Mehran University of Engineering & Technology, Jamshoro

Department of Civil Engineering

CURRICULUM

OF

B.E (CIVIL ENGINEERING)

(From 20-Batch to 22-Batch)

SCHEME OF STUDIES OF B.E. CIVIL ENGINEERING WITH EFFECT FROM 20- BATCH TO 22-BATCH UNDER OBE SYSTEM

1st Semester				2nd Semester			
Course ID	Subject	Theory (CH)	Practical (CH)	Course ID	Subject	Theory (CH)	Practical (CH)
CE102	Geometrical Drawing	02	01	CE112	Surveying-I	02	01
CE106	Civil Engineering Materials	03	01	MTH108	Applied Calculus	03	00
CE116	Engineering Mechanics	03	01	PS106	Pakistan Studies	02	00
ENG101	Functional English	03	00	SS111/ SS104	Islamic Studies / Ethics	02	00
CS146	Introduction to Computing & Programming	02	01	CE122	Civil Engineering Drawing	02	01
				CE125	Engineering Geology	03	01
Total		**13**	**04**	**Total**		**14**	**03**

3rd Semester				4th Semester			
Course ID	Subject	Theory (CH)	Practical (CH)	Course ID	Subject	Theory (CH)	Practical (CH)
CE207	***Railways and Waterways Engineering***	***03***	***00***	**CE241**	Applied Hydraulics	03	01
CE212	***Mechanics of Solids-I***	***02***	***01***	CE231	Construction Engineering	03	00
MTH204	Differential Equations, Fourier Series and Laplace Transforms	03	00	***CE251***	***Mechanics of Solids-II***	***03***	***00***
CE227	Fluids Mechanics and Hydraulics	03	01	MTH206	Complex Analysis, Statistical Methods and Probability	03	00
ENG201	**Communication Skills**	**02**	**00**	**CE202**	**Surveying-II**	**03**	**01**
CE222	***Theory of Structures***	***02***	***00***	CE246	Architectural and Town Planning	02	00
Total		**15**	**02**	**Total**		**17**	**02**

5th Semester				6th Semester			
Course ID	Subject	Theory (CH)	Practical (CH)	Course ID	Subject	Theory (CH)	Practical (CH)
MTH303	Linear Algebra and Numerical Methods	03	01	**CE351**	**Environmental Engineering-I**	**02**	**01**
CE306	Structural Analysis	03	00	CE326	Soil Mechanics	03	01
CE345	Plain and Reinforced Concrete	03	01	***CE337***	***Reinforced and Pre-Stressed Concrete***	***03***	***00***
CE362	***Hydrology***	***03***	***00***	CE316	Steel Structures	03	00
CE355	Project Management	02	00	**ENG301**	**Technical & Scientific writing**	**02**	**00**
CE366	***Geometric Design of Highways and Airports***	***02***	***00***	**CE341**	**Quantity Surveying and Estimation**	**03**	**00**
Total		**16**	**02**	**Total**		**16**	**02**

7th Semester				8th Semester			
Course ID	Subject	Theory (CH)	Practical (CH)	Course ID	Subject	Theory (CH)	Practical (CH)
CE406	Structural Design and Drawing	03	01	CE426	Foundation Engineering	03	00
CE411	Geotechnical Engineering	03	01	***CE443***	***Irrigation and Drainage Engineering***	***03***	***01***
CE431	Environmental Engineering-II	03	00	***CE438***	***Construction Planning & Management***	***03***	***00***
CE422	***Professional Ethics***	***02***	***00***	***CE451***	***Traffic Engineering and Pavement Design***	***02***	***01***
CE423	***Engineering Economics***	***02***	***00***	CE499	Final Year Project (FYP)-II	00	03
CE498	Final Year Project (FYP)-I	00	03				
Total		**13**	**05**	**Total**		**11**	**05**

Total Credit Hours = 140 C.H

Non-Engineering Courses …… 41 CH
Engineering Courses. ..... 99 CH

Courses Vs PLOs for 20CE-Batch														
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels											
			1	2	3	4	5	6	7	8	9	10	11	12
1.	CE102	Geometrical Drawing	C3,P3,P4											
	CE106	Civil Engineering Materials	C2			C3,P3								
	CE116	Engineering Mechanics	C3	C4		P4								
	FE101	Functional English		C3								C3		C2
	CS146	Introduction to Computing & Programming	C2		C3,P3		C3							
2.	CE112	Surveying-I	C2	C3			P4							
	MTH108	Applied Calculus	C2,C2,C3											
	SS111/SS 104	Islamic Studies / Ethics						C2		C2				
	PS106	Pakistan Studies						C2, C2						
	CE122	Civil Engineering Drawing	C3				P4							
	CE125	Engineering Geology	C1,C2			P4								
3.	CE222	Theory of Structures		C4, C5										
	CE207	Railways and Waterways Engineering	C2		C3									
	CE212	Mechanics of Solids-I	C3	C4		P3								
	MTH204	Differential Equations, Fourier Series and Laplace Transforms	C2,C2,C2											
	ENG201	Communication Skills									C3	C6		
	CE227	Fluid Mechanics & Hydraulics	C2	C3		P3								
4.	CE202	Surveying-II		C3	C3		P4							
	CE241	Applied Hydraulics		C4	C6	P5								
	CE231	Construction Engineering	C2	C3										

Courses Vs PLOs for 20CE-Batch														
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels											
			1	2	3	4	5	6	7	8	9	10	11	12
	CE251	Mechanics of Solids-II	C2	C4										
	MTH206	Complex Analysis, Statistical Methods and Probability	C2,C2,C2											
	CE246	Architecture & Town Planning	C2		C3									
5.	MTH303	Linear Algebra and Numerical Methods	C2,C2,C2				C2,C2,C2							
	CE306	Structural Analysis		C4	C3									
	CE345	Plain & Reinforced Concrete	C2		C6	P3								
	CE362	Hydrology	C2			C4								
	CE355	Project Management											C2, C3	
	CE366	Geometric Design of Highways and Airports	C2		C6									
6.	CE351	Environmental Engineering-I		C2		C5, P3								
	CE326	Soil Mechanics				C3,C4,P3								
	CE337	Reinforced & Prestressed Concrete	C2		C4									
	CE316	Steel Structures	C2		C4									
	CE341	Quantity Surveying and Estimation		C3		C4								
	ENG301	Technical and Scientific Writing										C4, C6		
7.	CE406	Structural Design & Drawing			C6, C2		P3							
	CE411	Geotechnical Engineering				C4, P3	C2							
	CE431	Environmental Engineering-II	C2	C2	C6				C6					

Courses Vs PLOs for 20CE-Batch													
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels										
			1	2	3	4	5	6	7	8	9	10	11	12
	CE422	Professional Ethics						A3		A2				
	CE423	Engineering Economics	C2	C3										
	CE498	Project / Thesis-I	C3	C5	C6					A3	A2	A5		
8.	CE426	Foundation Engineering			C6		C2							
	CE443	Irrigation and Drainage Engineering		C3	C6		P3							
	CE438	Construction Planning & Management											C2,C3	
	CE451	Traffic Management and Pavement Design			C3	C6, P3								
	CE499	Project / Thesis-II			P7						A2	A5	P5	A5

Title of Subject	**:**	**Geometrical Drawing (Th + Pr)**
Code	**:**	CE102
Discipline	**:**	Civil Engineering (1st Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Nil **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	02 + 01 **Marks :** 50 + 50
Minimum Contact Hours:		30 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	PREPARE orthographic projections of points, lines, planes and solids.	C3	1
2	**PRACTICE orthographic projections of points, lines, planes and solids.**	P3	1
3	MAKE isometric view of solids.	P4	1

Course outline:

- **Introduction**
  Drawing instruments and their use, Types of lines, Dimensioning and planning of a drawing sheet, Standard drafting conventions, Principal requirements of Geometric Drawing.

- **Projections**
  Orthographic projection of points in quadrants, First and third angle projections, Orthographic projection of lines and planes in simple and inclined positions, Traces, Basic solids, Axes of prisms and cylinders inclined to both reference planes, Isometric projections, Free hand isometric sketches of solids.

Practical work to be carried out:

1. To know about different drawing instruments & their usage in geometrical drawing and introduction of HSE measures.
2. To draw the projection of points, when point is in 1st and 2nd quadrant.
3. To draw the projection of points, when point is in 3rd and 4th quadrant.
4. To draw the projection of straight lines parallel to both planes.
5. To draw the projection of straight lines parallel to one & perpendicular to another plane.
6. To draw the projection of straight lines parallel to one & inclined to another plane.
7. To draw the projection of straight lines inclined to both planes.
8. To draw the projection of inclined lines with horizontal traces.
9. To draw the projection of inclined lines with vertical traces.
10. To draw the projection of perpendicular planes.
11. To draw the projection of oblique planes.

12. To draw the projection of solids in simple position.
13. To draw the projection of solids inclined to reference planes.
14. To draw the isometric projection of solids.
15. To perform an open-ended lab.

Recommended Books:

- Engineering Drawing, Bhatt ND, Charotor Publishing House India. Latest Edition
- Engineering Drawing and Geometry, Hoelscher RP and Springer CH, John Wiley & Sons, Inc., U.S. Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Civil Engineering Materials (Th + Pr)**
Code	**:**	CE106
Discipline	**:**	Civil Engineering (1st Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Nil **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Contact Hours:		48 + 48

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN various materials and their physical characteristics used in different types of civil engineering works.	C2	1
2	ILLUSTRATE the suitability of different materials and their behaviour for their use in civil engineering projects.	C3	4
3	PRACTICE various laboratorial and field tests to obtain physical properties of different materials.	P3	4

Course outline:

- **Bricks and Tiles**
  General characteristics, Varieties, Manufacturing, Strength tests, Uses.
- **Building Stone**
  Quarrying, Dressing, Varieties, Strength tests, Uses.
- **Aggregates**
  Characteristics and classifications, Fineness modulus, Strength and durability, Quality tests of aggregates.
- **Cement**
  Manufacturing, Properties and uses of cement, Types of cement, Quality tests
- **Lime**
  Composition, Manufacturing, Varieties, Uses
- **Concrete**
  Composition, Varieties, Properties, Tests and uses
- **Timber**
  Varieties and uses, Identification, Methods of seasoning and sawing, Decay and preservation of timber, Laminated materials
- **Glass**
  Composition, Varieties, Properties, Uses.
- **Metals and Alloys**
  Manufacturing, characteristics, strength and uses of different metals & alloys, Ferrous and non-ferrous metals and alloys, Iron and its types, Reinforcing steel bars, copper, tin, zinc,

lead, aluminium, nickel, brass and bronze, Induced corrosion and methods of corrosion control, Catholic protection, epoxy coats, antirust compounds. Galvanizing

- **Pipes and Sheets**
  Pipes, their types and uses, Plain and corrugated sheets.
- **Paints and Plasters**
  Composition, Preparation, Properties, Tests, Uses of paints, plasters, Varnishes and distempers.
- **Other Materials**
  Composition, preparation, tests and uses of Bitumen, Asphalt, Tar, Plastics, Fibre Glass, Epoxy, Bearing Pads, Resin materials, Laminates, Adhesive, Asbestos, Gypsum.

Practical Work to be carried out:

1. a). Introduction to the "Material Testing Laboratory" and HSE (Health, Safety and Environment) measures.
   b). To introduce the Civil Engineering Materials which are most commonly used for construction.
2. To determine the Particle Size Distribution of Coarse Aggregates by Sieve Analysis Method and to determine Fineness Modulus of Coarse Aggregates
3. To determine the Particle Size Distribution of Coarse Aggregates by Sieve Analysis Method and to determine Fineness Modulus of Fine Aggregates
4. To determine Specific Gravity and Water Absorption of Coarse Aggregate.
5. To determine the Bulking of Sand.
6. To determine the Efflorescence of a Burnt Clay Brick by Efflorescence test.
7. To determine the "Water Absorption" percent by mass of Burnt Clay Bricks.
8. To determine the Compressive Strength of a Burnt Clay Brick Using Universal Testing Machine (UTM).
9. To determine the Dimension Tolerance Test of a Burnt Clay Brick.
10. To determine the Fineness of Ordinary Portland Cement (OPC) by Sieving Through IS.75 / BS.200 / ASTM.200 Sieve.
11. To determine the Normal Consistency of Ordinary Portland Cement (O.P.C) by Using Vicat's Apparatus (VA) With Plunger Attachment
12. To determine the Initial and Final Setting Time of Cement Paste by Vicat's Apparatus with Different Needle Attachment.
13. To determine the Diameter, Unit Weight and Bending of Steel bar, the Yield Strength, Proportional Limit, and Ultimate Strength for Steel Bar.
14. To determine the impact resistance of tiles.
15. To perform an open-ended lab.

Recommended Books:

- Engineering Material and their application, Flinn. Richad. A Boston-Houghton Mifflin Co, Latest Edition
- Engineering Material, Surendra Singh, Vikas Publishing House Delhi, Latest Edition
- Engineering Material, R.S Deshpande, Poona United Book corporation, Latest Edition

Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Engineering Mechanics (Th + Pr)**
Code	**:**	**CE116**
Discipline	**:**	Civil Engineering (1st Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Nil **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO No.	Description	Taxonomy Level	PLO
1	ANALYZE the two-dimensional Force System and Equilibrium conditions by applying the basic principles of statics.	C4	2
2	APPLY fundamental concepts of kinetics and kinematics to the analysis of a body when it is subjected to different types of motion.	C3	1
3	DEMONSTRATE external behavior of bodies subject to force system and equilibrium.	P4	4

Contents:

- **Introduction:** Concept of mass, force, time and space, Scalar and Vector quantities
- **System of Forces:** Force types, characteristics and system of forces, resolution and composition of force system by analytical and graphical method, Concept of moment of force, Principle of Transmissibility, Principle of Moment
- **Equilibrium of Rigid Bodies:** Equilibrium and its Conditions, free body diagram and its application. Equilibrium of Rigid Body, Determination of Support Reactions
- **Friction:** Concepts, laws of friction, Friction on horizontal and inclined plane, angle and co-efficient of friction.
- **Kinematics:** Newton's laws of motion, motion under constant acceleration, motion under variable acceleration, Projectile Motion, Simple harmonic motion
- **Kinetics:** Work, Power, Energy and laws of conservation of energy.

Practical Work to be carried out:

1. Introduction to the Engineering Mechanics Laboratory and HSE (Health, Safety and Environment) measures.
2. To verify Parallelogram law of forces by using Force Board.
3. To verify Triangle law of forces by using Force Board.
4. To verify Polygon law of forces by using Force Board.
5. To verify the polygon law of forces using Funicular polygon apparatus.
6. To verify the first condition of equilibrium using Force Board.
7. To verify the second condition of equilibrium using meter scale-beam method Board.
8. To find out the co-efficient of friction on horizontal steel plane for various materials.
9. To find out the angle of static, dynamic friction and the coefficient of friction between various materials on inclined steel plane for various materials.

10. To find out the angle of static, dynamic friction and the coefficient of friction between various materials on precision friction force apparatus at different speeds.
11. To verify that the centrifugal force varies in direct proportion to mass of rotating body, square of speed of rotation and the radius of gyration.
12. To determine the experimental values of the force in the principal parts of the Jib Crane and to see the effect of altering the tie length.
13. To compare the results of wall Jib crane with the forces obtained from graphical solutions using polygon or triangle law of forces.
14. To measure the bending moment and shear force at a normal section of a loaded beam and to check its agreement with theory.
15. To perform an open-ended lab.

Recommended Books:

- Engineering Mechanics, R.C Hibbler, Prentice Haul IC, Latest Edition
- Engineering Mechanics, F.L Singer, Harper & Row Publisher, Latest Edition
- Engineering Mechanics, R.S Khurmi, Poona United Book Corporation, Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Introduction to Computing and Programming (Th + Pr)**
Code	**:**	CS146
Discipline	**:**	Civil Engineering (1st Semester)
Effective	**:**	18-Batch and onwards
Pre-requisite	**:**	--- **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	02 + 01 **Marks :** 50 + 50
Minimum Contact Hours:		30 + 45

Specific Objectives of course:

- To know the computer, its different parts of their working.
- C++ Programming and its use in Civil Engineering.

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND basic computer organization and functions of various computer hardware and software components.	C2	1
2	APPLY effective solutions to computer oriented civil engineering problems.	C3	3 & 5
3	Capable of effectively USING computer applications to ease civil engineering design processes.	P3	3

Course outline:

- **Introduction to Computers**

  Generations of computers, Application areas of computer Information/Data Processing Cycle, Number systems (Binary, Octal, Decimal, Hexadecimal), Input, output and peripheral Devices, Computer Memory: RAM, ROM, SRAM, DRAM, PROM, EPROM, EEPROM, Primary, cache memory, Secondary storage: Magnetic, Optical and solid state, Units of memory measurement, Basic CPU organization, Parts of CPU: ALU, MU, CU, FPU and Registers, Basic functions of operating system, Computer software and its types, Basics of computer networks.

- **Programming Fundamentals**

  Instruction and program, Source and object code, Language Translators: Assembler, Interpreter and Compiler, Bug and Debugging, Compilation process, Basic C++ program structure, Statement, functions, header files, Conditional controlled structures: If, If-Else, Else-If, Switch, Iterative control structures: for, while, do-while, break and continue, Arrays: one and multi-dimensional, Strings, Functions: predefined and user-defined, Structures and nested structures.

Practical Work to be carried out:

1. Introduction to computers and its parts.
2. Get familiar with input/output devices.
3. Introduction to various OS and working with DOS and its commands.
4. Working with word, excel and PowerPoint.
5. Working with windows accessories, system tools and internet.
6. Getting familiar with Code::Blocks and Dev Cpp IDE and writing basic C++ programs.
7. Creating variables and working with data types in C++.
8. Working with Operators of C++.
9. Working with Conditional Control Structures-I of C++.
10. Working with Conditional Control Structures-II of C++.
11. Working with Iterative Control Structure of C++.
12. Working with One-Dimensional and Two-Dimensional Arrays in C++.
13. Working with Functions in C++.
14. Working with Structures in C++.
15. Working with Stings in C++.

Recommended Books:

- Computing Essentials Latest Complete Edition, Timothy J. O'Leary and Linda I. O'Leary
- Discovering Computers: Fundamentals, Latest Edition, Shelly Cashman Series
- Problem Solving and Programming Concepts, Latest Edition, Maureen Sprankle and Jim Hubbard
- C++ Programming: From Problem Analysis to Program Design, Latest Edition, D.S. Malik

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Approval:

Board of Studies:	**Resolution No. 30.2**	**Dated: 07-08-2018**
Board of Faculty:	**Resolution No. 18.3**	**Dated: 11-09-2018**
Academic Council:	**Resolution No. 93.8(b)**	**Dated: 04-10-2018**

Title of Subject	**:**	**Surveying-I (Th + Pr)**
Code	**:**	**CE112**
Discipline	**:**	Civil Engineering (2nd Semester)
Effective	**:**	20-Batch and Onwards
Pre-requisite	**:**	Nil **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	02 + 01 **Marks :** 50 + 50
Minimum Contact Hours:		30 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS various survey equipment and techniques to be used for linear and angular measurements and for computing the areas of plots.	C2	1
2	PREPARE the L-section and X-section using the computations of levels.	C3	2
3	EXECUTE various surveying instruments used for linear and angular measurements.	P4	5

Course outline:

- **Introduction**
  Introduction to Surveying, Classification of surveying.

- **Measurement of Distance**
  Various methods of measuring distance, Instruments for measuring distance and marking stations, Ranging out survey lines, Chaining on sloping ground.

- **Chain Surveying**
  Introduction to Chain Surveying, Offset and its types, Obstacles in Chain Surveying, Layout by Offset Method.

- **Traverse Survey**
  Traverse, types of traverse, Bearing and designation of bearings, Local attraction, magnetic declination, Equipment used for finding Bearings, Computation of Bearings and Angles.

- **Levelling**
  Definition, principles, classification of levelling, Types of levels and their temporary and permanent adjustments, Booking and reduction of levels, Profile and cross-section levelling, contouring.
- **Computation of Areas and Volume**
  Computation of areas by using mid-ordinate rule, average ordinate rule, trapezoidal and Simpson rule, Computation of areas by co-ordinates, Computation of volume by trapezoidal and end area method.

- **Surveying Drafting**
  Plotting Profiles, Cross Sections, Plans and Contours.

Practical Work to be carried out:

1. a). Introduction to Health and Safety measures in Surveying Lab.
   b). Introduction to various Surveying Instruments.
2. To range out a survey line when the two ends of a line are inter-visible from each end.
3. To measure the horizontal distance between two terminal stations by different methods. (Pacing, Measuring Tape and Chain).
4. To range out a survey line and mark the intermediate points when two ends of lines are not inter-visible from each end. (Indirect Ranging).
5. To determine the horizontal distance between the two terminal stations on a sloping ground by (i). Stepping Method. (ii). Using Abney Level
6. To set out the base line and Perpendicular lines / Offsets in the field.
7. Layout of rooms of a house by offset method using Pythagoras Theorem.
8. Introduction to Automatic Level and Temporary Adjustment of an Automatic Level.
9. To determine the Staff Readings at different points on the natural ground by Auto Level.
10. To determine the reduced level of an existing Road-Profile Levelling.
11. To collect data for cross sectional levelling of a proposed road using Auto Level.
12. To draw Profile of a Road (L-section) from the obtained level data.
13. To draw Cross sections of a proposed road from obtained level data.
14. To determine area of an irregular boundary by Simpson's Rule.
15. To perform an open-ended lab.

Recommended Books:

- Plane Surveying, Dr A M Chandra, Latest Edition
- Surveying Vol: (I + II), B.C Punmia, Latest Edition
- Surveying Practice, Jerry. A. Nothanson and Philip Kissam, Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Civil Engineering Drawing (Th + Pr)**
Code	**:**	CE122
Discipline	**:**	Civil Engineering (2nd Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Geometrical Drawing **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	02 + 01 **Marks :** 50 + 50
Minimum Contact Hours:		30 + 45

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	PREPARE plans, elevations and sections of various civil engineering works and related works.	C3	1
2	MAKE drawings of civil engineering works using modern tools.	P4	5

Course outline:

- **Introduction**

  Need and requirement of drawings for civil engineering works, General nature of drawings, Components, symbols and nomenclature needed for specific drawings such as architectural, plumbing, electrical, roads and earthwork, Drawing at various stages of works.

- **Architectural Drawing**

  Elements of architectural planning and design, Schematic and working drawings and details of residential, commercial, religious, recreational, industrial, clinical, hospital and educational buildings, Working drawings of Foundation, Beam and Column, Details of doors, windows and staircases.

Practical work to be carried out:

1. To know about different tools used in Civil Engineering Drawing and introduction of HSE measures.
2. To draw plan, elevation and section of one room.
3. To draw plan, elevation and section of two room with verandah.
4. To draw the plan, elevation and cross section of Beam and column.
5. To draw the plan and elevation of different types of stairs.
6. Introduction to AutoCAD software and to know about UNITS and DIMENSIONS in Auto CAD.
7. To know the procedure and usage of different commands of DRAW, PROPERTIES, INQUAIRY and DIMENSION toll bar.
8. To know the procedure and usage of different commands of MODIFAY and LAYER toll bar.
9. To draw irregular closed figure and calculate its area and perimeter in AutoCAD.
10. To draw the architect plan, elevation and cross section of single room and double room with verandah in AutoCAD.
11. To draw the architect plan and layout of bungalow in AutoCAD.
12. To draw the plan, elevation and cross section of isolated column with footing and plinth beam in AutoCAD.
13. To draw the plan of half turn staircase in AutoCAD.

14. To draw the plumbing plan of house in Auto CAD.
15. To Perform an open-ended lab.

Recommended Books:

- Civil Engineering Drawing, M. Chakraborti, Malik Book Depot, Lahore, Latest Edition
- Civil Engineering Drawing, Gurcharan Singh, Malik Book Depot, Lahore, Latest Edition
- Introduction to AutoCAD® 2016 2D and 3D Design, Berned S Palm and Alf Yarwood, AutoDesk, Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
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Title of Subject	**:**	**Engineering Geology (Th + Pr)**
Code	**:**	CE125
Discipline	**:**	Civil Engineering (2nd Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Civil Engineering Materials **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	IDENTIFY the minerals, rocks, and their physical properties.	C1	1
2	DISCUSS structural geology, geo-hazards, hydrogeology, tunnelling and site for the important Civil Engineering projects.	C2	1
3	MAKE drawing of cross sections and landslide models and recognize the physical and chemical properties of rocks and minerals; and folds and faults in rocks.	P4	4

Course outline:

- **Introduction**

  Introduction to Geology and Engineering Geology, Engineering Geology versus Geology, Importance of Engineering Geology for Civil Engineering Projects, Geological Science and Subdivisions: Earth's Materials, Earth's Process, Earth's History, Structure and Composition of the Earth, Geological Times, Sequence and Principles of Stratigraphy.
- **Minerals and Rocks**

  Introduction to Minerals and Rocks, Identification of Minerals, Crystal Form of Minerals, Rocks: Igneous, Sedimentary and Metamorphic, Rock Cycle, Rock-Forming Minerals, Physical Properties of Rocks and Minerals and Their Determination, Classification of Rocks and Minerals with Respect to Color, Hardness, Grain Size, Texture, Strength and Weathering, Identification of Common Rock Types and Their Engineering Properties: Shales, Sandstones and Limestone.
- **Structural Geology**

  Introduction to Structural Geology, Dip and Strike, Folds and Their Types, Faults and their Causes, Classification of Faults with Respect to Relative Moment, Dip and Strike of Strata, Amount of Inclination, Mode of Occurrence, Joints and Their Classification, Field Interpretation of Folds Faults and Joints, Structures due to Denudation.
- **Earthquakes**

  Tectonics Plates, Earthquakes and Their Causes, Measurements of Earthquakes, Protective Measures against Earthquakes, Earthquake Zoning of Pakistan.

- **Earthflows and Land Sliding**

  Introduction to Earthflows and Land Sliding, Types of Earthflows: Soil Creep, Rock Creep, Solifluction and Mudflows, Causes of Earthflows, Types of Land Sliding: Slump, Rockslides and Rock Falls, Causes of Land Slides.

- **Hydrogeology:**
  Introduction to Wells, Springs, Streams, Ground Water, and Glaciers, Types of Wells, Springs, Streams, Ground Water, and Glaciers.

- **Tunnelling**
  Introduction to Tunnels, Types of Tunnels, Tunnel Construction Methods in Rocks, Geological Survey Prior to Tunnelling, Lining of Tunnels and Its Sections.

- **Selection of Sites for Civil Engineering Projects**
  Role of Geology in Selection of Sites for Dams, Reservoirs, Tunnels and Other Civil Engineering Projects, Such as Highways, Airfields and Bridges, Brief Introduction of Local Geology.

Practical work to be carried out:

1. Introduction to the Engineering Geology Laboratory and HSE (Health, Safety and Environment) measures
2. To determine the hardness of minerals using Moh's scale.
3. To determine the streak of minerals.
4. To determine the compressive strength of rocks using Schmitt hammer.
5. To determine the unconfined compressive strength of rocks in UTM machine.
6. To determine the tensile strength of rocks in UTM machine.
7. To determine the slake durability index (Weathering) of rocks.
8. To determine the presence of carbonates in rocks using acid test.
9. To observe the folds using sand box.
10. To observe the different types of faults using sand box.
11. To distinguish the folds and faults in rocks at site
12. To prepare the rainfall-induced landslide in landslide Physical Model.
13. To prepare the relationship between rainfall intensity and erosion using landslide physical model.
14. To prepare drawing of Cross Sections from Geological maps.
15. To perform an open-ended lab.

Recommended Books:

- A Geology for Engineers, Blyth, F.G.H, Arnold International, Latest Edition
- Geology and Engineering, Legget, R.F, McGraw Hill International, Latest Edition
- Goodman, R.E: Engineering Geology: Rock in Engineering Construction, John Wiley & Sons, Inc., Singapore, Latest Edition

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Title of Subject	**:**	**Railways and Waterways Engineering (Th)**
Code	**:**	CE207
Discipline	**:**	Civil Engineering (3rd Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Nil **Co-requisite:** Nil
Assessment	**:**	20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS concepts of transportation systems and its planning in solving unban transportation problems.	C2	1
2	APPLY the principles of transportation engineering to solve the problems that are most likely to be encountered in the planning and design of railways and coastal structures based on best practices and guidelines.	C3	3

Course outline:

- **Introduction to Transportation Systems and Planning**

  Comparison of different modes of transportation, Phases of planning, Planning process and mode choice decisions, Urban transportation problems: Transportation and urban growth, Mass transit system, Comparison of different transit modes, Transit and environment, Transit and urban sustainability.

- **Railway Engineering**

  Introduction, planning, routes of railways, crossings and transfer, passengers' traffic and stations, planning of stations / platforms for passengers, Railway Track, gauge, Track components, Rail, rail fittings, fixtures, Sleepers and ballast requirements and specification per kilometre of track, Formation and cross- section details, drainage, track defects, signals, branching, classification and Marshall signals, other signals, maintenance and adjustment of railway.

  Design analysis: Geometric design of track, Points and Crossing, Station and Yards, Level crossing, Signalling and control, Suburban Railways, Metro railways system, Modernization of railways, Underground Railways.

- **Ports and Harbour Engineering**

  Water Transportation: Sea Port, Harbours, Ports and harbours of Pakistan Types and selection of site, Breakwaters, Jetties, Wharves, Navigation aids: Buoys and light houses, Inland water transportation. Components and classification, site investigation, waterway design. Design principles and requirements of harbours, and their construction, Transit sheds and warehouses.

Recommended Books:

- Transportation Engineering Introduction to Planning, Design and Operations, Jason C. Yu, Elsevier Science Ltd. Latest Edition
- Port Engineering Planning Construction Maintenance and Security, Gregory P. Tsinker, John Wiley, Latest Edition
- Urban Mass Transportation Planning, A. Black, McGraw Hill.
- Railway Engineering by Chandra and Agarwal, Oxford University Press
- Dock and Harbour Engineering, Oza and Oza, Charotar Publisher.

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Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
Board of Faculty: 23	**Resolution No. 23.09**	**Dated: 09-12-2021**
Academic Council:	**Resolution No.**	**Dated:**

Title of Subject	**:**	**Mechanics of Solids-I (Th +Pr)**
Code	**:**	CE212
Discipline	**:**	Civil Engineering (3rd Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Engineering Mechanics **Co-requisite:** Nil
Assessment	**:**	Theory: 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	02 + 01 **Marks :** 50 + 50
Minimum Contact Hours:		30 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	SOLVE problems related to simple stress and strain in materials subjected to axial forces.	C3	1
2	ANALYZE simple beams subjected to simple bending and explain torsion and energy theory.	C4	2
3	PRACTICE various laboratory tests to determine various properties of materials.	P3	4

Course outline:

- **Simple Stress and Strain**
  Types of stresses and strains, Stress-stain diagrams of different materials, Elastic constants, Load-deflection relation with respect to length, area of cross-section and Young's modulus of elasticity, Thermal stresses in restraint and compound bars.

- **Stresses in Beams**
  Centroid of general cross-section, second moment of area/Moment of inertia and Product of inertia, Theory of simple bending: position of neutral axis, Moment of resistance and section modulus, Application of flexural formula.

- **Strain Energy**
  Theory of torsion of solids and hollow circular shafts, Strain energy due to direct loads, Stresses due to gradual, sudden and impact loads.

Practical Work to be carried out:

1. Introduction to Laboratory and HSE Measures.
2. To determine the diameter and unit weight of metallic bar.
3. To determine the yield strength, proportional limit, ultimate strength of steel bars and develop stress-strain relationship.
4. To determine the percentage elongation and percentage reduction in area of steel bar.
5. To perform the bend test of steel bar.
6. To determine the shear strength of steel bar
7. To determine shear modulus and Poisson's ratio for metals
8. To determine the location of neutral axis in the beam cross-section and compare it with the theoretical value
9. To determine the bending stress and deflection of simply supported beams
10. To determine the bending stress and deflection of cantilever beams
11. To perform torsional test on steel bars and determine modulus of rigidity

12. To perform hardness/toughness test on steel bars
13. To determine impact strength of steel bars
14. To determine the stiffness of the spring
15. To perform an open-ended lab.

Recommended Books:

- Strength of Materials, F.L Singer, Harper and Row Publisher New York, Latest Edition
- Elements of Strength of Materials, S. Timoshenko, D. Van Nostrand Company New Jersy, Latest Edition
- Strength of Materials, R. L Ryder, McMillan education limited, Latest Edition

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Title of Subject	**:**	**Fluid Mechanics and Hydraulics (Th + Pr)**	
Code	**:**	CE227	
Discipline	**:**	Civil Engineering (3rd Semester)	
Effective	**:**	19-Batch and onwards	
Pre-requisite	**:**	Engineering Mechanics	**Co-requisite:** Nil
Assessment	**:**	Theory: 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination	
Credit Hours	**:**	03 + 01	**Marks :** 100 + 50
Minimum Contact Hours:		45 + 45	

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE the concepts related to fluid statics, kinematics, dynamics and simulation model of a real hydraulic structure.	C2	1
2	SOLVE problems related to various open channel x-sections and flow based on hydraulic energy & momentum principles.	C3	2
3	PRACTICE experiments to verify the theoretical principles of fluid mechanics & hydraulics engineering.	P3	4

Course outline:

- **Properties of Fluid**
  Density, Specific weight, Specific volume, Specific gravity, Viscosity and Newton's law of viscosity, Bulk modulus of elasticity, Surface tension, Capillarity, Dimensions and Systems of units.

- **Fluid Statics**
  Pressure; Pressure head, Pressure-head relationship, Atmospheric pressure, Absolute pressure, Gauge pressure and Pascal's law. Equipment's for measurement of pressure, Piezometer, Manometers, Bourdon gauge and Mechanical gauges. Hydrostatic pressure, Buoyancy and stability of floatation.

- **Fluid Kinematics**
  Basic concepts of uniform and non-uniform, Flow rate and mean velocity, Acceleration in fluid flow.

- **Fluid Dynamics**
  Continuity equation in differential form for steady and unsteady flows, Continuity equation's integral form, Total head or energy (Bernoulli's) equation and its applications.

- **Hydraulic Similitude**
  Dimensions analysis of physical quantities (FLT or MLT system of measurement) by Releigh's or Buckingham's π-Theorem and its applications, Model analysis, Model and its prototype's geometric, kinematic, dynamic and hydraulic similarities, Dimension less number and their significance.

- **Open Channel Flow and its Classifications**
  Types of open channel and flow. States of flow and Regimes of flow, uniform flow (Chezys's and Manning's velocity equations) through various channel sections.

- **Design of Open Channels and Their Properties**

Open channels Channel geometry, Design of most efficient, effective and economical open channel sections.

- **Energy and Momentum Principles**
  Non-uniform flow, Energy in open channels, Specific energy, Critical flow, Momentum principle and its applications, Hydraulic jump and its applications.

- **Flow Rate Measurement in Open Channels**
  Measurement of discharge through weirs, modular and non-modular venturi-flumes.
- **Introduction to subject relevant software's**

Practical Work to be carried out:

1. Introduction to Practical contents, Equipment's, and HSE (Health, Safety and Environment) measures.
2. To determine errors in the readings of a Bourdon pressure gauge.
3. To determine the metacentric height of floating body.
4. To investigate the validity of the formulas for resultant force on, and position of center of pressure of, a vertical rectangular surface.
5. To prove validity of Bernoulli's Theorem.
6. To determine coefficient of discharge for Venturimeter and Orifice meter.
7. To find the coefficient of velocity for a small orifice.
8. To find the coefficient of discharge for a small orifice.
9. To investigate relation between head over sill of a rectangular notch and flow rate through the notch.
10. To investigate relation between head over vertex of a Vee-notch and flow rate through the notch.
11. To determine Chezy's and Manning's coefficients for a rectangular smooth open channel.
12. To examine the quantitative characteristics of hydraulic jump formation on a horizontal floor of a rectangular channel.
13. To determine coefficient of discharge for a Venturi flume.
14. To draw specific energy curve for open channel with subcritical and super critical flow.
15. To perform an open-ended lab.

Recommended Books:

- Fluid Mechanics with Engineering Applications, Daugherty, Franzini and Finnemore, McGraw Hill Book Company, Latest Edition.
- Applied Fluid Mechanics, Robert L. Mott and Jaseph A. Untener, Pearson Education Inc, Latest Edition.
- A Textbook of Fluid Mechanics and Hydraulics Machines, Er. R.K. Rajput. S. Chand & Company Ltd, Latest Edition.
- A Textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, Latest Edition.

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Title of Subject	**:**	**Theory of Structures (Th)**
Code	**:**	CE222
Discipline	**:**	Civil Engineering (3rd Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Engineering Mechanics **Co-requisite:** Nil
Assessment	**:**	20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	02 + 00 **Marks :** 50 + 00
Minimum Contact Hours:		30 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	ANALYZE shear force and bending moment in beams and frames.	C4	2
2	EVALUATE axial forces in Trusses; axial force, shear force and bending moment in arches; buckling of columns and influence lines and moving loads.	C5	2

Course outline:

1. **Introduction**
   Definition of types of structures, Loads on structures, serviceability and safety of structures.

2. **Reactions, Shear and Bending Moments**
   Concept of bending and shear, Shear force and bending moment diagrams in determinate beams, Relation between loading intensity, Shear force and bending moment, Symbols and conventions.

3. **Determinate Plane Frames**
   Analysis of normal force, shear force and bending moment diagrams of determinate plane frames.

4. **Trusses**
   Analysis of forces in the trusses by the method of joints and method of sections.

5. **Arches**
   Analysis of three hinged parabolic and circular arches

6. **Columns and Struts**
   Axial loading, Simple strut theory, Long columns, Empirical formula for long columns, combined direct and bending stresses.

7. **Influence Lines and Moving Loads**
   Influence lines for statically determinate beams and girders, Influence lines for shear, Reaction, shear and bending moment for beams. Calculation of maximum reaction, shear and bending moment in a simply supported beam due to series of moving loads, Absolute maximum bending moment and its evaluation.

Recommended Books:

1. Mechanics of Structures Vol-I & Vol-II, Junarkar JB, Vivek Publication Mumbai. Latest Edition
2. Elementary Theory of Structures, Wang CK & Eckel CL McGraw Hill Book Company, Singapore. Latest Edition
3. Theory of Structures, Timoshenko SP and Young DH, McGraw Hill Book Company, Singapore. Latest Edition

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Title of Subject	**:**	**Applied Hydraulics (Th + Pr)**
Code	**:**	CE241
Discipline	**:**	Civil Engineering (4th Semester)
Effective	**:**	19-Batch and onwards
Pre-requisite	**:**	Fluid Mechanics and Hydraulics **Co-requisite:** Nil
Assessment	**:**	Theory: 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Semester Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours	**:**	45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	ANALYZE states of flow with respect to water surface and channel bed profiles due to sediment transport in open channels.	C4	2
2	DESIGN effective solution (flow computation) of pipes looping, branching, network and water hammer problems.	C6	3
3	MANAGE experimentally the open channel, pipe network flows and investigate technically the usage of hydraulic machines in daily life and their effect on environment.	P5	4

Course outline:

- **Gradually Varied Flow in Open Channels**
  Dynamic equation of gradually varied flow, Surface profiles, Computation of backwater curve length and surface profiles.

- **Sediment Transport in Open Channels**
  Importance of sediment transport, Bed load and suspended load, Threshold motion of the sediment, Use of different empirical methods/formulae to estimate sediment load in ppm, Open channel bottom deformation (theory and practical aspects).

- **Waterpower Development**
  Hydroelectric power, Important terms and definitions and principal components of a hydroelectric scheme, Classification of hydel plants, Runoff plants, Storage plants, Pumped storage plants, Tidal plants, Low head, medium head and high head schemes.

- **Flow in Pipes**
  Flow through simple pipes, Compound pipes, Pipes in series and parallel, Looping and branching pipes, Analysis of network of pipes and water hammer.

- **Steady Incompressible Flow in Pressure Conduits**
  Major and minor losses, Reynold's number and its significance, Viscous flow through circular pipes, Turbulent flow through pipes, Universal velocity distribution and Prandtil's mixing length theory.

- **Reaction and Centrifugal Turbine**
  Types, Construction features, Operations, Specific speed.

- **Pumps:**
  Centrifugal pumps their classification, Cavitation, Draft tube, Construction features and operation and specific speed, Reciprocating pumps their classifications (single acting and double acting pumps), Acceleration head, Maximum suction lift, Use of air vessels, Specific speed.

- **Introduction/use of the subject related software's.**

Practical Work to be carried out:

1. To determine the coefficient of weir for a broad –crested weir.
2. To determine the coefficient of weir for a Sharp –crested weir.
3. To determine the coefficient of discharge for an Ogee weir.
4. To determine the friction factor of a pipe by using fluid friction apparatus.
5. To determine the friction factor of a slanted seat valve using fluid friction apparatus.
6. To determine the friction factor of a socket shut-off gate valve using fluid friction apparatus.
7. To determine minor losses due to a pipe bend using fluid friction apparatus.
8. To determine minor losses due to a 90^o elbow.
9. To determine minor losses due to a 45^o elbow using fluid friction apparatus.
10. To determine minor losses due to gradual enlargement and constriction.
11. To determine minor losses due to Line and Branched flow at 90^o Tee.
12. To determine minor losses due to a sharp 90^o elbow.
13. To determine the loss coefficient of a bent pipe using Losses in pipes & bends apparatus.
14. To determine the real fluid flow using Laminar flow analysis table.
15. To perform an open-ended lab.

Recommended Books:

- Open Channel Hydraulics, Ven Te Chow, International Students Edition McGraw Hill Book Company
- Irrigation and Waterpower Engineering, Dr. B. C. Punmia and Pande B. B. Lal, Standard Publishers, Delhi, Latest Edition
- Applied Fluid Mechanics, Robert L. Mott and Joseph A. Untener, Pearson Education Inc, Latest Edition
- A Textbook of Fluid Mechanics and Hydraulic Machines, Er. R.K. Rajput. S. Chand & Company Ltd. Latest Edition
- A Textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, S. Chand & Company Ltd. Latest Edition

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Title of Subject	**:**	**Surveying-II (Th + Pr)**
Code	**:**	CE202
Discipline	**:**	Civil Engineering (4th Semester)
Effective	**:**	19-Batch and onwards
Pre-requisite	**:**	Surveying-I **Co-requisite:** Nil -
Assessment	**:**	Theory:20% Sessional, 80% Written Semester Examination (20% Mid,60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	APPLY different survey techniques for indirect linear measurements in horizontal and vertical plane, and measurements in water bodies and larger areas.	C3	2
2	USE data for setting out of curves on highways and setting out works for different structures.	C3	3
3	CONDUCT the various survey tasks in groups.	P4	5

Course outlines:

- **Theodolite Traversing**
  Adjustment of transit theodolite, traversing with theodolite, Traverse computations, Closing error and its adjustment, Computation of Omitted measurements.

- **Tachometric Surveying**
  Tachometry, System of tachometry, Principles and field procedures of tachometry, Use of tachometry for traversing.

- **Trigonometric Levelling**
  Determination of Reduced levels of elevated objects when the base is accessible and inaccessible.

- **Highway Curves**
  Introduction to curves, Types of curves, Simple circular curves, Compound curves, reverse curves, transition curves, vertical curves, Computation and setting out of curves by different methods.

- **Hydrographic Surveying**

Hydrographic Surveying and its applications, sounding and instruments used in soundings, Shore line survey and location of soundings.

- **Triangulation**
  Classification of triangulation, Operations in triangulation, Selection of stations, Base line measurement.

- **Photogrammetry**
  Photographic surveying, Principles of aerial and terrestrial Photogrammetry, Arial surveying.

- **Setting out works**
  Setting out the buildings, roads, culverts, bridges.

- **Remote Sensing, GPS and GIS**
  Introduction to remote sensing, Use of GPS and GIS in the field of Survey.

Practical work to be carried out:

1. Introduction to Digital Theodolite and its temporary adjustment.
2. To determine the horizontal angles, vertical angles and bearing of lines.
3. To determine the latitudes and departures of lines and to calculate the Coordinates of Points.
4. To determine the Area of a Closed Traverse by Coordinates method.
5. To determine the horizontal distances by Tacheometric Surveying when the line of sight is horizontal.
6. To determine the horizontal distances and Vertical distances by Tacheometric Surveying when the line of sight is Inclined.
7. Orientation of total station and its adjustment.
8. To determine the independent coordinates of an existing building. Theodolite Traversing.
9. To draw the Plan of an existing building by plotting the Coordinates using Auto CAD software / Microsoft Excel.
10. To set out the Simple Circular Curve by deflection Angle method.
11. Measuring the Heights of buildings using Trigonometric Leveling.
12. To determine the R.L at top of elevated object by Trigonometric Leveling.
13. Introduction to GPS, Angular coordinates system, Base camp software and Google earth.
14. To record the World Geographic Coordinates System (WGS) / Angular Coordinates of points in the field by GPS.
15. To perform an open-ended lab.

Recommended Books:

- Plane Surveying, Dr A M Chandra, Latest Edition
- Surveying Vol: (I + II), B.C Punmia, Latest Edition
- Surveying Practice, Jerry. A. Nothanson and Philip Kissam, Latest Edition

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Title of Subject	**:**	**Construction Engineering (Th)**
Code	**:**	CE231
Discipline	**:**	Civil Engineering (4th Semester)
Effective	**:**	19-Batch and onwards
Pre-requisite	**:**	Civil Engineering Materials **Co-requisite:** Nil
Assessment	**:**	20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS different construction methodologies being used in construction industry.	C2	1
2	APPLY acquired knowledge to supervise different components of building works.	C3	2

Course outline:

1. **Introduction**
   An overview of constructional aspects for different types of engineering projects, e.g. building retaining structures, bridges, pavements and special structures, General consideration common to all projects with special reference to building structures.
2. **Layout Techniques**
   Building layout, De-watering Techniques, shoring to prevent excavations, Scaffolding techniques and their purposes, Introduction to earth walls, Use of bentonite etc., Form works for super structures, Types and costs involved (in construction), Thermal insulation of building and water proofing technique and materials, Use of admixtures to prevent efflorescence of brick and brick works, Dampness, Wall-dampness etc, Construction techniques etc.
3. **Constructional Methodologies**
   Floor its types and construction, Floor finishing, Roofs and their construction types and Roofing Systems-finishes and waterproofing, Walls and their construction and types etc, Non-structural elements especially wood-construction and wood framing, Masonry, Stone-masonry, Brick works with sufficient details related to constructional aspects, Doors, and windows allied services, e.g. Acoustics and maintenance of buildings etc.

Recommended Books:

1. Building Construction, A. Kumar, Mir-Publisher Karachi, Latest Edition
2. Building Construction, S.K Sharma, S. Chand & Company New Delhi, Latest Edition.
3. Building Construction, Thomson J.F, Butter worth London, Latest Edition
4. Building Construction, Whitney C. Huntington, National Book Foundation Pakistan, Latest Edition

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Title of Subject	**:**	**Mechanics of Solids -II (Th)**
Code	**:**	CE251
Discipline	**:**	Civil Engineering (4th Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Strength of Materials-I **Co-requisite:** Nil
Assessment	**:**	20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100+ 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND plane stress and strain in the members subjected to various loading conditions.	C2	1
2	ANALYZE the horizontal shear stress/force in thin walled sections and circular sections within the elastic limits; and describe unsymmetrical bending, curved beams, theories of failure, creep, fatigue and inelastic materials.	C4	2

Course outline:

- **Stress and Strain during General Loadings**
  Analysis of plane stresses, including principal stresses (Analytically and graphically), Principal stresses in beams. Analysis of plane strain (Analytically and graphically), Strain rosette, Stresses due to combined loading (bending and torsion).

- **Horizontal Shear Stress/Force**
  Horizontal shear stresses in beams, Stress in built-up beams, Shear flow and shear centre.

- **General Topics**
  Unsymmetrical bending, Analysis of curved beams, Theories of failure, Creep and fatigue fracture, Introduction to inelastic materials, limit torque, limit moment, position of neutral axis and residual stresses.

Recommended Books:

- Strength of Materials, F.L Singer, Harper & Row Publishers New York, Latest Edition
- Elements of Strength of Materials, S. Timoshenko &D.H Young, D Van Nostrand Company Inc. Princeton, New Jersey, Latest Edition
- Strength of Materials, R. L Ryder, Macmillan Education Limited, Latest Edition

Approval:

Board of Studies: 33 **Resolution No. 33.3** **Dated: 30-11-2021**
Board of Faculty: 23 **Resolution No. 23.09** **Dated: 09-12-2021**
Academic Council: **Resolution No.** **Dated:**

Title of Subject	**:**	**Architecture and Town Planning (Th)**
Code	**:**	CE246
Discipline	**:**	Civil Engineering (4th Semester)
Effective	**:**	19-Batch and onwards
Pre-requisite	**:**	Nil **Co-requisite:** Nil
Assessment	**:**	20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	02 + 00 **Marks :** 50 + 00
Minimum Contact Hours:		30 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN concepts of Architecture and its implications on Engineering and Design.	C2	1
2	APPLY the principles of town planning in the development of modern cities and towns based on best practices and guidelines.	C3	3

Course outline:

1. **Architecture**
   Historical Development, General introduction to history of architecture, Emergence/Development of Islamic Architecture, Geographical, climatic, religious, social and historical influences, Architectural beauty.

2. **Qualities, Factors and Use of Materials**
   Strength, Vitality, Grade, Breadth and scale, Proportion, Bolour and balance, Stone, Wood, Metals, Concrete, Composites, Ceramics.

3. **Architectural Aspects of Building Planning**
   Walls and their construction, Openings and their position, Character and shape, Roofs and their development and employment, Columns and their position, Form and decoration, Moulding and their form decoration, Wind orientation of buildings, Energy efficient materials and thermal insulation, Modern Architecture and use of advance materials, Ornament as applied to any buildings.

4. **Town Planning**
   Definitions, Trends in Urban growth, Objectives of town planning, Modern planning in Pakistan and abroad.

5. **Preliminary Studies**
   Study of natural resources, Economic resources, Legal and administrative problems, Civic surveys, Preparation of relevant maps.

6. Land Use Patterns, Street Patterns

Various theories of land use pattern, Location of Parks and recreation facilities, Zoning and its aspects, Public and semi-public buildings, Civic centres, Commercial centres, Local shopping centres, Public schools, Industry & residential areas, Layout of street, Road crossing & lighting, Community planning.

7. City Extensions and Urban Planning

Sub Urban development, Neighbourhood Units, Issues related to inner city urban design and emergence/upgradation of squatter settlements, Satellite Towns and Garden City.

Recommended Books:

1. A History of Architecture, Dan Cruickshank, Sir Banister Fletcher's Architectural Press; Latest Edition
2. Origins of Modern Town Planning, Leonard Benevolo; MIT Press, Latest Edition
3. Town Planning in Practice, Sir Rymond Unwin, FQ Legacy Books, Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Structural Analysis (Th)**
Code	**:**	CE306
Discipline	**:**	Civil Engineering (5th Semester)
Effective	**:**	18-Batch and onwards
Pre-requisite	**:**	Theory of Structures **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	SOLVE beams, frames and trusses for deflections and slopes in determinate and indeterminate structures	C3	3
2	ANALYZE the structures by modern analytical methods.	C4	2

Course outline:

- **Introduction**
  Determinate and indeterminate structures, Degree of indeterminacy in beams, frames and trusses.

- **Determinate Structures:**
  Beams: Double integration, Moment area, Conjugate beam, Unit load method and theory of Castigliano, Frames: Unit load, Moment area method and movement of joints, Trusses: Unit load, Joint displacement, Graphical and angle weight method.

- **Indeterminate Structures:**
  Consistent deformation method: Statically indeterminate beams /frames of one and two redundant, Laws of reciprocal deflections, Theorem of least work, Three Moment Theorem Derivation of the theorem and application to statically indeterminate beams, Method of Slope Deflection Derivation of equation, Analysis of continuous beams and portal frames without joint movement/with joint movement, Analysis of continuous beams and portal frames due to yielding of supports, Moment Distribution Method Concept, distribution and carryover factors, Analysis of continuous beams and portal frames without joint movement/with joint movement, Analysis of continuous beams and portal frames due to yielding of supports, Introduction to matrix stiffness method Stiffness Methods Formation of element stiffness matrix for truss, beam and frame element, Deformation transformation matrix, Structures stiffness matrix for truss, beam and frame elements, Analysis of indeterminate structure using stiffness method.

Recommended Books:

- Statically Indeterminate Structure, Chu-Kia-Wang, Me Graw Hill International, Latest Edition
- Structural Analysis, Russel C Hibbler, Prentice Hall International, Latest Edition
- Matrix method of structural analysis, B. Fraeijs de Venbehe Pergmon Press Oxford, Latest Edition
- Intermediate structure analysis, Chu Kia Wang, Mc Graw Hill International, Latest Edition

Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
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Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Plain and Reinforced Concrete (Th + Pr)**
Code	**:**	CE345
Discipline	**:**	Civil Engineering (5th Semester)
Effective	**:**	18-Batch and onwards
Pre-requisite	**:**	Civil Engineering Materials **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE various properties of concrete and its ingredients.	C2	1
2	DESIGN various structural elements of reinforced concrete.	C6	3
3	PRACTICE laboratory tests on concrete and its ingredients.	P3	4

Course outline:

- **Plain concrete:**
  Cement: manufacture of Portland cement, physical and chemical properties of cement, Aggregate: properties of aggregates, Admixtures, various types of aggregates, Design of concrete mixes, Production of concrete, batching, mixing, transportation, placing, compaction and curing of concrete, Properties of concrete in fresh state, Properties of concrete in hardened state, Durability of concrete structures, cracks and repair of concrete structures.

- **Reinforced concrete:**
  Basic principles of Reinforced concrete design, Design methods of reinforced concrete members, Basic concepts of working stress and ultimate strength design methods, Balanced, under reinforced and over reinforced section, Analysis and design of prismatic and non-prismatic sections in flexure, Slab and its types, Analysis and design of one-way solid slabs.

Practical Work to be carried out:

16. Introduction to Laboratory and HSE Measures.
17. To determine the soundness of a given sample of cement by Le-Chatelier's Apparatus.
18. To determine the zoning of a given sample of fine aggregate.
19. To determine the maximum size of a given sample of coarse aggregate.
20. To determine the quantity of silt and clay in a given sample of fine aggregate.
21. To determine the compressive strength of mortar cubes.
22. To prepare the concrete mix and determine the workability of fresh concrete by slump test method.
23. To determine the workability of fresh concrete by compaction factor test method.

24. To determine the workability of fresh concrete by Ve-Bee Consistometer test method.
25. To determine the workability of fresh concrete by flow table test method.
26. To determine the unit weight of fresh concrete.
27. To determine the unit weight of hardened concrete.
28. To determine the water absorption of hardened concrete.
29. To cast cubes and cylinders and determine the compressive strength of concrete cubes and cylinders.
30. To perform an open-ended lab.

Recommended Books:

- Concrete Technology, A. M. Neville and J.J. Brooks, Publisher: Longman, Latest Edition
- Advanced Concrete Technology: Constituent Material, J. Newman and B.S. Choo, Publisher: Butterworth Heinemann, Latest Edition
- Design of Concrete Structures, A.H. Nilson, D. Darwin and C.W. Dolan, Publisher: McGraw Hill Company, Latest Edition
- Structural Concrete: Theory and Design, M.N. Hassoun and A.A. Manaseer, Publisher: John Wiley & Sons. Inc., Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
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Title of Subject	**:**	**Project Management (Th)**	
Code	**:**	CE355	
Discipline	**:**	Civil Engineering (5th Semester)	
Effective	**:**	18-Batch and onwards	
Pre-requisite	**:**	**Nil**	**Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)	
Credit Hours	**:**	02 + 00	**Marks :** 50 + 00
Minimum Contact Hours:		30 + 00	

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE primary theoretical knowledge of Project Management in the field of Engineering and construction industry.	C2	11
2	DEMONSTRTE essential theoretical knowledge of complete project life cycle of construction projects and their related issues.	C3	11

Course outline:

- Introduction to Engineering Management, Project Management, Objectives and Functions of management, Identification of Project, Project development and feasibility, identification of project stakeholders, SWOT analysis, Preparation and approval procedure of PC-1 and PC-2, Project Life cycle. Project roles and responsibilities, Design and project documentation, Introduction to Value Engineering & life cycle costing, Quality Management Systems, Human resource management, Procurement process and contractual relationship, Types of Engineering Contracts, Claims, Cost escalation, Arbitration and Litigation, Risk Analysis and management, Entrepreneurship and its types.

Recommended Books:

- Project Management- A managerial approach, Meredith, J.R and mantel S.J, John Wiley. Latest Edition
- Human Resource Management in Construction, Langford, D, Longman Group Ltd, UK, Latest Edition
- Construction Methods and Management, Nunnally S.W Prentice Hall, USA. Latest Edition
- Principles of Construction Management Roy Pilcher, Mc Graw Hill Company, Latest Edition

Approval:

- **Board of Studies:** **Resolution No. 32.3** **Dated: 03-10-2020**
- **Board of Faculty:** **Resolution No. 20.11** **Dated: 07-10-2020**
- **Academic Council:** **Resolution No. 98.7(ii)** **Dated: 22-10-2020**

Title of Subject : **Hydrology (Th)**

Code : CE362
Discipline : Civil Engineering (5th Semester)
Effective : **20-Batch and onwards**
Pre-requisite : Applied Hydraulics **Co-requisite:** Nil
Assessment : 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 03 + 00 **Marks :** 100 + 00
Minimum Contact Hours: 45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN hydrologic processes, their measurements and computations.	C2	1
2	ANALYZE the occurrence, movement and distribution of water in the atmosphere, at the ground surface and within sub-surface	C4	4

Course outline:

- **Introduction**
  Hydrology, The world's freshwater resources, Hydrologic cycle, Hydrologic equation, Importance and Scope of hydrology.

- **Hydrologic Measurements and Data Sources**
  Hydrologic measurements, Data networks, Telemetry systems and Remote sensing.

- **Hydrologic Processes and their Computation**
  Precipitation, Evaporation, Transpiration, Evapotranspiration and Runoff, their measurement / estimation. Hydrograph and Unit hydrograph their analysis and application.

- **Floods- Estimation, Routing and Control**
  Size of floods, Estimation of peak flood, Flood frequency studies, Introduction to Reservoir routing and Channel routing, Methods of flood control, Flood forecasting and warning.

- **Groundwater, Well Hydraulics and Tube Wells**
  Basic terminology, Types of aquifers, Yield of a well, Well losses, Specific capacity of well, Interference among wells. Types and Parts of tube well, Tube well construction, Design of tube well for irrigation purposes, Comparison of Tube well irrigation and Canal irrigation.

- **Water Resource Management**

Water resources of Pakistan, Indus Basin Irrigation System (IBIS), Indus Water Treaty (IWT) 1960 and Water Accord (WA) 1991, Indus River System Authority (IRSA).

- **Sea water intrusion**

Recommended Books:

- Hydrology: Principles, Analysis and Design, H. M. Raghunath, New Age International Publishers, India, Latest Edition.
- Introduction to Hydrology, Warren Viessman, Jr. and Gary L. Lewis, Prentice Hall, Latest Edition
- A Textbook of Hydrology, Dr. P. Jaya Rami Reddy, University Science Press, India, Latest Edition.
- Hydrology for Engineers, R. K. Linsley, Max A. Kohler, and Joseph L. Paulhus McGraw-Hill Education (ISE Editions); Latest Edition.

Approval:

Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
Board of Faculty: 23	**Resolution No. 23.09**	**Dated: 09-12-2021**
Academic Council:	**Resolution No.**	**Dated:**

Title of Subject : Geometric Design of Highways and Airports

Code : CE366
Discipline : Civil Engineering (5th Semester)
Effective : 20-Batch and onwards
Pre-requisite : Transportation Engineering **Co-requisite: ---**
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours : 02 + 00 **Marks :** 50 + 00
Minimum Contact Hours: 30 + 00

Specific Objectives of Course:

- To equip students with knowledge related to geometric design of highways and airports

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS design controls for geometric elements of highways and airports.	C2	1
2	DESIGN geometric parameters of Highways and airports.	C6	3

Course outline:

- **Design Controls**
  Introduction/Functional classification of highways and airports, Design controls, Design vehicle, Design speed, Design Driver, Design Volume, Sight Distances. Airport Geometric standards.
- **Horizontal and Vertical Alignment**
  Introduction, Horizontal curves, Transition, curves, Super-elevation, Attainment of super elevation. Types of Cross section, Cross section elements, Cross slopes. Introduction, Grades, Vertical curves.
- **Airport Design**
  Type & elements of airport planning, Factors affecting airport site selection, Airport classification, Various Runway configurations.

Recommended Books:

- Highway Engineering, Paul H. wright / Karen K Dixon, Latest Edition
- Traffic & Highway Engineering, Nicholas J Garber lester H. Hoel, Latest Edition
- Highways The Location, Design, Construction and Maintenance of Pavements, C. A. O'Flaherty, Latest Edition
- Planning and Design of Airports, Horonjeff, R. McGraw-Hill Professional; Latest Edition

Approval:

Board of Studies: 33 **Resolution No. 33.3** **Dated: 30-11-2021**
Board of Faculty: 23 **Resolution No. 23.09** **Dated: 09-12-2021**
Academic Council: **Resolution No.** **Dated:**

Title of Subject	**:**	**Environmental Engineering-I (Th + Pr)**
Code	**:**	CE351
Discipline	**:**	Civil Engineering (6^{th} Semester)
Effective	**:**	19-Batch and onwards
Pre-requisite	**:**	**---** **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	02 + 01 **Marks:** 50 + 50
Minimum Contact Hours:		30 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE the characteristics of potable water used in daily life, environmental legislations and management.	C2	1
2	***EVALUATE the water treatment plant unit and water distribution networks.***	***C5***	***4***
3	PRACTICE various laboratory and field tests to obtain physical, chemical and biological properties of water.	P3	4

Course outline:

PART I. INTRODUCTION TO ENVIRONMENTAL ENGINEERING

Understanding the environment (basic concepts) and environmental engineering, Importance for civil engineers, Basic facts.

PART II. ENVIRONMENTAL LEGISLATION AND MANAGEMENT

Environmental issues of urban and rural areas, Environment and sustainable development, Role of various environmental agencies and NGOs to prevent environmental degradation, National Environmental Quality Standards (NEQS). Environmental Impact Assessment (EIA).

PART III. WATER SUPPLY ENGINEERING

Subject Overview, Water demands, Water quality, Water treatment

- **Water Demands**
  Various types of water demand, Estimation of water use: per capita demand, factors affecting water use, variations in demand and their effects on the design of a water supply project components, Design periods and factors governing design periods, Pollution forecast, and methods of population forecast, Water sources.
- **Water Quality**
  Hydrological cycle and water quality, Water characteristics, Sampling methods, Water quality analysis, Water quality parameters/monitoring.

- **Water Treatment Unit Processes/Operations**

Standard water treatment methods: screening, sedimentation, coagulation, filtration and disinfection, water softening, special water treatment methods.

- **Water Supply Projects**
  Importance and necessity of planned water supplies, Planning and preparing a water supply project: data to be collected, analysis of data and project formulation, project drawings, project estimates, project supervision and reporting.
- **Water Collection**
  Water collection methods, Intakes, factors governing location of intake, types of intake, design of intake.
- **Water Conveyance**
  Conduit and its types, Pumps, types of pumps and design of a pumping Station.
- **Design of Water Treatment Plant**
  Design of various water treatment unit operations: screens, plain sedimentation tanks, coagulant dose, coagulation-cum-sedimentation tanks/clarifiers/dissolved air floatation tanks, filters, chlorination dose, dewatering and sludge disposal.
- **Water Distribution**
  Water supply system, Water distribution methods: requirements of a good distribution system, design of distribution systems forces (stresses) acting on pipes, materials for pressure conduits, pipe appurtenances, pipe fittings, laying and testing of water supply lines, Design of service reservoirs, Detection of water wastage in distribution pipes, House water connections.

Practical Work to be carried out:

1. Introduction of Environmental Engineering lab and HSE measures.
2. Sample preparation techniques including Dilution, Filtration/Centrifugation, Solid phase extraction, Digestion and Distillation.
3. To determine the Turbidity contents of given sample of water.
4. To determine the Suspended Solids / Non-filterable residue in sample of water.
5. To prepare different water samples of varying pH and Total Dissolved Solids (TDS) and to determine pH, TDS and Electrical Conductivity (EC) of prepared water samples.
6. To determine the Taste and Odour value of given water sample.
7. To determine the Acidity of given sample of water.
8. To determine the Alkalinity of given sample of water.
9. To determine the Hardness of given sample of water.
10. To determine the Chloride Concentration in given sample of water.
11. To determine the Sulphates in given sample of water.
12. To determine the Total Chlorine Concentration in given sample of water.
13. Determination of Jar Test (Alum dose selection) for turbid waters.
14. Determination of Dissolved Oxygen (D.O).
15. To perform an open-ended lab.

Recommended Books:

1. Water Supply Engineering, S. K. Garg, Khana Publication Delhi. Latest Edition
2. Water Supply Engineering and Sewerage, E. W. Steel and TJ. Mcghee, Me Graw Hill Company, Latest Edition
3. Environmental Pollution and control, PAarne. Ves. Lined and J.Jaffery Peirce, Me Graw Hillinc USA, Latest Edition
4. Environmental Management, Dr. Biswaryo Mukherjee, Viskas Publishing House Pvt Ltd, Latest Edition

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Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
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Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Soil Mechanics (Th + Pr)**
Code	**:**	CE326
Discipline	**:**	Civil Engineering (6th Semester)
Effective	**:**	18-Batch and onwards
Pre-requisite	**:**	Engineering Geology **Co-requisite: ----**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 30% Sessional, 60% Final Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DEMONSTRATE index properties of soils and carry out classification of soils.	C3	4
2	ANALYZE the range of soil related problems especially those involving in-situ stresses, flow of water through soils and consolidation settlement of soils.	C4	4
3	PRACTICE laboratory testing to determine index properties of soil, flow of water through soil and consolidation parameters of soil.	P3	4

Course outline:

- **Introduction**
  Importance of mechanics of soils in Civil 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.
- **Soil Water**
  Modes of occurrence of water in soil absorbed / adsorbed water, Capillary water.
- **In Situ Stresses**
  Stress condition in soil: effective and neutral stresses, stresses in saturated soils with upward and downward seepages.

- **Permeability of Soil**

  Permeability, Darcy's law, Factors affecting permeability, Permeability of stratified soils, Laboratory and field determination of permeability.

- **Seepage in Soils**

  Seepage, Hydraulic potential, Hydraulic gradient, and seepage pressure, Quick sand condition and critical hydraulic gradients, Introduction to Flow nets: Flow lines, equipotential lines, seepage calculation from a flow net, Liquefaction, Piping.

- **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.

Practical Work to be carried out:

1. Introduction to the Soil Mechanics Laboratory and HSE (Health, Safety and Environment) measures.
2. Collection of soil samples from field and to prepare the representative soil sample for laboratory testing:
   a). Quartering Method b). Riffle Box Method
3. To determine the water content of soil sample by:
   a). Oven Drying Method b). Hot Plate Method c). Sand Bath Method
   c). Speedy Moisture Tester d). Infrared Moisture Tester
4. To determine the particle size distribution of coarse grained soil by Sieve Analysis.
5. To determine the particle size distribution of fine grained soil by Hydrometer Analysis.
6. To determine the liquid limit of fine grained soil by Casagrande Apparatus
7. To determine the liquid limit of fine grained soil by Fall Cone (Penetrometer) Method.
8. To determine the plastic limit of the fine grained soil by Glass Plate/Fall Cone Method.
9. To determine the shrinkage limit of fine grained soil.
10. To determine the specific gravity of fine grained soil by Density Bottle Method.
11. To determine the coefficient of permeability of coarse grained soil by Constant Head Method.
12. To determine the coefficient of permeability of fine grained soil by Falling Head Method.
13. To determine consolidation parameters of saturated fine grained soil by One Dimensional Consolidation Test.
14. To determine free swell of clayey soils.
15. To perform an open-ended lab.

Recommended Books:

- Soil Mechanics and Foundations, Punmia, B.C, Standard Book Company, Delhi, Latest Edition
- Principles of Geotechnical Engineering, Das, B.M, Brook/Cole. Latest Edition
- Soil Mechanics and Foundations, Garg, S. K, Khanna Publishers, Delhi, Latest Edition

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Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
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Title of Subject :		**Reinforced and Prestressed Concrete**
Code	**:**	CE337
Discipline	**:**	Civil Engineering (6th Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Plain and Reinforced Concrete **Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid,60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS various reinforced and prestressed concrete members	C2	1
2	ANALYZE and design various Reinforced and Prestressed concrete members.	C6	3

Course outline:

- **Reinforced Concrete**

  Analysis and design of doubly reinforced and continuous beams, Shear stress in reinforced concrete sections, Columns, types of columns, Analysis and design of short columns subjected to combined flexural and axial loading, Footing, types of footings, Analysis and design of isolated, combined, strip and raft/mat footing, Analysis and design of two-way solid slabs, Design of staircase.

- **Prestressed Concrete**

  Basic concepts of prestressing, Classification and methods of prestressing, Advantages and applications of prestressed concrete, Properties and importance of high strength materials used in prestressed concrete, Losses of prestressing: Immediate and time dependents losses, lump sum and detailed estimation of prestress losses, Analysis and design of simply supported prestressed beams for flexure and shear.

Recommended Books:

- Advanced Concrete Technology: Constituent Material, J. Newman and B.S. Choo, Publisher: Butterworth Heinemann, Latest Edition
- Design of Concrete Structures, A.H. Nilson, D. Darwin and C.W. Dolan, Publisher: McGraw Hill Company, Latest Edition
- Structural Concrete: Theory and Design, M.N. Hassoun and A.A. Manaseer, Publisher: John Wiley & Sons. Inc., Latest Edition
- Reinforced &Prestressed Concrete.F.K. Kong, R.H. Evans, Van Nostrand Reimhold U.K., Latest Edition
- Prestressed Concrete Design, T.Y. Lin, Mc Graw Hill Company, Latest Edition

Approval:

Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
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Title of Subject	**:**	**Steel Structures (Th)**
Code	**:**	CE316
Discipline	**:**	Civil Engineering (6th Semester)
Effective	**:**	19-Batch and onwards
Pre-requisite	**:**	Strength of Materials-II **Co-requisite: -----**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS the basic concepts related to design of steel structures along with design loads.	C2	1
2	***ANALYZE and design main structural members and connections of steel structures.***	***C4***	***3***

Course outline:

- **Design Methods and Specifications**

  Properties of Steel, Variation of stress-strain diagram with different percentage of carbon, Advantages and disadvantages of steel structures, Various steel sections used in the design of steel structure, Use of steel table, Introduction to AISC steel construction manual, Basic concepts and specification related to Allowable Stress Design (ASD) and Load and Resistance Factor Design (LRFD) methods.

- **Design Loads and Analysis**

  Different loads considered in the design such as dead load, live load, wind load, earth quake load and traffic load on bridges, Load calculation and analysis of main structural members.

- **Design of Structural Members**

  Euler's column theory, slenderness ratio, effective length, buckling of columns, Design of column using different steel sections, Design of hot rolled I- beam, floor beams and girders, purlins, beam with additional flange plates, Web buckling and web crippling in steel beams, Design of plate girder, stiffeners and steel truss, Types and strength of steel connections, Significance of steel connection design, Fabrication and erection methods involved in the construction of steel structures.

Recommended Books:

- Structural Steel Design, Jack C. McCormac, Stephen F. Csernak, Prentice Hall, Latest Edition
- Steel Structures: Design and Behavior, Charles G. Salmon, John E. Johnson, Faris A. Malhas, Prentice Hall, Latest Edition
- Design of Steel Structures, Gaylord, E.H. and C. N. Gaylord, McGraw-Hill Companies; Latest Edition

Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Quantity Surveying and Estimation (Th)**
Code	**:**	CE341
Discipline	**:**	Civil Engineering (6th Semester)
Effective	**:**	18-Batch and onwards
Pre-requisite	**:**	**---** **Co-requisite:** ---
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid,60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	SOLVE the numerical related to quantities of various civil engineering works.	C3	2
2	ANALYZE cost of construction project and discuss contract award procedure	C4	4

Course outline:

- **Introduction**
  Estimate and its' types, Scope of civil engineering works and its' impact on cost estimate, Role of quantity surveyor at different organizational levels, Main requirements for preparing an estimate, Factors to be considered while preparing a detailed estimate, Importance of preliminary estimate in administrative approval of public sector projects, Preliminary estimate of various buildings, Significance of cost estimation in construction industry.

- **Quantity Calculation in Various Civil Engineering Works**
  Load Bearing Structures: Calculation of quantities for different items of work using spate wall and centre line method, R.C.C Structures: Quantity calculation related to column, beam, slab, staircase and retaining wall, Road works: Lead and Lift, Earthwork calculation in road works using different methods, Calculation of quantities related to bridges, steel truss, sewerage and water supply works.

- **Rate Analysis and Bill of Quantities**
  Task or Out-turn work, Importance of rate analysis in construction industry, Significance of productivity calculation in rate analysis, Factors influencing rate analysis, Specification for various items in construction, General practice in government departments for schedule of rates, Rate Analysis of different construction works: Earthwork in excavation, lean concrete in foundation, brickwork, plastering and R.C.C work, Bill of Quantities (B.O.Q) for construction project, Maintaining measurement book.

- **Tendering and Award of Works**
  Introduction to types of contracts, Preparation of civil engineering contracts and tender documents, Evaluation of bids, Security deposit and earnest money, General procedure for award of works in public sector departments, Valuation of buildings and its' purpose.

Recommended Books:

- Estimating and Costing in Civil Engineering, S. Dutta, Latest Edition,S. Dutta & Company, Lucknow, Latest Edition
- Estimating, Costing and Accounts, DD Kohli, S. Chand & Company (Pvt) Ltd, Latest Edition
- Fundamentals of construction. Estimating & Cost Accounting, Keith Collier, McGraw Hill Book Company, Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Professional Ethics (Th)**	
Code	**:**	CE422	
Discipline	**:**	Civil Engineering (7^{th} Semester)	
Effective	**:**	**20-Batch and onwards**	
Pre-requisite	**:**	Nil	**Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)	
Credit Hours	**:**	02 + 00	**Marks :** 50 + 00
Minimum Contact Hours:		30 + 00	

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	FOLLOW ethical values that guide the civil engineers in their profession.	A2	8
2	ADOPT means of ethically sound professional engineer with commitment and responsible conduct	A3	6

Course outline:

Human Values and Engineering Ethics

Morals, values, ethics, integrity, work ethics, respect for others, living peacefully, honesty, cooperation, commitment, self-confidence, challenges in workplace. Senses of Engineering ethics, Moral autonomy, Professionalism, Responsibilities, Ethical Theories, Self-control.

Engineering as Social Experimentation

Engineering as experimentation, Engineers as responsible practitioners, Codes of ethics in industry. Civil Engineering as Profession, The American Council of Engineering Companies Ethical Conduct Guidelines, The American Society of Civil Engineers Code of Ethics Pakistan Engineering Council Code of conduct and Code of ethics, --Engineer's Role in Project Development, Writing Engineering Proposals, Permitting, Construction and Operation of Engineering Works Byelaws 1987, Dispute Resolution in Construction Projects.

Responsibilities and Rights

Collegiality and loyalty, Confidentiality, Conflict of interests, Occupational crime, Human rights, Employee rights, Whistle blowing, Intellectual property rights.

Communicating as a Professional Engineer

Communication Conduits, E-mail Usage and Limitations, Behavioural Characteristics of Team Members, Ethical responsibilities of civil engineer in project life cycle, Best practices related to professional ethics, Case studies.

Recommended Books:

1) A Textbook on Professional Ethics and Human Values by R.S Naagarazan, New Age International Publisher, Latest Edition
2) Civil Engineer’s Handbook of Professional Practice by Karen Lee Hansen and Kent E. Zenobia, John Wiley & Sons, Latest Edition
3) Engineering Ethics Edited by Michael Davis, Routledge Publishing, Latest Edition

Approval:

Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
Board of Faculty: 23	**Resolution No. 23.09**	**Dated: 09-12-2021**
Academic Council:	**Resolution No.**	**Dated:**

Title of Subject	**:**	**Engineering Economics (Th)**	
Code	**:**	CE423	
Discipline	**:**	Civil Engineering (7th Semester)	
Effective	**:**	20-Batch and onwards	
Pre-requisite	**:**	Nil	**Co-requisite:** Nil
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Exam (20% Mid, 60% Final)	
Credit Hours	**:**	02 + 00	**Marks :** 50 + 00
Minimum Contact Hours:		30 + 00	

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	UNDERSTAND fundamental principles and basic concept of engineering economy	C2	1
2	APPLY the cost and value concepts to solve engineering problems	C3	2

Course Outline:

- Introduction to Economics: Supply and demand theory, supply and demand equilibrium, micro-and macro-economic analysis
- Engineering Economics: Principles of engineering economy, engineering economy methodology, steps in an engineering economic analysis.
- Cost and Value Concepts: Sunk and opportunity costs, fixed, variable and incremental costs, recurring and non-recurring costs, direct, indirect and overhead costs, standard costs, cash versus book costs, life cycle costs, value, market value, use value, fair value, book value, salvage value, value addition.
- Comparing alternatives: Net present value, net present cost, Cost Benefit analysis, internal rate of return, payback period, levelised costs, break-even analysis, applicable to capital investment.
- Margin of safety application in Master Production Scheduling. Depreciation: Types of depreciation, methods of computing depreciation, economic life of equipment and replacement decisions.
- Product Costing: Sources of costing information: labor material, overheads, fixed cost, variable cost, absorption costing marginal costing standard costing. Inventory Valuation Methods.

Recommended Books

1. Fundamentals of Engineering Economics by C.S Park, Pearson. Latest Edition
2. Engineering Economy by William G. Sullivan, James A. Bontadelli, Elin M. Wicks, Latest Edition
3. Contemporary Engineering Economics by Chan S. Park. Latest Edition

Approval:

Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
Board of Faculty: 23	**Resolution No. 23.09**	**Dated: 09-12-2021**
Academic Council:	**Resolution No.**	**Dated:**

Title of Subject	**:**	**Environmental Engineering-II (Th)**
Code	**:**	**CE431**
Discipline	**:**	Civil Engineering (7th Semester)
Effective	**:**	17-Batch and onwards
Pre-requisite	**:**	Environmental Engineering-I **Co-requisite: -----**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESCRIBE various characteristics of municipal and industrial wastewater and its composition, solid waste management, air and noise pollution.	C2	1
2	EXPLAIN wastewater collection and conveyance systems, understanding the management tools for solid waste reduction, reuse and recycling.	C2	2
3	DESIGN the wastewater treatment plant and manage the hazardous waste for societal and environmental sustainability.	C6	3,7

Course outline:

PART – I: WASTEWATER ENGINEERING

- **Wastewater Quality**
  Wastewater terminology, Characteristics of municipal industrial wastewater, Wastewater composition, Sampling techniques, Wastewater quality and analysis, Quality parameters/monitoring.

- **Wastewater Treatment Unit Processes/Operations**
  Estimating wastewater quantity, Conventional wastewater treatment systems, Municipal wastewater treatment unit processes: physical treatment methods, biological treatment methods, special/physico-chemical and chemical treatment methods, Sludge disposal and reuse, Wastewater reclamation and reuse, Natural treatment, Self-purification systems.

- **Design of a Wastewater Treatment Plant**
  Design of bar racks and screens, Grit chambers, Sedimentation tanks (detritus tanks, skimming tanks), Activated sludge processes, Aerated lagoons, Trickling filters, Rotating biological contractors, Stabilization ponds, Control of nutrients, Odour and VOCs control, Sludge thickeners and digesters, Composting units, Dewatering equipment, Wetlands.

- **Small Wastewater Treatment Systems**

Small wastewater systems and characteristics, Design of on-site systems: septic tanks, imhoff tanks, pit latrines.

- **Wastewater Infrastructure (collection and conveyance)**
  Sewerage systems, Methods of carrying wastewater and its disposal: sewer materials, shapes, fittings and joints, design of sewers, laying and testing of sewers, ventilation of sewers, cleaning of sewers, surface drains, sewer appurtenances, House drainage system.

PART – II: SOLID AND HAZARDOUS WASTE MANAGEMENT

Characteristics of solid waste, Generation-collection-transferring and disposal of waste (incineration and landfill options), Waste minimization: recycling reuse of solid waste, composting, Hazardous waste: classification and treatment, Contaminated sites and their remedies.

PART – III: AIR AND NOISE POLLUTION

Air pollution: their origin, sources, types, effects, and dispersion, Control of air pollutants, Air emission measurement and control, Ambient air quality, Noise pollution: concept of sound and sound pressure level, noise sources and their effects on health, Acoustic environmental criteria (safety and health at work), Noise measurement and control.

Recommended Books:

- Environmental Engineering and management, Suresh K. Dhamejarg, Vikas Publishing House Pvt Ltd. Latest Edition
- Wastewater Engineering, Metcalf and Eddy, Tata Mc Graw Hill Publishing Company Ltd.
- Water Supply, Twort, Ac Twist. F.M. Low and FW Crowley Arnold International student Edition (AISE), Latest Edition

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Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject : **Structural Design and Drawing (Th + Pr)**
Code : CE406
Discipline : Civil Engineering (7th Semester)
Effective : 17-Batch and onwards
Pre-requisite : Reinforced and Prestressed Concrete **Co-requisite: ---**
Assessment : Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid,60% Final)
Practical: 40% Sessional, 60% Written Semester Examination
Credit Hours : 03 + 01 **Marks :** 100 + 50
Minimum Contact Hours: 45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DESIGN various reinforced concrete structural members	C6	3
2	DISCUSS design requirements and techniques of RCC bridges and Tall buildings.	C2	3
3	PRACTICE on various structural software for design and analysis of different structures and structural components.	P3	5

Course outline:

Slender columns, analysis and design of slender columns, Shear walls, analysis and design of shear walls, Two way slab systems, methods for the design of two way slabs, Flat plate, flat slab, and waffle slabs, Design of flat plate, flat slab and waffle slabs for flexure and shear under gravity loading, Retaining walls, analysis and design of retaining walls, Water tanks, design of water tanks, Bridges, types of bridges, preliminary design of reinforced concrete bridges, High rise buildings, design considerations for high-rise buildings, Introduction to seismic design of reinforced concrete structures.

Practical work to be carried out:

1. To get acquainted with the structural drawing of RCC beams.
2. To get acquainted with the structural drawing of RCC columns.
3. To get acquainted with the structural drawing of RCC slabs.
4. To get acquainted with the structural drawing of RCC footings.
5. To get acquainted with the structural drawing of RCC staircases.
6. To draw the L-section and cross section of a simply supported rectangular RCC beam.
7. To draw a sectional plan and elevation of a square, rectangular and circular column with a footing.
8. To draw a sectional plan and elevation of a simply supported one-way and two-way RCC slabs.

9. To draw a cross section of end connection of a column with a beam.
10. To draw cross section showing connection of two beams (1st floor and roof level) with intermediate and end columns.
11. Introduction to ETABS software and setting out grid lines and story data in ETABS.
12. To define and assign the various sections and loads in ETABS.
13. To analyze a multi-story building using ETABS software.
14. To design a multi-story building using ETABS software.
15. To perform an open-ended lab.

Recommended Books:

- Reinforced Concrete Design, Park &Palily, Willy Interscieer Publication, John Willy &Sons
- Reinforced Concrete Design, C.K Wang and C.G Salamon, Harlperand Row Publisher New York, Latest Edition
- Reinforced & Pre-stressed Concrete, F.K Kong and R.H Evans, Ven National Reinhold U.K, Latest Edition
- Structural Concrete: Theory and Design, M.N. Hassoun and A.A. Manaseer, Publisher: John Wiley & Sons. Inc., Latest Edition

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Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
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Title of Subject	**:**	**Geotechnical Engineering (Th + Pr)**
Code	**:**	CE411
Discipline	**:**	Civil Engineering (7th Semester)
Effective	**:**	17-Batch and onwards
Pre-requisite	**:**	Soil Mechanics **Co-requisite: ---**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid,60% Final) Practical: 40% Sessional, 60% Written Semester Examination
Credit Hours	**:**	03 + 01 **Marks :** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	EXPLAIN various soil improvement techniques, their applications and equipment.	C2	5
2	ANALYZE the range of soil related problems especially those involving external stresses, shear strengths, earth retaining structures and slope stability.	C4	4
3	PRACTICE laboratory testing to determine compaction characteristics and shear strength parameters of soil.	P3	4

Course outline:

- **Compaction**
  Definition, compaction fundamentals, Moisture-Density relationship, Laboratory compaction methods: standard and modified Proctor tests, Factors affecting compaction, Compaction in the field, field compaction equipment and machinery, field control and measurements of in-situ density.

- **Soil Improvement**
  Introduction to soil improvement techniques: removal and replacement of soil, mechanical and chemical stabilization of soil, in-situ densifications, grouting, preloading, and vertical drains, and soil reinforcement, Basic principles and objectives of various methods of soil improvement, Application of various soil improvement techniques.

- **Shear Strength**
  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.

- **Earth Pressures**
  Earth pressure at rest, active and passive earth pressures, Coulombs and Rankine theories for active and passive earth pressures, Earth pressure diagrams for different loading conditions.

- **Stress in a Soil Mass**

Boussinesq's equations for computing vertical stresses in soil mass under various loadings: point load, line load, uniform load on a strip area, uniform load on circular area, uniform load on rectangular area and stresses at a point outside the loaded area, Pressure distribution diagrams: Stress isobar, pressure distribution diagrams on horizontal and vertical planes, Equivalent point load method, Newmark influence chart for vertical pressure, 2:1 Method.

- **Stability of Slopes**
  Types of slopes, Factors affecting stability, Types of failure and remedial measures, Factor of safety, Stability of infinite slopes, stability numbers, Stability analysis of finite slopes: Taylor's chart, friction circle, method of slices.

- **Introduction to Relevant Software**

Practical work to be carried out:

1. To determine the moisture-density relationship by Standard Proctor Test.
2. To determine the moisture-density relationship by Modified Proctor Test.
3. To determine the CBR value for un-soaked soil sample.
4. To determine the CBR value for soaked soil sample.
5. To determine the field density by Core Cutter Method.
6. To determine the field density by Water Replacement/Oil Replacement Method.
7. To determine the field density by Sand Replacement (Sand Cone) Method.
8. To determine the relative density of soil sample by Vibrating Table.
9. To determine the shear strength parameters of sandy soil by Direct Shear Box Test.
10. To determine the shear strength parameters of clayey soil by Direct Shear Box Test.
11. To determine the shear strength of clayey soil by Un-Confined Compression Test and Pocket Penetrometer Test.
12. To determine the shear strength of a clayey soil by Laboratory Vane Shear Test.
13. To determine shear strength of fine grained soil by Tri-Axial Test (Demonstration only).
14. To determine sand equivalent value of sand.
15. To perform an open-ended lab.

Recommended Books:

- Modern Geotechnical Engineering, Alam Singh, CBS Publication, Latest Edition
- Principles of Geotechnical Engineering, Das, B.M, Brook/Cole, Latest Edition
- Soil Mechanics and Foundations, Garg, S. K, Khanna Publishers, Delhi, Latest Edition

Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**

Title of Subject	**:**	**Irrigation and Drainage Engineering (Th+Pr)**
Code	**:**	CE443
Discipline	**:**	Civil Engineering (8th Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Hydrology **Co-requisite: NIL**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Written Semester Examination
Credit Hours	**:**	03 + 01 **Marks:** 100 + 50
Minimum Contact Hours:		45 + 45

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DEMONSTRATE soil-water-crop relationships and various hydraulic structures.	C3	2
2	DESIGN irrigation canals and drainage system	C6	3
3	PRACTICE the field and software experimentation to verify crop water requirements for designing of irrigation scheduling.	P3	5

Course outline:

- **Soil-Water-Crop Relationship**
  Introduction of irrigation, Soil and its physical and chemical properties, Root zone soil water, Crops of Pakistan and crop rotation.

- **Methods of Irrigation**
  Irrigation methods, Factors affecting choice of irrigation methods, Pressurized and non-pressurized methods, Uniformity coefficient.

- **Water Requirement of Crops**
  Functions of irrigation water, Standards for irrigation water, Terminology, Relationship between duty and delta, Factors affecting duty, Improving duty, Classes of soil water, Equilibrium points- soil moisture tension, Depth of effective root zone, Depth and Frequency of watering, Evapotranspiration, Irrigation efficiencies, Gross irrigation requirements.

- **Canal Irrigation System and Design of Irrigation Canals**
  Alluvial and non-alluvial canals, Alignment of canals, Distribution system for canal irrigation, Determination of canal capacity, Canal losses and channel section for minimum seepage loss. Variables affecting flow in earthen channels, Kennedy's theory, Lacey's theory, Hydraulic design of earthen channels, Sediment transport, Tractive force method, Earthen canal section, Lined and its advantages, Types of lining with their merits and demerits, Hydraulic design of lined channels, Drainage behind lining, Super elevation, Discharge measurement in canals, Sediment measurement, Maintenance of canal section, Telemetry system.

- **Diversion Head Works**
  Weir and barrage with their Functions, Components, and Design considerations, Canal head regulator, Silt excluding devices.

- **River Training Works**
  Types, Guide banks, Marginal banks, Spurs, Pitched islands.

- **Canal Outlets**
  Requirements of an outlet, Classification and description of outlets, Tail cluster and tail escape, Selection of the type of outlets.

- **Dams**
  Types of dams and reservoirs, Storage zones of reservoirs, Storage capacity and yield of reservoir, Reservoir sedimentation and its control in reservoir, Economic height of dam, Factors governing the selection of type and site of dam.

- **Waterlogging and salinity**
  Waterlogging and its causes, Optimum depth of water table, Salinity and its causes, Waterlogging and salinity management techniques.

- **Drainage methods**
  Horizontal drainage, Tile drainage system and its design, disposal of drainage effluent, Installation of tile drains, Vertical (Tube well) drainage, Conditions required for vertical drainage, Design procedure of drainage tube wells.

- **Cross drainage structures**
  Introduction, Classification of cross drainage structures and their description.

Practical work to be carried out

1. To investigate the effect of nozzle size on the radial distribution of water from a Rotary Sprinkler.
2. To investigate the effect of pressure on the radial distribution of water from a Rotary Sprinkler.
3. To investigate the effect of height of riser on the radial distribution of water from a Rotary Sprinkler.
4. To determine the Coefficient of uniformity for a drip irrigation system.
5. To construct flow net and investigate the seepage flow rate underneath a sheet pile wall.
6. To determine uplift pressure on foundation of hydraulic structure.
7. To change uplift pressure on foundation of hydraulic structure by changing length of flow lines.
8. To reduce or eliminate uplift pressure by providing drainage.
9. To measure discharge using Current meter.
10. To determine crop water requirement using CROPWAT.
11. To study the rainfall-runoff characteristics of multiple storm rainfalls.
12. To study the effects of reservoir storage on runoff hydrograph.
13. To draw a drawdown curve for a single well in an unconfined aquifer pumping at a constant discharge.
14. To draw a drawdown curve for a single well in a confined aquifer pumping at a constant discharge.
15. To perform an open-ended lab.

Recommended Books

- Irrigation and Drainage Engineering, Iqtidar H. Siddiqui, Oxford University Press, Latest Edition.
- Irrigation and Hydraulic Structures: Theory, Design and Practice, Dr. Iqbal Ali, Institute of environmental Engineering Research, NED University Karachi, Latest Edition.
- Irrigation Engineering and Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers, Latest Edition.

- Irrigation and Waterpower Engineering, Dr. B. C. Punmia and Pande B. B. Lal, Standard Publishers, Delhi, Latest Edition

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Approval:

Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
Board of Faculty: 23	**Resolution No. 23.09**	**Dated: 09-12-2021**
Academic Council:	**Resolution No.**	**Dated**

Title of Subject	**:**	**Traffic Engineering and Pavement Design (Th + Pr)**
Code	**:**	CE451
Discipline	**:**	Civil Engineering (8th Semester)
Effective	**:**	20-Batch and onwards
Pre-requisite	**:**	Transportation Engineering **Co-requisite: Nil**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final) Practical: 40% Sessional, 60% Final Examination
Credit Hours	**:**	02 + 01 **Marks :** 50 + 50
Minimum Contact Hours:		30+45

Specific Objectives of Course:

- To equip students with knowledge related to Pavement design, construction, maintenance and traffic operations.

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	APPLY basics of traffic engineering for effective traffic management.	C3	3
2	DESIGN Rigid and Flexible pavements.	C6	4
3	PRACTICE to investigate properties asphalt mix and capacity analysis of road segments.	P3	4

Course outline:

- **Traffic Engineering**
  Introduction, Highway safety, Traffic control devices, Traffic sign, Traffic signals, Capacity Analysis, Traffic Management.

- **Pavement Design**
  Introduction, Types of Pavements, Wheel loads, Equivalent Single Axle load, Repetition & impact factors, Design of flexible & rigid pavements, Constructions / Maintenance of pavement.

- **Asphalt Mix Design**
  Importance of Asphalt mix design, Conventional and Performance based techniques and Design of Asphalt with Marshal Mix design method.

Practical Work to be carried out:

1. Introduction to Laboratory and HSE Measures.
2. To analyse the spot speed on selected road using different methods.
3. To carry out intersection traffic count including turning movement on an intersection using manual and camera technique.

4. To calculate Peak hour factor, ADT, AADT of any selected road section.
5. To calculate intersection delay at any selected signalised intersection.
6. To carry out parking study in any parking lot.
7. To determine the Los Angeles abrasion value (% wear) of aggregate sample.
8. To determine the flakiness and elongation index of aggregate.
9. To determine the stripping value of the given aggregate sample by static immersion method.
10. To determine the aggregate impact value of the given aggregate sample.
11. To determine the soundness of the aggregate using different chemicals.
12. To determine specific gravity, flash & fire point and ductility of bitumen.
13. To determine penetration grade and softening point of bitumen.
14. Determination of aggregate gradation for job mix formula.
15. Volumetrics of asphalt mix (open ended lab).

Recommended Books:

- The Design and a performance of Road Pavement, David Croney, HMSO London, Latest Edition
- Highway Engineering, Justo and Khanna, Publication Company, Delhi, Latest Edition
- Traffic engineering and Design, R. J Salter, McGraw Hill Book Company, Latest Edition
- ASHTO Standards, Vall& Valli, Latest Edition
- Traffic & Highway Engineering, Nicholas J Garber lester H. Hoel, Latest Edition
- Highway Engineering, Paul H. wright / Karen K Dixon, Latest Edition
- Transportation Engineering Introduction to Planning, Design and Operations, Jason C. Yu. Elsevier Science Ltd, Latest Edition

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Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
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Academic Council:	**Resolution No.**	**Dated**

Title of Subject	**:**	**Construction Planning & Management (Th)**	
Code	**:**	CE438	
Discipline	**:**	Civil Engineering (8th Semester)	
Effective	**:**	20-Batch and onwards	
Pre-requisite	**:**	Project Management	**Co-requisite: ----**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid,60% Final)	
Credit Hours	**:**	03 + 00	**Marks :** 100 + 00
Minimum Contact Hours:		45 + 00	

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	APPLY the knowledge of deterministic and probabilistic models for project planning and scheduling.	C3	11
2	DISCUUS engineering contracts and procurement methods related to construction projects.	C2	11

Course outline:

- **Introduction**
  Evolution of construction management, Construction industry players and their role, Type of construction project, Skills and responsibilities of construction managers, Construction economy and civil engineer.
- **Project Planning, Scheduling and Controlling**

  Deterministic Models: Construction activities, Work Break Down Structure (WBS), Gantt chart, Planning and Scheduling by using different Network Techniques, Activity on Arrow Diagram Method (AOA), Activity on Node Diagram Method (AON), Critical Path Method (CPM), Precedence Diagram Method (P.D.M.), Line of Balance (LOB) Technique, Scheduling of labor, materials, equipment and expenditure. Determining the minimum total cost of a project.

  Probabilistic Models: Project Evaluation and Review Technique (PERT). Graphical Evaluation and Review Technique (GERT). Determining mean, variance, standard deviation, probability and beta distribution. Identification of critical path.

  Resource Planning, Resource Loading, Resource Aggregation & Resource Levelling. Information and Knowledge Management.
- **Equipment Planning and Management**

  Importance of equipment management in construction, Development in construction equipment, Extent of mechanization and equipment planning in construction projects. Types of construction equipment, Factors influencing selection of construction equipment, Factors influencing equipment productivity, Productivity estimation and equipment planning.

  Software Application: Introduction to software application in construction project management.
- **Engineering contracts and procurement methods**

Different types of engineering contracts, Procurement methods and their selection, Procurement in project life cycle, Procurement guidelines, E-procurement in construction industry. Prequalification process, Preparation of bidding documents and NIT, Factors influencing contractor selection, Joint venturing, Public Private Partnership, Construction claims and dispute resolution.

Recommended Books:

- Principle of Construction Management, Roy Pilcher, MC Graw Hill Company, Latest Edition.
- Precedence and Arrow Net-working Techniques for Construction, Robert B. Harris, John Wiley and Sons, Latest Edition
- Construction Planning, Equipment and Methods, Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C.J, McGraw Hill, USA, Latest Edition.
- Smith G.R., (2003). Contracts and Claims. In: Chen, W.F. and Richard Liew, J.Y., The Civil Engineering Hand Book. Latest Edition. CRC Press LLC.
- Standard Procurement Document "Prequalification Document for Procurement of Works and User's Guide", The World Bank, Latest Version.
- FIDIC condition of contract for construction for Building and Engineering Works designed by the Employer, Multilateral Development Bank Harmonized Edition, Latest Version.

Approval:

Board of Studies: 33	**Resolution No. 33.3**	**Dated: 30-11-2021**
Board of Faculty: 23	**Resolution No. 23.09**	**Dated: 09-12-2021**
Academic Council:	**Resolution No.**	**Dated**

Title of Subject	**:**	**Foundation Engineering (Th)**
Code	**:**	CE426
Discipline	**:**	Civil Engineering (8^h Semester)
Effective	**:**	17-Batch and onwards
Pre-requisite	**:**	Geotechnical Engineering **Co-requisite:**
Assessment	**:**	Theory**:** 20% Sessional, 80% Written Semester Examination (20% Mid, 60% Final)
Credit Hours	**:**	03 + 00 **Marks :** 100 + 00
Minimum Contact Hours:		45 + 00

Course Learning Outcomes (CLOs):
Upon successful completion of the course, the student will be able to:

CLO	Description	Taxonomy Level	PLO
1	DISCUSS soil investigation techniques, in situ tests and equipment.	C2	5
2	DESIGN shallow and pile foundations; and discuss earthen dam components including design parameters.	C6	3

Course outline:

- **Soil Exploration**
  Importance of soil exploration and planning of soil exploration program, Soil exploration methods: probing, test pits, auger boring, wash percussion and rotary drilling and geophysical methods, Soil samplers, Disturbed and undisturbed sampling, In situ tests: standard penetration test, cone penetration test, and field vane shear test, Coring of rocks, Core recovery and RQD. Borehole logs and sub soil exploration report.

- **Foundations**
  Purpose and types of foundations, Selection of foundation type, Types of bearing capacities of foundation, Gross and net pressures on footing, Design requirements for the foundations, Failure modes in foundations and their characteristics and criterion, General requirements for foundation design.

- **Shallow Foundations**
  Techniques to obtain bearing capacity of shallow foundations, Development of bearing capacity theory, Theories to calculate bearing capacity: Terzaghi's, Meyerhof's, Hansen's, Vesic's, Skempton's, Effects of water table, Design of strip, isolated, combined and raft footings, Elastic settlement of shallow foundations based on theory of elasticity, elastic and consolidation settlement of shallow foundations on saturated clays, settlement of sandy soil, Presumptive values, Plate load test

- **Pile Foundations**
  Introduction to deep foundations, Types of Deep foundations, Reasons to use piles, Classification of piles, Methods of installation, Load transfer mechanism of piles, Load carrying

capacity of piles in different soils, Empirical relationships, Settlement of Piles, Pull out resistance of piles, Pile driven formulas, Negative skin friction, Pile load test, Group piles: Group efficiency, elastic and consolidation settlement of group piles, up lift capacity of group piles.

- **Foundation on difficult soils**
  Foundation on layered soils, foundation on collapsible soils, foundations on expansive soils.

- **Earthen Dams**
  Types of earthen dams, components and their functions, General design considerations and typical cross-section.

- **Introduction to relevant software**

Recommended Books:

- Foundation Analysis and Design, J.E Bowles, McGraw Hill Book Company, Latest Edition
- Foundation Engineering, B.M, Das, Brooks/Cole, Latest Edition
- Foundation Design and Construction, Tomilimson, ELBS, Latest Edition

Approval:

Board of Studies:	**Resolution No. 32.3**	**Dated: 03-10-2020**
Board of Faculty:	**Resolution No. 20.11**	**Dated: 07-10-2020**
Academic Council:	**Resolution No. 98.7(ii)**	**Dated: 22-10-2020**