow Through Orifices	3 hours
8.1	Introduction, Types of orifices	
8.2	Jet of water, vena contract	
8.3	Co-efficient of Discharge & velocity of approach	
8.4	Discharge through a large rectangular orifice	
8.5	Mouth pieces	
9.	Flow Over Notches	3 hours
9.1	Introduction, Types	
9.2	Discharge formula for notches	
9.3	Numerical Problems	
10.	Flow Over Weir	3 hours
10.1	Introduction, Types	
10.2	Discharge formula for weirs	
10.3	Numerical Problems	
11.	Uniform Flow Through Open Channel	6 hours
11.1	Introduction	
11.2	Chezy's formula for discharge through open channel	
11.3	Manning's formula for discharge through open channel	
11.4	Bazin's formula for discharge through open channel	
11.5	Most economical section of channel, conditions for maximum Discharge through channel	
11.6	Discharge through rectangular & trapezoidal channel sections	
11.7	Numerical problem	
12.	History and Introduction of Irrigation	3 hours
12.1	History	
12.2	Definition, necessity and scope of Irrigation	
12.3	Sources of water	

- 13. Irrigation System in Pakistan** **3 hours**
- 13.1 Irrigation net-work in Pakistan
 - 13.2 Characteristics of Pakistan Rivers
 - 13.3 Types of Irrigation
 - 13.4 Rain fall in Country
 - 13.5 Important barrages of country
- 14. Weirs and Barrages** **3 hours**
- 14.1 Introduction to weir
 - 14.2 purpose of weir/barrage
 - 14.3 Components parts
 - 14.4 Site selection
 - 14.5 Types of weir
 - 14.6 Surface flow at weirs
- 15. Canals** **6 hours**
- 15.1 Types
 - 15.2 Alignment of canal
 - 15.3 Lining types
 - 15.4 Sections of lined channels-relative merits
 - 15.5 Merits & Demerits of Lined and unlined channel
 - 15.6 Kennedy's Critical velocity & Lacy's Regime Velocity
 - 15.7 Design of Canal.
- 16. Water Requirement of Crops** **3 hours**
- 16.1 Brief Description
 - 16.2 Crop period, Base period, Kharif Rabi Ratio, Core Watering, Cash Crop, Crop rotation.
 - 16.3 Duty Delta of water-factors affecting, significance & relation between duty & Delta
- 17. Silt Controlling Works** **3 hours**
- 17.1 Brief Description.
 - 17.2 Silt Ejector.
 - 17.3 Silt Vanes.
- 18. Regulating Works** **3 hours**
- 18.1 Brief Description.
 - 18.2 Head Regulator.
 - 18.3 Flume - meter flume.
- 19. Cross Drainage Works** **3 hours**
- 19.1 Types aqueduct, siphon, and Drainage inlet.
 - 19.2 Super passage, siphon super passage, level crossing.

19.3	Drainage out let, tail escape.	
20.	Distribution Works	3 hours
20.1	Introduction-outlets.	
20.2	Essential requirements of an outlet.	
20.3	Characteristics of outlet.	
20.4	Types of outlet-modular, semi modular and non-modular outlet.	
21.	Canal Falls	3 hours
21.1	Definition & basic requirements.	
21.2	Types.	
22.3	Canal falls site selection.	
22.	Maintenance of Canals	3 hours
22.1	Up-keep and maintenance.	
22.2	Breaches in canals-courses, Preventive measure and methods Of closing.	
22.3	Silting tanks, their classes, objects and working.	
22.4	Repair to berms, formation of new berms.	
23.	Storage Irrigation	3 hours
23.1	Necessity.	
23.2	Various terms used.	
23.3	Assessment of maximum run off from a catchment area.	
24.	Earthen Dams	3 hours
24.1	Introduction.	
24.2	Types.	
24.3	Construction details of earthen dams.	
24.4	Causes of failure of Earthen Dams and their remedies.	
25.	Water Logging & Salinity	6 hours
25.1	Water logging Definition	
25.2	Causes and prevention	
25.3	Salinity Definition	
25.4	Causes & prevention	
25.5	Methods of reclamation of soil	
26.	Indus Basin Project	3 hours
26.1	Indus basin project	
26.2	Need and details of water replacement works	
27.	River Training Works	3 hours

CT-344 HYDRAULIC AND IRRIGATION

INSTRUCTIONAL OBJECTIVES

- 1. Know the Scope, Significance and Basic Definitions**
 - 1.1 State development, scope and significance of this subject in civil engineering.
 - 1.2 Define density, specific weight, specific volume, specific gravity surface tension, viscosity and compressibility.

- 2. Understand Fluid Pressure And Its Measurement**
 - 2.1 State pressure, pressure head and Pascal's law.
 - 2.2 Distinguishes among atmospheric pressure, gauge pressure and absolute pressure.
 - 2.3 Describe measurement of fluid pressure by piezometer tube and simple manometer.

- 3. Understand The Application And Location Of Total Pressure On Immersed Surface**
 - 3.1 State pressure on immersed surface.
 - 3.2 Define center of pressure and resultant pressure.
 - 3.3 Compute the total pressure and center of pressure on a horizontal and vertical surface immersed in a liquid.

- 4. Know The Equilibrium Of Floating Bodies**
 - 4.1 Define the terms, buoyancy, floatation buoyant force and center of buoyancy.
 - 4.2 Define metacentre and metacentric height.
 - 4.3 State the kinds of equilibrium of a floating body.

- 5. Understand The Different Types Of Flow Of The Liquids**
 - 5.1 State discharge and equation of continuity of a liquid flow.
 - 5.2 Distinguish path lines and stream lines.
 - 5.3 Distinguish the type of flow in pipes i.e steady and unsteady flow-uniform and non uniform flow turbulent flow.

- 6. Understand The General Principles Of Flow Of The Liquids**
 - 6.1 State the term hydrodynamics.
 - 6.2 State the energies of liquid in motion.
 - 6.3 State the total head of flowing liquid.
 - 6.4 Explain Bernoulli's theorem with its formula, limitations and practical application i.e, venturimeter & Pitot tube.

- 7. Understand The Flow Through Pipes**
 - 7.1 Explain the major and minor losses of head of water flowing through pipes.
 - 7.2 State chezy's and Darcy's formulae for friction loss in pipe flow.
 - 7.3 Define & Sketches the Hydraulic gradient and total energy line under different conditions.

8. Understand The Function And Flow Through Orifices

- 8.1 Define orifice and its types.
- 8.2 State the terms; jet of water, venal contract, co-efficient of discharge and velocity of approach.
- 8.3 Derive formula for discharge
- 8.4 Differentiate between bitumen, orifice and mouth piece.

9. Use Discharge Formula For Solving Problems On Notches

- 9.1 Define notch and its types.
- 9.2 State the discharge formulae for notches.
- 9.3 Solve problems based on discharge formulae.

10. Understand The Flow Over Weirs

- 10.1 Define weir and its types.
- 10.2 Differentiates sharp crested and broad crested weirs.
- 10.3 State the discharge formulae for weirs.
- 10.4 Solve problems based on discharge formulae.

11. Understand The Principles Of Flow Through Open Channel.

- 11.1 State the flow through open channels.
- 11.2 State chezy's, Manning & s Bazin's formulae for discharge through open channel.
- 11.3 State most economical section of channel and condition for maximum discharge through channel.
- 11.4 State discharge through rectangular & trapezoidal channel section and their formulae.
- 11.5 Solve problems on discharge through open channels.

12. Understand The History, Necessity And Scope Of Irrigation

- 12.1 State history of irrigation.
- 12.2 Define irrigation.
- 12.3 State necessity and scope of irrigation.
- 12.4 Explain various sources of water.

13. Understand The Salient Features Of Irrigation System Of Pakistan

- 13.1 Describe with map the irrigation net work in Pakistan.
- 13.2 State the characteristics of Pakistan Rivers.
- 13.3 Explain the different methods of irrigation.
- 13.4 State the important barrages of Pakistan.

14. Understand Features And Function Of Weir/Barrages

- 14.1 Define weir and barrages.
- 14.2 Distinguishes between barrages and weir.

- 14.3 Describe with sketches the components/parts of barrage.
- 14.4 State the factors governing the site selection of barrage.
- 14.5 State the types of weir.
- 14.6 Explain surface flow at weirs.

15. Understand The Basic Ideas About Canals

- 15.1 State the types of canal.
- 15.2 Explain the factors governing alignment of canal.
- 15.3 Explain lining and its types.
- 15.4 Describe with sketches the section of lined channels and relative merits.
- 15.5 State merits and demerits of lined and unlined channels.
- 15.6 State Kennedy's critical velocity and lacy's regime velocity.

16. Understand Water Requirement Of Crop

- 16.1 Describe the term water requirement of crop.
- 16.2 Define the terms crop period, base period. Kharif Rabi ratio, Core watering, cash crop, crop rotation, delta.
- 16.3 Explain duty of water, factors affecting and significance.
- 16.4 State relation between duty and delta.

17. Understand The Silt Controlling Works

- 17.1 Describe the need of silt controlling of canal.
- 17.2 Describe with sketches the silt ejector and silt vanes.

18. Understand The Regulation Works Of Canal

- 18.1 Describe the necessity and importance of regulation works.
- 18.2 Explain head regulator, flume, meter flume, canal falls and their types with sketches.

19. Understand The Basic Idea Cross Drainage Works

- 19.1 Describe with sketches the different types cross drainage works.
- 19.2 Describe with sketches, super passage, siphon supper passage and level crossing.
- 19.3 Describe drainage outlet and tail escape.

20. Understand The Basic Idea Of Distribution Works

- 20.1 Define outlet.
- 20.2 State essential requirements of an outlet.
- 20.3 Explain the characteristics of outlets.
- 20.4 Describe with sketches the types of outlets (modular, semi modular and non modular).

21. Understand The Basic Idea Of Canal Falls

- 21.1 Define canal galls.
- 21.2 State the basic requirement of canal fall.

- 21.3 Describe the types of canal falls.
- 21.4 Explain the factors governing the site selection of canal falls.

22. Understand The Principles Of Maintenance Of Canals

- 22.1 Describe up keep and maintenance of canals.
- 22.2 Explain breaches in canal, water courses, preventive measure and methods of closing.
- 22.3 Describe with sketch the silting tanks their classes, objects and working.
- 22.4 Explain repair to berms and formation of new berms.

23. Understand The Basic Idea Of Storage Irrigation

- 23.1 State the necessity of storage irrigation.
- 23.2 Define the various terms used in storage irrigation.
- 23.3 Explain the methods of assessment of maximum run off from a catchment area.

24. Understand The Need Of Earthen Dams And Their Components

- 24.1 Describe the term dam, its significance and necessity.
- 24.2 Explain the types of earth dams.
- 24.3 Explain the construction details of earthen dams.
- 24.4 State the causes of failure of earthen dams and their remedies.

25. Understand The Methods Of Soil Reclamation

- 25.1 Define water logging and salinity.
- 25.2 Explain causes and prevention of water logging salinity.
- 25.3 Explain methods of land reclamation.

26. Understand About The Indus Basin Project

- 26.1 State the salient features of Indus basis project.
- 26.2 Explain the need and details of water replacement works.

27. Understand The Types Of River Training Works

- 27.1 List the objects of river training.
- 27.2 Explain with sketches different types of protective and river training works.

CT-344 HYDRAULICS & IRRIGATION

LIST OF PRACTICALS

96 hours

1. Study of pressure gauges
2. Numerical problems on Hydrostatics
3. Find Hydrostatic pressure and center of pressure of vertically immersed surface
4. Numerical problem on floating bodies equilibrium
5. Find the metacentric height of a floating body in lab
6. Numerical problems on Hydro kinematics
7. Numerical problems on Hydrodynamics
8. Find co-efficient of venturimeter of a given venturimeter apparatus
9. Numerical problems on flow through pipes
10. To find the co-efficient of discharge through a rectangular notch in weir apparatus
11. Numerical problems on uniform flow in open channels
12. Finding the velocity by velocity rod & by current meter
13. Draw a skeleton map of Pakistan showing rivers, main and link canal, Head works and barrages
14. Draw a plan showing general lay out of river training and protection works.
15. Draw typical cross-sections of a weir floors
16. Draw a plan showing the general layout of head works of a perennial canal
17. Draw the alignment of a canal, distributor minors and water courses on contour map
18. Numerical problems on duty, delta and discharge
19. Draw the typical X-sections of channels
20. Numerical problems on velocity (Kennedy critical velocity & Lacey's regime velocity)
21. Draw the plan and section of a silt ejector
22. Draw the plane and L-section of a masonry flume
23. Drawings of an Aqueduct crossing
24. Drawings of a pipe outlet
25. Drawings of an A.P.M
26. Sketches of various canal falls
27. Determination of storage capacity of a reservoir
28. Draw the plan of a multipurpose irrigation project

REFERENCE BOOKS

1. Hydraulics Fluid Mechanics and Hydraulic Machines by R.S Khurmi
2. Irrigation Engineering by Dr. Iqbal Ali
3. Hydraulics & Fluid Mechanics by E.H. Lewitt.
4. Fluid Mechanics by Daughtar
5. Civil Engineering Hydraulics by J.R.D. Francis & Minton
6. The Fundamental Principles Irrigation Water Power by V.B Prcyani
7. Principles & Practice of Irrigation Engineering by S.K. Sharma

8. Irrigation Engineering by Birdie & Dass
9. Hydraulic Engineering by Sham Series
10. Irrigation Engineering by Punmia
11. Irrigation Engineering by V.B. Priyani
12. Irrigation Hand Book by Syed Inam Ali
13. Asan Abpashi by Abdullah Jan

CT-353 RAILWAYS, DOCKS, HARBORS AND BRIDGES

T	P	C
2	3	3

Total Contact Hours 160

Theory	64
Practical	96

AIMS: The student will be able to understand the fundamentals of construction, alignment and maintenance of tracks, bridges and harbors

COURSE CONTENTS

- 1. Introduction To Development Of Bridges** **4 hours**
 - 1.1 Definition of terms-Bridge, culvert, cause way, submersible bridge, clearance free board, Head room, highest flood level, low-water level, afflux, run off, water way, span, abutment, Wing walls, foundation, piers approaches deck, through, semi-through bridges.
 - 1.2 Structural parts of a bridge

- 2. Permanent Bridges** **6 hours**
 - 2.1 Permanent girder bridges, component parts & type-(R.C.C, steel & pre-stress conc.)
 - 2.2 Arch bridges-types (masonry, R.C.C, steel & prestressed conc.)
 - 2.3 Suspension & Rigid Frame bridge (R.C.C & steel)
 - 2.4 Permanent big bridges-Abutment, wing walls, approaches, pairs, & their foundation

- 3. Culvert** **4 hours**
 - 3.1 Types (pipe, box, arch, & slab)
 - 3.2 High level & low level cause way

- 4. Temporary Bridges** **4 hours**
 - 4.1 Introduction types (Wooden, suspended, floating & Moveable)
 - 4.2 Necessity & suitability

- 5. Selection Of Bridge Type & Site** **4 hours**
 - 5.1 Comparison of various types.
 - 5.2 Characteristics of an ideal site for a bridge (River & banks, foundation design & construction facilities, approaches)
 - 5.3 Location of an alignment
 - 5.4 Factor governing the choice of a bridge

- 6. Maintenance Of Bridges** **4 hours**
 - 6.1 Brief description of general maintenance

- 6.2 Brief description of maintenance of steel, masonry, R.C.C. bridges
- 6.3 Brief description of maintenance of cause ways.

- 7. Role Of Railways In Development Of A Country 4 hours**
 - 7.1 Introduction
 - 7.2 Railway system in Pakistan
 - 7.3 Comparison between Rail & Road transport

- 8. Permanent Way 8 hours**
 - 8.1 Definition, parts
 - 8.2 Requirement of permanent way
 - 8.3 Formation, ballast & sleepers of various types
 - 8.4 Gauge, their values
 - 8.5 Factors governing adoption of a particular gauge
 - 8.6 Rails-types Rail joints (including fastening-fish plates, bolts, spikes, chair and bearing plates)
 - 8.7 Railway carriage wheel, conning of wheels

- 9. Creep 4 hours**
 - 9.1 Definition
 - 9.2 Cause of creep
 - 9.3 Magnitude of creep
 - 9.4 Results of creep
 - 9.5 Methods of correction of creep

- 10. Points and Crossing 6 hours**
 - 10.1 Purpose
 - 10.2 Sleepers for point & crossing (through & inter excel sleepers)
 - 10.3 Switches-shapes, length of stock & tongue rails, heel clearance, switch angle, throw of switch
 - 10.4 Types of crossing
 - 10.5 Theoretical & actual nose of crossing
 - 10.6 Crossing angle & number
 - 10.7 Station yards and their layout.

- 11. Signals 4 hours**
 - 11.1 Purpose & types
 - 11.2 Classification according to function & location
 - 11.3 Signaling-objects
 - 11.4 Inter locking, principles & requirements
 - 11.5 Methods of inter-locking

12. Docks Harbors	6 hours
12.1 Definition of harbors	
12.2 Classification of harbors	
12.3 Requirement of a commercial harbor its location & size	
12.4 Tidal waves break water & their classification	
12.5 Wharves, quay walls & jetties, piers & landing, plate form	
12.6 Beach erosion & protection	
12.7 Classification	
12.8 Locks & lock gates	
13. Dredging	4 hours
13.1 Definition, types of dredging devices	
13.2 Disposal of dredged material	
14. Navigational Aids	2 hours
14.1 Brief description	
14.2 Types of signal-light house, Beacons, Light ship & buoy	

CT-353 RAILWAYS, DOCKS, HARBORS AND BRIDGES

INSTRUCTIONAL OBJECTIVES

- 1. Understand The Terms And Structural Parts Of A Bridge**
 - 1.1 Define the terms; bridge, culvert, causeway submersible bridge, clearances, free board, head room highest flood level, low water level, affix, run off, waterway, span, abutment, wing walls, piers, foundation, approaches, deck, through and semi through bridge.
 - 1.2 Describe with sketches the structural parts of bridge.
- 2. Understand The Different Types Of Permanent Bridges**
 - 2.1 Describe with sketches the component parts and different types of permanent girder bridge (R.C.C. steel and pre-stressed).
 - 2.2 Describe with sketches the component parts and different types of arch bridges (masonry, R.C.C steel and prestressed concrete).
 - 2.3 Describe with sketches the component parts and different types of suspension and rigid frame bridges (R.C.C and steel).
 - 2.4 Describe with sketches the component parts of permanent big bridge.
- 3. Understand The Different Types Of Culvert And Cause Way**
 - 3.1 Describe with sketches the different types of culverts (pipe-arch and slab).
 - 3.2 Describe with sketches the different types of cause way.
- 4. Understand The Types Of Suitability Of Temporary Bridges**
 - 4.1 State the features and types of temporary bridges. (Wooden, suspended, floating and moveable)
 - 4.2 Explain necessity and suitability of temporary bridges.
- 5. Understand The Selection Of A Bridge Site And Suitable Type Of Bridge**
 - 5.1 Compare various types of bridges.
 - 5.2 Explain the factors governing the choice of a bridge.
 - 5.3 Explain the factors influencing selection of alignment and site for a bridge.
- 6. Know Maintenance Of Different Types Of Bridges**
 - 6.1 State the general maintenance operation of bridge.
 - 6.2 State the maintenance operation of steel, masonry and R.C.C.
 - 6.3 State the maintenance operation of causeway.
- 7. Understand The Importance Of Railway**
 - 7.1 State the advantages of railway.
 - 7.2 State salient features of railway system in Pakistan.
 - 7.3 Compare rail and road transport.

8. Understand The Functions Of The Permanent Way

- 8.1 Define permanent way.
- 8.2 State the requirement of permanent way.
- 8.3 Explain the components parts of permanent way and their functions.
- 8.4 Explain the different types of rails, rail joints, rail fittings sleeper and its types, formation, ballast.
- 8.5 State the merits and demerits of different rails.
- 8.6 State the requirement of good rail joint and ballast.
- 8.7 Explain gauge and their values.
- 8.8 State factors governing adoption of a particular gauge.
- 8.9 State the terms railway carriage wheel and conning of wheels.

9. Understand The Creep And Its Correction

- 9.1 Define creep.
- 9.2 Explain the causes of creep.
- 9.3 Explain with sketch magnitude of creep.
- 9.4 State the results of creep.
- 9.5 State the methods of correction of creep.

10. Understand The Arrangements Of Points And Crossing For Safe Running Of Trains

- 10.1 State the purpose of points and crossing.
- 10.2 Describe with sketches the sleepers for point and crossing (through and interlaced sleepers).
- 10.3 Explain the terms switches, shapes, length of stock and tongue rails, head clearance, switch angle, through switches.
- 10.4 State the types of crossing.
- 10.5 Explain theoretical and actual nose of crossing.
- 10.6 Explain the terms crossing angle and number.
- 10.7 Explain station yards and sketch their layout.

11. Understand The Arrangements Of Signals For Safe Running Of Trains

- 11.1 State the purpose and types of signals.
- 11.2 State the classification of signals according to function and location.
- 11.3 Explain signaling and its objects.
- 11.4 Describe with sketches the inter locking its principles and requirements.
- 11.5 Explain the methods of inter locking.

12. Understand The Idea About Docks And Harbors

- 12.1 Define harbors.
- 12.2 State the classification of harbor.
- 12.3 Explain the requirement of a commercial harbor, its location and size.
- 12.4 Explain the terms tidal waves, break water and their classification.

- 12.5 Explain terms: Wharves, quay walls, jetties port, break water, docks dry and wet dock, moorings.
- 12.6 State the classification of docks.
- 12.7 State the terms locks and lock gate.

13. Understand The Purpose Of Dragging

- 13.1 State the necessity for dredging.
- 13.2 Explain the types of dredging devices.
- 13.3 Explain the methods of dredging.
- 13.4 Explain disposal of dredging material.

14. Understand Fundamentals Of The Navigation Aids

- 14.1 Describe navigation aids.
- 14.2 Explain types of signal, light house, beacons, light ship and buoy.

CT-353 RAILWAYS, DOCKS, HARBORS & BRIDGES

LIST OF PRACTICALS

1. Sketching Bridges according to
 - i. Function/purpose
 - ii. Materials of construction
 - iii. Relative portion of permanent floor
 - iv. Type of super structure
2. Drawing of RCC slab culvert
3. Drawing of high level & low level cause way
4. Drawing of RCC deck slab bridge having 2 spans 10 meter each
5. Visit to a nearby track, observation of parts drawing plan & cross section of permanent way
6. Drawing of the connection of rails to sleepers
7. Drawing of broad gauge track in cutting & filling
8. Drawing various types of rails and chairs.
9. Sketching various fastening
10. Sketching railway carriage wheel.
11. Sketching points and crossing and staling yards.
12. Sketching various types of signals. (common, semi phone, light disc and dwarf signals)
13. Sketch of various tools used in rail track maintenance.
14. Visit to a nearby harbor (if convenient) or sketching general layout of harbor.
15. Drawing sections of breakwater.
16. Drawing layout of typical harbor and outline the important structures.
17. Sketching jetties and pier, lock gates, quay, draggers
18. Sketching a typical light house, floating signal (beacon, buoys, mooring buoys.)

REFERENCE BOOKS

1. Bridge Engineering by J.S Alagia.
2. Road, Railways, Bridges and tunnel by Deshpande and Antia.
3. Railway Engineering by Deshpande.
4. Principles of Railway Engineering by S.C. Rangwala.
5. Dock and Harbors by Khan A.T.
6. Railway Dock and Harbors (Urdu) by A.B. Mallick
7. Railway Bridge Tunnel by Vazarni.
8. Bridge Engineering by Khatak
9. Operational Safety of Rail Transport in Pakistan by Abdul Kadoos.
10. Railway Tracks by Antia.
11. Railway Track Engineering by Agor

CT-364 CONCRETE TECHNOLOGY & RCC DESIGN

T	P	C
3	3	4

Total Contact Hours:192

Theory:	96
Practical:	96

AIMS:

1. Understand the properties and behavior of concrete and art of making good CONCRETE
2. Understand the fundamentals of R.C.C Design

COURSE CONTENTS

- 1. Ingredients Of Concrete** **6 hours**
 - 1.1 Cement-types, uses, properties, tests of cement
 - 1.2 Aggregates-classifications and their properties, bulking of sand, grading of fine and course aggregates.
 - 1.3 Water-impurities, effect of excess impurities, function of water in concrete.
- 2. Workability** **6 hours**
 - 2.1 Definition
 - 2.2 Factors affecting workability
 - 2.3 Water cement ratio-Hydration of cement, w/c ratio law, relations between w/c ratio and strength of concrete.
 - 2.4 Measurement of workability-slump test, compacting factor test, vee-bee test.
 - 2.5 Recommended slumps for various conditions of placement.
- 3. Mix Design** **6 hours**
 - 3.1 Object of mix design.
 - 3.2 Methods of proportioning-nominal mix, design mix.
 - 3.3 Method of batching.
 - 3.4 Pre-requisites for mix design.
 - 3.5 Procedure of mix design-nominal/ordinary concrete mix and controlled concrete mix.
- 4. Concreting Operations** **6 hours**
 - 4.1 Introduction-List of operation.
 - 4.2 Storing of concrete materials-cement, aggregates.
 - 4.3 Batching of materials, by volume, by weight.
 - 4.4 Mixing of concrete-hand mixing, machine mixing, mixers and types.

- 4.5 Transportation of concrete-methods, time factor, loss of moisture, pumping of concrete.
 - 4.6 Compaction-hand and machine compaction, vibrators, precautions.
 - 4.7 Finishing concrete surface-types
 - 4.8 Curing of concrete-object, methods duration of curing.
 - 4.9 Joints in concrete-types, construction and positions, joint fillers, joint treatments.
- 5. Properties Of Concrete 3 hours**
- 5.1 Properties of fresh concrete-segregation, bleeding, workability, harshness etc.
 - 5.2 Properties of harden concrete-strength, impermeability, durability, elasticity, shrinkage, creep, thermal expansion, factor affecting properties of concrete.
 - 5.3 Activities and admixtures-accelerators, retarders, water repelling agents, air entraining agents, and puzzolons.
- 6. Sampling And Testing Of Concrete 3 hours**
- 6.1 Laboratory conditions.
 - 6.2 Precautions in making test specimens
 - 6.3 Testing procedure.
 - 6.4 Non-destructive testing of concrete.
- 7. Special Concretes 3 hours**
- 7.1 light weight concrete, classifications properties, uses.
 - 7.2 High strength concrete.
 - 7.3 Mass concrete,
 - 7.4 Ready mixed concrete.
- 8. Reinforcement for R.C.C 3 hours**
- 8.1 Types and their properties.
 - 8.2 Storing cleaning bending, fixing, placing, binding.
- 9. Concreting Under Special Conditions 3 hours**
- 9.1 Effects of temperature on concrete.
 - 9.2 Recommended precautions and practice for hot weather concreting.
 - 9.3 Recommended precautions and practice for cold weather concreting.
 - 9.4 Under water concreting-method, precautions.
- 10. Introduction of R.C.C Design 6 hours**
- 10.1 Introduction to R.C.C. Design.
 - 10.2 Advantages and disadvantages of R.C.C.
 - 10.3 Grades of concrete, characteristics, compressive strength, tensile strength, modules of elasticity. Modular ratio.
 - 10.4 Working and ultimate stresses of concrete and steel

- 10.5 Bending moment and shear force in beams bending moment and shear force coefficient.
- 10.6 Loads to be adopted in R.C.C design-live loads, dead loads, wind load, seismic loads.
- 10.7 Code of practice for R.C.C. design, B.S code, and A.C.I. code
- 10.8 Methods of design-service load method (working stress method), strength method (limit-state design)

11. Shear And Bond Stresses In Beam 6 hours

- 11.1 Shear stresses in beam-horizontal shear, diagonal tension and compression
- 11.2 Types of shear reinforcements-stirrups, inclined bars
- 11.3 Design for diagonal tension, bent up bars, spacing of stirrups
- 11.4 Design problems
- 11.5 Bond between concrete and reinforcement bend stresses, development length, checking bond stresses in beam

12. Design Of Rectangular Beam 6 hours

- 12.1 Method of design (working stress method), assumptions used in working stress design
- 12.2 Derivation of flexure formula for R.C.C beam
- 12.3 Determination of design-constants for different values stresses and modular ratio
- 12.4 Balanced, under reinforced and over reinforced sections
- 12.5 Design of simple R.C.C beam code provisions, steps in design of R.C.C simple beam-design of simple supported, cantilever, over hanging beam under different situations.
- 12.6 Design of limits, design elements and procedure

13. Design Of One Way Slab/Slab Spanning In One Direction) 6 hours

- 13.1 Definition, one way slab, two way slabs
- 13.2 Code provisions and assumptions for design of one way slab- stiffness ratios, distribution steel, loads and its standard values, tension reinforcement
- 13.3 Design steps and formulae
- 13.4 Design of simply supported, overhanging one way slab in various situations

14. Design Of Doubly Reinforced Beam 6 hours

- 14.1 Definition, necessity and use, limitation
- 14.2 Methods of design, elastic theory, load factor
- 14.3 Elements and assumption related to design, method design steps.
- 14.4 Design of simply supported doubly reinforced beam.

15. Design Of Two Way Slab 5 hours

- 15.1 Definition, code provisions and assumption related to design.
- 15.2 Loads, bending moment coefficients and its use, torsion steel
- 15.3 Design of isolated and continuous two way slab.

16. Design Of Tee And Ell Beam	4 hours
16.1 Definition, necessity, advantages, main and secondary beam	
16.2 Code provisions, Load distribution, design formulae and procedure.	
16.3 Design simply reinforced Tee and Ell beam.	
16.4 Design procedure/steps for mains and secondary (Tee & Ell) beams.	
17. Design Of Axially Loaded Columns And Footings	6 hours
17.1 Short column	
17.2 Code provisions, design formulae and design procedure.	
17.3 Design of column section, longitudinal and transverse reinforcement.	
17.4 Footing for isolated column-load on foundation, size of footing for given bearing capacity punching shear, bending moment in base etc.	
17.5 Design depth of footing and reinforcements	
18. Design Of Simple Stair Case	3 hours
18.1 Types, spanning horizontally and spanning longitudinally.	
18.2 Loads, design elements procedure	
18.3 Design of stair spanning horizontal and longitudinally.	
19. Principles Of Prestressed Concrete	3 hours
19.1 Principles of prestressing	
19.2 Methods of tensioning-post tension pretensioning	
19.3 System of prestressing	
19.4 Steel and concrete used.	
19.5 Advantages of prestressed concrete over R.C.C.	
20. Seismic Design And Construction	6 hours
20.1 Seismic Design	
20.2 Horizontal structure	
20.3 Vertical structure	

CT-364 CONCRETE TECHNOLOGY & RCC DESIGN

INSTRUCTIONAL OBJECTIVES

- 1. Understand The Properties And Functions Of Ingredients Of Concrete**
 - 1.1 Describe the main properties of different types of cement and their uses
 - 1.2 Explain tests of cement i.e. Initial and final setting time test, soundness test, compression strength test and tensile test
 - 1.3 Define aggregates
 - 1.4 State classification of aggregates according to nature of formation, size and shape
 - 1.5 State the characteristics of good fine and course aggregates
 - 1.6 Explain the effects of bulking of sand on proportioning of materials and on strength of concrete
 - 1.7 Define importance of gradation of aggregated in strength design of concrete
 - 1.8 State sieve analysis of aggregates
 - 1.9 Explain the function of water in concrete
 - 1.10 State common impurities in water
 - 1.11 Explain the effects of excess impurities in water on strength of concrete

- 2. Understand The Importance Of Workability In Strength Design Of Connect**
 - 2.1 Define the term workability
 - 2.2 Explain the factors effecting on workability
 - 2.3 State relation ship between hydrations of cement and water content
 - 2.4 State the water cement ratio law
 - 2.5 State the limits of w/c ratio for hydration as well as for strength of concrete mix
 - 2.6 Explain the effects of w/c ratio on strength of harden concrete
 - 2.7 Describe various methods of measurement of workability such as, slump test, compacting factor test, vee test etc
 - 2.8 List the recommended slumps for various conditions of placement

- 3. Understand The Principles And Procedures Of Concrete Mix Design**
 - 3.1 Explain the objectives of mix design
 - 3.2 State pre-requisites for preparing a mix design
 - 3.3 Explain various methods used for proportioning of correct ingredients
 - 3.4 Explain procedure for proportioning of ordinary correct mix and adjustment on site for water content, bulking, absorption etc
 - 3.5 Solve problems on design of ordinary concrete mix
 - 3.6 Explain procedure for proportioning of design mix/controlled connect mix

- 4. Understand The Methods Of Batching, Mixing, Transporting, Placing, Compacting, Finishing, Jointing And Curing On Given Jobs**
 - 4.1 List the concreting operations
 - 4.2 Discuss the storing of concrete materials at job rite

- 4.3 Describe method of batching i.e. by volume and by weight
- 4.4 Explain the importance of weight batching
- 4.5 Explain the procedure of hand and machine mixing of concrete
- 4.6 State the types of concrete mixers
- 4.7 Explain various methods of transportation of fresh concrete
- 4.8 Explain the factors affecting the selection of a system of transportation
- 4.9 Explain the preparation of framework for concrete
- 4.10 Explain the method of placing steel
- 4.11 Explain the method of placing concrete
- 4.12 State various methods of compacting concrete
- 4.13 Explain the method of the compaction by vibrators
- 4.14 Explain the various methods of finishing concrete surface
- 4.15 Describe the object of curing
- 4.16 List the methods of curing
- 4.17 Explain each method of curing
- 4.18 Explain the need of joints in concrete structures
- 4.19 Explain the construction and position of construction joint, contraction joints and expansion joint
- 4.20 State various types of joint fillers
- 4.21 Explain procedure of treatment of joints
- 4.22 Perform supervision of concreting jobs independently.

5. Understand The Factors Influencing Concrete Properties

- 5.1 Explain the properties of fresh concrete such as workability, aggregation, bleeding and hardness.
- 5.2 Explain the properties of hardened concrete such as strength, impermeability, durability, elasticity, shrinkage, creep and thermal expansion
- 5.3 Explain compressive strength, tensile strength, shear strength, bond strength of concrete and describe relationship between them
- 5.4 Explain the factors affecting properties of concrete
- 5.5 State the purposes of additives and admixtures in concrete
- 5.6 Explain the suitability and function of different types of admixtures

6. Apply Principles And Techniques Of Testing Concrete To Practical Situation

- 6.1 List tests on concrete
- 6.2 Explain standard laboratory conditions for testing of concrete
- 6.3 Prepare the test specimen in laboratory as well as in field in order to test various strengths of concrete
- 6.4 State precautions in making test specimen and testing/breaking of test specimen
- 6.5 State the non-destructive tests of concrete

7. Understand Light Weight Concrete, High Strength Concretes Mass Concrete And Ready Mixed Concrete

- 7.1 State the types of light weight aggregates
- 7.2 Explain properties and uses of light weight concretes
- 7.3 State importance and uses of high strength concrete
- 7.4 Explain the special techniques involved in mass concreting
- 7.5 Explain necessity and manufacturing of ready mixed concrete

8. Know Methods And Procedures Of Laying Reinforcement

- 8.1 State the types of steel and their properties used in R.C.C
- 8.2 State standards for storing, straightening, cutting, bending, placing and binding reinforcement

9. Understand Standard Practices For Concreting Under Special Conditions

- 9.1 Explain the effects of temperature on concrete
- 9.2 Explain standard practices and precautions for hot and cold weather concreting
- 9.3 Explain methods of concreting under water

10. Understand Basic Concepts To Design R.C.C Member

- 10.1 Define R.C.C
- 10.2 State advantages and disadvantages of R.C.C
- 10.3 State grades of concrete, steel and their respective permissible stress
- 10.4 Solve examples on drawing shear force and bending moments diagram for cantilever, simply supported, and overhanging beams under various loading
- 10.5 Use standard tables of bending moment and shear force coefficients for finding bending moment in continuous beam
- 10.6 State the loads to be considered for design
- 10.7 State the methods of design of R.C.C structures i.e. service load method and strength method
- 10.8 State the codes of practice for R.C.C design such as B.S code and A.C.I code

11. Understand Shear And Bond In Beams

- 11.1 State shear stress in homogenous beam
- 11.2 Explain shear stress in R.C.C beam
- 11.3 Explain horizontal shear, diagonal tension and compression developed in a beam
- 11.4 State the types of shear reinforcement
- 11.5 Explain formulae and steps to be followed in the determination of number of stripes and mild bars as shear reinforcement
- 11.6 Explain bond between concrete and reinforcement
- 11.7 Explain the formula to check the bond stress in beams
- 11.8 Design sheer reinforcement for different types of beams and check for bond

12. Understand The Flexural Formula And Design Of Simple R.C.C Beam

- 12.1 State the assumption used in working stress method
- 12.2 Derive flexure formula for R.C.C beam
- 12.3 Calculate design-constants for different values of concrete and steel stresses and modular ratio
- 12.4 Explain balanced, under reinforced and over reinforced sections
- 12.5 Define simple R.C.C beam
- 12.6 State code provisions for design of beam i.e. effective span, beam dimension, concrete covers minimum and maximum reinforcement and spacing of bars etc
- 12.7 State the steps for the design of simple R.C.C beam
- 12.8 Design simply supported, cantilever and overhanging beam
- 12.9 State the steps and formulae to be followed in design of lintels
- 12.10 Design R.C.C lintel

13. Understand The Principles Involved In The Design Of Slab

- 13.1 Distinguish between one way and two way slab
- 13.2 State code provisions and assumption for design of one way slab
- 13.3 State the loads taken into account for design of slab
- 13.4 State the steps and formulae for designs of one way slab
- 13.5 Design simply supported, and overhanging one way slab

14. Understand Principles Involved In The Design Of Doubly Reinforced Beam

- 14.1 Explain necessity of compression reinforcements in beam
- 14.2 Explain various methods of design of doubly reinforced beam
- 14.3 Explain elements and assumption related to design of doubly reinforced beam
- 14.4 State steps and formulae for design
- 14.5 Design a simply supported doubly reinforced beam

15. Understand The Principles Involved In The Design Of Two Way Slab

- 15.1 Define two way slabs
- 15.2 Explain design elements
- 15.3 Use banding moment coefficients for different conditions
- 15.4 State code provisions for design of simply supported and continuous slabs
- 15.5 Solve problems on two way simply supported slabs

16. Understand Principles Involved In The Design Of Tee And Ell Beam

- 16.1 Define Tee beam
- 16.2 Explain advantages of Tee and Ell beams
- 16.3 State design elements and code provisions
- 16.4 Solve problem on simply supported Tee beam
- 16.5 Define main and secondary beam

17. Understand The Principles Involved In The Design Of Column And Column Footings

- 17.1 State design elements for column
- 17.2 Explain code provisions and formulae for the design of column and its footing
- 17.3 Calculate the loads coming over the column and design sections of column and footing according to bearing capacity
- 17.4 Compute longitudinal and transverse reinforcement
- 17.5 Calculate depth of footing and reinforcement
- 17.6 Design an isolated column footing

18. Understand The Procedure Involved In The Design Of Stairs

- 18.1 Distinguish between stair spanning horizontally and stair spanning longitudinally
- 18.2 Compute loads taken into accounts for design of stair
- 18.3 Explain code provisions and steps involved in the design of stairs
- 18.4 Design a simple stair;
 - i. Spanning horizontally
 - ii. Spanning longitudinally

19. Know About Principles Of Prestressed Concrete

- 19.1 Understand principles of prestressing and methods of tensioning
- 19.2 State the systems of prestressing such as Freyssinet, Magnel Blaton, and Lee Mecall systems
- 19.3 State the requirements of concrete and steel for prestressing
- 19.4 Explain the advantages of prestressed concrete over conventional R.C.C

20. Seismic Design And Construction

Students should be able to:

- 20.1 Explain how ductility and capacity work in a building
- 20.2 Outline the various seismic options for buildings
- 20.3 Identify transfer elements and diaphragms in buildings
- 20.4 Explain the role of horizontal elements as part of a seismic system and be able to sketch typical details
- 20.6 Identify the supervision requirements for horizontal structure
- 20.7 Identify vertical structural elements in buildings
- 20.8 Explain the role of vertical elements as part of a seismic system and be able to sketch typical Details identify the supervision requirements for vertical structure.

CT-364 CONCRETE TECHNOLOGY & RCC DESIGN

LIST OF PRACTICALS

Test on Cement

1. Preparation of cement paste of standard consistence
2. Determination of Initial and final setting time
3. Le-chatrelier's test for soundness of cement
4. Test for compressive strength of cement using mortar(1:3) cube
5. Briquette test for tensile strength of cement using mortar(1:3)

Test on Aggregates

6. Determine clay percentage in sand
7. Determination of particle size distribution of fine and coarse aggregates by sieve analysis
8. Determination of bulk density and voids in aggregates
9. Determination of flakiness index and elongation index of coarse aggregates
10. Determination of specific gravity and water absorption of aggregates

Test on Concrete

11. Test for workability of concrete by slump cone
12. Test for workability of concrete by compacting factor apparatus
13. Preparation of concrete cubes and cylinders, vibrated and hand compacted, hand mixed and machine mixed and with different water cement ratio
14. Determination of compression strength of concrete using cubes
15. Preparation of standard size beams for flexural strength of concrete
16. Modulus of rupture test, (breaking of beam prepared in above practical)
17. Split cylinder test for tensile strength of R.C.C concrete Design
18. Solve problems on bending moment and shear force in beams
19. Prepare a chart showing the values of moment of resistance for different values of f_c , f_t and m .
20. Design and drawing of simple rectangular R.C.C beam with U.D.L
21. Design and drawing of simply supported and overhanging one way slab
22. Design and drawing shear force reinforcements for a rectangular beam and check for bond
23. Design of cantilever beam and lintels.
24. Design and drawing of doubly reinforced beams along with shear reinforcement and check for bond
25. Design and drawing of two way slab
26. Design and drawing of simply supported Tee and Ell beams.
27. Design and drawing of main and secondary Tee & Ell beam for a hall
28. Design and drawing of R.C.C column with isolated footing
29. Design and drawing of stair case

Seismic Design and Construction

30. Site visit and report
31. Practical in class sessions and report.
32. Application of the RESIST Seismic Program to a practical issue.

REFERENCE BOOKS

1. Concrete Technology by Hando
2. Properties of Concrete by Neville
3. Concrete technology by Alyas Mughal
4. Elementary Reinforced concrete design by W. Morgan
5. R.C.C Design by J.L Sharma
6. R.C.C Design by C.K Wang
7. R. C. C. design by Nelson
8. **Seismic Design for Architects: Outwitting the Earthquake by Andrew Charleson
published by Elsevier**

CT-373 SOIL MECHANICS, HIGHWAY AND AIRPORTS

T	P	C
2	3	3

Total Contact Hours: 160

Theory	64
Practical	96

AIMS: Understand the fundamentals of soil mechanics Highways and air ports.

COURSE CONTENTS

- 1. Introduction** **4 hours**
 - 1.1. Definition of terms solid void voids, ratio Porosity degree of saturation, percentage of air void moisture and control and their interrelation.
 - 1.2. Special gravity and various densities.
 - 1.3. Numerical problem based on special gravity and density.

- 2. Plasticity** **2 hours**
 - 2.1. Description of Atter Berg's Limit.
 - 2.2. Methods of determination of Atter Berg's Limits for given soil sample.

- 3. Soil Classification** **6 hours**
 - 3.1. Introduction
 - 3.2. Necessity of classification.
 - 3.3. System of classification PRE classification particle size classification. Textural classification.
 - 3.4. Use of charts adopted by US Public road administration.

- 4. Compaction** **2 hours**
 - 4.1. Introduction and necessity.
 - 4.2. Proctor test standard modified
 - 4.3. Comparison between compaction and consolidation.
 - 4.4. Site procedure (field compaction methods - methods of relation compaction in field - core cutter method and sand replacement methods)

- 5. Permeability** **4 hours**
 - 5.1. Definition.
 - 5.2. Description of factors affecting permeability.
 - 5.3. Darcy's Law.
 - 5.4. Determination of coefficient of permeability constant head, variable head parameters and application of the formula $K=2.238$ for finding the coeff permeability in the field.

- 6. Shear Strength Of Soils** **2 hours**
- 6.1 Introduction to shear strength of soils.
 - 6.2 Shear box test and coulomb's Law.
- 7. Stability Of Slopes** **2 hours**
- 7.1 Factors contributing to slope failure.
 - 7.2 Remedial measure to avoid slop failures.
- 8. Bearing Capacity Of Soils** **4 hours**
- 8.1 Introduction to bearing capacity of soil.
 - 8.2 Factors affecting bearing capacity.
 - 8.3 Brief description of the method for finding bearing capacity by standard penetration test.
- 9. Highway Development And Planning** **2 hours**
- 9.1 Introduction importance of transportation and modes of transportation.
 - 9.2 Early road historical development of roads with special references to Pakistan.
 - 9.3 Description of terms Road highway, carriage way dual carriageway etc.
- 10. Road Alignment** **4 hours**
- 10.1 Introduction
 - 10.2 Fundamental principles.
 - 10.3 Factor controlling selection of road Alignment.
 - 10.4 Special consideration for hilly road grades and camber.
- 11. Highway Geometric Design** **4 hours**
- 11.1 Sight distance,Kerb, shoulder, footpath, driveway, right of way, bay of road.
 - 11.2 Necessity of super elevation.
 - 11.3 Derivation of formula for super elevation.
 - 11.4 Method of introducing super elevation.
 - 11.5 Widening at curves and formula.
- 12. Structures** **2 hours**
- 12.1 Types of roads.
 - 12.2 Components parts Soil grade, bare, bare surfacing consolidation.
 - 12.3 Types of surfacing earth, gravel,
 - 12.4 Economic consideration for selection of road surfaces.
 - 12.5 Road materials-stone aggregates, bituminous materials, cement and concrete.
 - 12.6 Retaining walls. Stone aggregates.
- 13. Road Construction** **4 hours**
- 13.1 Detailed construction of water bound macadam, road.
 - 13.2 Dust nuisance and its prevention.

13.3	Detailed construction of bituminous roads.	
13.4	Construction details of surfacing cold and hot process bituminous macadam, prefix asphalt macadam bituminous concrete pavement, sheet asphalt permanent.	
14.	Concrete Road	2 hours
14.1	Kinds premix conc., roads, cement bound macadam.	
14.2	Detailed construction of cone roads.	
14.3	Comparison between rigid and flexible pavements.	
15.	Drainage Of Roads	2 hours
15.1	Introduction	
15.2	Importance of highway drainage.	
15.3	Surface drainage.	
15.4	Sub-surface drainage.	
15.5	Drawings of slopes and version control.	
15.6	Catch water drain in hilly area.	
16.	Traffic Engineering	4 hours
16.1	Accidents and their causes.	
16.2	Method of prevention of accidents.	
16.3	Road junction.	
16.4	Design consideration for provision of junctions.	
16.5	Traffic island	
16.6	Refuse island.	
16.7	Pedestrian crossing.	
17.	Road Signs	2 hours
17.1	Introduction	
17.2	Characteristics of signs.	
17.3	Road signal, types and purposes.	
18.	Road Maintenance	2 hours
18.1	Resurfacing.	
18.2	Causes and repairs of Pot Holes, corrugations, ruts, repair to concrete roads.	
19.	Road Making Machinery	4 hours
19.1	Roller & its types	
19.2	Bulldozer, Premixing plant, tractors & trolleys.	
19.3	Grader.	
20.	Air Ports	6 hours
20.1	General layout.	
20.2	Consideration of its selection.	

- 20.3 Classification of Air Ports.
- 20.4 Terms used landing strip, approach zone, run way length, taxiway apron etc.

CT-373 SOIL MECHANICS, HIGHWAY AND AIRPORTS

INSTRUCTIONAL OBJECTIVES

1. Understand The Preliminary Definitions And Relationships

- 1.1 Define the terms, soil, voids, voids-ratio, porosity, degree of saturation, percentage air voids and moisture contents.
- 1.2 State three phase diagram of soil.
- 1.3 Define specific gravity and various densities of soil.
- 1.4 Solve the numerical problems based on 1.1 to 1.3

2. Understand The Plasticity Variation Of Soil

- 2.1 Describe the atterberg limits.
- 2.2 Explain the methods of determination of atterberg limits.

3. Understand The Classification Systems Of Soil

- 3.1 State classification and its necessity.
- 3.2 Explain PRA classification system, particle size classification system and textural classification system.
- 3.3 Explain the use of charts adopted by U.S public road administration.

4. Understand The Compaction Tests (Field And Lab)

- 4.1 State term compaction its significance.
- 4.2 Compare between compaction and consolidation.
- 4.3 List the procedure of standard proctor test and modified compaction test.
- 4.4 List the procedure of field compaction tests, core cutter method and sand replacement method.
- 4.5 State the factors affecting compaction.

5. Understand The Methods Of Determining The Permeability Of Soil

- 5.1 Define permeability.
- 5.2 Describe factors affecting permeability.
- 5.3 State the Darcy's law of permeability.
- 5.4 Explain the method of determining the permeability of soil

6. Know The Shear Strength Of Soil

- 6.1 State the term shear strength of soil & its significance.
- 6.2 State shear box test and coulomb's law.

7. Understand The Need Of Stability Of Slope

- 7.1 State the necessity, types and failure of slope.
- 7.2 State the factors contributing to slope failure.

7.3 Explain the remedial measure to avoid slope failure.

8. Understand The Bearing Capacity Of Soil

8.1 Define bearing capacity, ultimate bearing capacity and safe bearing capacity of soil.

8.2 State the factors affecting bearing capacity of soil.

8.3 Explain the method for finding bearing capacity of soil by standard penetration test.

9. Understand The High Way Development Planning

9.1 Explain the necessity, importance and modes of transportation.

9.2 State early roads and historical development of roads with special reference to Pakistan.

9.3 Describe the terms road, highway, carriage way, dual carriage way etc.

10. Understand The Highway Surveys Required For Roads

10.1 Define the term road alignment.

10.2 State the fundamental principles of road alignment.

10.3 State the factors influencing selection of alignment for a road in plain and hilly area.

10.4 Explain the surveys required for fixing alignment.

11. Understand Road Geometric (Super Elevation)

11.1 Define the terms Kerb, Shoulder, Footpath, Drive way, Right of way, Bay of roads.

11.2 Explain sight distance, stopping and over taking sight distance.

11.3 Describe method of introduction super elevation.

11.4 Explain widening at curves.

11.5 Derive formula for super-elevation.

12. Understand The Component Part Of Road Structure

12.1 Describe the types of roads with sketches.

12.2 Explain the component parts of road i.e. sub-grade, sub-base, base and surfacing.

12.3 State the types of surfacing earth surface, general surface, water bound, bituminous and concrete roads.

12.4 State the economic consideration for selection of road surfaces.

12.5 Describe the road materials, stone aggregate, bituminous materials, cement and cement concrete.

1 2.6 Describe the necessity and function of retaining walls, with sketches.

13. Understand The Construction Process Of Flexible Pavements

13.1 Explain the construction procedure of water bound macadam road.

13.2 Explain the dust nuisance and its prevention.

13.3 Explain the construction procedure of cone roads.

13.4 Explain the construction detail of surfacing cold and hot process bituminous macadam, premix asphalt macadam, bituminous concrete pavements and sheet asphalt pavement.

14. Understand The Construction Of Concrete Roads

- 14.1 Explain the construction of concrete roads.
- 14.2 Compare rigid and flexible pavements.

15. Understand The Drainage Of Roads

- 15.1 State the necessity and importance of highway drainage.
- 15.2 Describe with sketch surface drainage.
- 15.3 Describe with sketch sub-surface drainage.
- 15.4 State drainage of slopes and erosion control.
- 15.5 State catch water drain in hilly area.

16. Understand The Causes And Prevention Of Accidents And Understand Road Junctions, Traffic Island And Pedestrian Crossing

- 16.1 State accidents and their causes.
- 16.2 State method of prevention of accidents.
- 16.3 Describe with sketches road junction.
- 16.4 State design consideration for provision of junctions.
- 16.5 Describe with sketches traffic island refuge Island pedestrian crossing.

17. Understand The Purpose Of Road Signs And Signals

- 17.1 Describe with sketches different types of road sign.
- 17.2 Explain the characteristics of road sign.
- 17.3 Describe the purpose of road signals and their types.

18. Understand The Maintenance Of Roads

- 18.1 Explain resurfacing.
- 18.2 Describe the causes and repair of pot holes, castigations and ruts.
- 18.3 Describe the causes of defects of concrete road and its repair.

19. Understand The Function Of Different Type Of Machinery Used In Road Construction

- 19.1 Explain the working and uses of rollers, bulldozer, and grader.
- 19.2 Explain the working and uses of tar-boiler, premix plant, asphalt paver etc.

20. Understand The Layout And Components Of An Airport

- 20.1 Explain the terms, landing strip, approach zone, run way length, taxiway, apron, etc.
- 20.2 State the classification of an airport.
- 20.3 Sketch the general layout of various types of airport.
- 20.4 Explain the factors affecting for site selection of an air port.
- 20.5 Describe the run way pavements and its types.
- 20.6 Sketch different patterns of run way.
- 20.7 Explain the drainage systems of an air port.
- 20.8 Describe the routine and special repairs of run way.

CT-373 SOIL MECHANICS, HIGHWAY AND AIRPORTS

LIST OF PRACTICALS

1. Determination of moisture content in a given soil sample by
 - i. Speedy moisture content apparatus
 - ii. Oven method in the lab
2. Determination of specific gravity of given soil sample by pycnometer
3. Sieve analysis for a given soil sample in the lab.
4. Performing standard and modified Proctor test.
5. Finding field density by
 - i. Core cutter method
 - ii. Sand replacement method
6. Problem solving relating to Permeability
7. Direct shear test (shear box) on the given soil sample
8. Performing standard Penetration test and finding bearing capacity of the soil.
9. Drawing skeleton plan/map of Pakistan showing major roads.
10. Demarcation of road alignment on a given contour map.
11. Drawing typical cross-section of National and Provincial Highway.
12. Measurement of Stone metal at site and marking main quarries on Pakistan map.
13. Drawing typical cross-section of hill roads.
14. Sketching various road junction, traffic and refuge islands.
15. Sketching various types of traffic signs.
16. Sketching of subsurface drainage.
17. Visit to a road project under construction.
18. Preparation of general layout plan of an air port showing typical cross-section of run way.
19. Sketches of various air port patterns.

REFERENCE BOOKS

1. Soil Mechanics by Jumikis.
2. Soil Mechanics by M.S. Smith.
3. Soil Mechanics and Foundations by B.C. Punmia.
4. Road Engineering by Piryani.
5. Highway Engineering by Gurcharn Singh.
6. Development of Road and Road Transport in Pakistan by Khalifa Afzal Hussain.
7. Highway Engineering and Airports by K.L.Bhanot and S.B.Sehgal.

CT-381 CIVIL ENGINEERING PROJECTS

Total Contact Hours:96

Practical

96

T	P	C
0	3	1

AIM Apply concepts of Civil Engineering on designing actual projects and schemes.

LIST OF PROJECTS

96 hours

1. Design of single storey R.C.C. frame structure Slab, beams, columns, linnets & foundation. Prepare structural drawing and report.
2. Design underground/over head water reservoir (50,000 gallons) prepares structural drawing and report.
3. Layout, design, preparation of drawing and specification for a water supply scheme of a small (200 houses or 25 acres)
4. Layout, design, preparation of drawing and specification for a sewerage scheme of a small (200 houses or 25 acres).
5. Carry out high way project-layout, reconnaissance survey, selection of road alignment, topographic map and drawing longitudinal section and cross-section of a road (2 km long) and preparation of report.
6. Irrigation Project. Field work, topographic map, marking of alignment, detailed drawing, schedule of quantities and abstract of cost.

REFERENCE BOOK

1. Relevant books on the subject relating to the project.