Mehran University of Engineering & Technology, Jamshoro

Department of Civil Engineering

CURRICULUM OF

BACHELOR OF SCIENCE
(CIVIL ENGINEERING TECHNOLOGY)

(From 22-Batch to 23-Batch)

SCHEME OF STUDIES
BACHELOR OF SCIENCE (B. Sc.) CIVIL ENGINEERING TECHNOLOGY/ B.E TECH (CIVIL) (22-Batch and 23-Batch)

*1st Year - 1st Semester		
Course Code	**Course Title**	**Credit Hours Th+Pr**
CH112	Islamic Studies / Ethics	2+0
CS113	Linear Algebra and Calculus	3+0
CS123	Introduction to Computer Fundamentals	1+2
CT113	Civil Engineering Drawing	1+2
CT124	Surveying & Leveling	2+2
CT133	Applied Mechanics	2+1
	Total (18)	**11+7**

*1st Year - 2nd Semester		
Course Code	**Course Title**	**Credit Hours Th+Pr**
CT134	Concrete Technology	2+2
CH123	Communication Skills	3+0
CH133	Pakistan Studies	2+0
CT144	Materials and Methods of Building Construction	2+2
CS133	Differential Equations	3+0
	Total (16)	**12+4**

2nd Year - 3rd Semester		
Course Code	**Course Title**	**Credit Hours Th+Pr**
CET201	Evolution of Architecture and Engineering	2+0
CETN201	Applied Chemistry	2+1
CETH201	Professional Ethics	2+0
CET202	Environmental Technology	1+1
CET203	Fluid Mechanics	2+1
CET204	Mechanics of Solids	2+1
CET205	Geology	1+1
	Total (17)	**12+5**

2nd Year - 4th Semester		
Course Code	**Course Title**	**Credit Hours Th+Pr**
CET206	Transportation and Highway Technology	2+1
CET207	Soil Mechanics	1+2
CET208	Structural Principles	2+0
CET209	Computer Aided Drawing and Building Information Modelling	1+2
ENG202	Technical & Scientific Writing	2+0
CETN202	Fundamentals of Applied Economics	2+0
MATH214	Statistics and Probability	3+0
	Total (18)	**13+5**

3rd Year - 5th Semester		
Course Code	**Course Title**	**Credit Hours Th+Pr**
CET301	Hydrology	1+1
CET302	Reinforced and Prestressed Concrete	2+1
CET303	Construction Equipment and Jobsite Practices	2+1
CETH301	Human Skills	2+0
CETM301	Construction Planning and Management	1+1
CET304	Electro-Mechanical Technology	2+0
CET305	Project Part –I	0+3
	Total (17)	**10+7**

3rd Year - 6th Semester		
Course Code	**Course Title**	**Credit Hours Th+Pr**
CET306	Geotechnical Investigation and Foundations	1+1
CET307	Irrigation Technology	2+0
CET308	Construction of Steel Structures	1+1
CET309	Quantity Surveying and Estimation	2+1
CET310	Maintenance and Repair of Civil Works	1+1
CETM02	Technopreneurship	2+0
CET311	Project Part-II	0+3
	Total (16)	**9+7**

4th Year - 7th Semester		
Course Codes	**Course Title**	**Credit Hrs.** Th+Pr
CET-401	GIS and remote Sensing	2+1
CET-402	Ground Improvement Techniques	2+1
CET-403	Design Assessment Tools	1+1
CET-404	Building Codes and Compliance	3+0
CET-405	Smart Technologies for Facilities Management	2+1
CET-406	Construction Project Administration	2+1
CET-407	Drainage Technology	3+0
CET-408	Applied Hydraulics	2+1
CET-409	Water Supply Systems	1+1
Note: Students can take 5 to 6 courses from the list according to the per week credit hours.		
	Total (16)	**10+6**

4th Year - 8th Semester				
CET-421	**Supervised Industrial Training (Compulsory)**	Civil Engineering Technology Domain Industrial Training	**Credit Hrs. Th. + Pr.** **0+16**	**Contact Hrs. Th. + Pr.** **0+40**
Total Credit Hours & Contact Hours in Four Years (When Optional Courses will be conducted instead of SIT in 7th semester**)**			77+(41+16) = **134****	77+(41*3+40) = **240****
Theory VS Practical with respect to Contact Hours			Theory Practical	77 **(32.08%)** 163 **(67.91%)**

Approval:

IAB	Res. No. 4(ii)	Dated:01.11.2023
Board of Studies	Res. No. 2.1	Dated:07.11.2023
Board of Faculty	Res. No. 1.3(b)	Dated:29.11.2023
Academic Council	Res. No. 106.10(iii)	Dated:14.12.2023

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards

Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels											
			1	2	3	4	5	6	7	8	9	10	11	12
1.	CH112	Islamic Studies / Ethics	C2							C2,C5				
	CS113	Linear Algebra and Calculus	C2	C2										
	CS123	Introduction to Computer Fundamentals	C1,C2				P2,P5							
	CT113	Civil Engineering Drawing	C2	P3	P4									
	CT124	Surveying & Leveling	C2		C3		P3							
	CT133	Applied Mechanics	C2	C3		P1								
2.	CT134	Concrete Technology	C2		C6,P3									
	CH123	Communication Skills										C2		C1

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards													
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels										
			1	2	3	4	5	6	7	8	9	10	11	12
	CH133	Pakistan Studies		C1	C1			C4						
	CT144	Materials and Methods of Building Construction	C2		C3	P3								
	CS133	Differential Equations		C3		C3								
3.	CET201	Evolution of Architecture and Engineering	C3					C2						
	CETN201	Applied Chemistry	C1,P1	C2										
	CETH201	Professional Ethics								C2				C4
	CET202	Environmental Technology		C3,P3					C1,C2					
	CET203	Fluid Mechanics	C2	C3		P4								

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards													
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels										
			1	2	3	4	5	6	7	8	9	10	11	12
	CET204	Mechanics of Solids	C2	C4							P2			
	CET205	Geology	C1, C3								P3			
4.	CET206	Transportation and Highway Technology	C2,C3			P3	P4							
	CET207	Soil Mechanics	C2	C3							P5			
	CET208	Structural Principles		C2,C3										
	CET209	Computer Aided Drawing and BIM	C1				C2,C3, P3							
	ENG202	Technical & Scientific Writing										C4, C6		
	CETN202	Fundamentals of Applied Economics						C2,C2, C4						

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards													
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels										
			1	2	3	4	5	6	7	8	9	10	11	12
	MATH214	Statistics and Probability	C3,C3, C3											
5.	CET301	Hydrology	A2		C3	C4					P3			
	CET302	Reinforced and Prestressed Concrete	C2		C4						P4, A2			
	CET303	Construction Equipment and Jobsite Practices		C4							P4	A3	C3	
	CETH301	Human Skills								C3		C3		
	CETM301	Construction Planning and Management			P3								C2, C3	
	CET304	Electro-Mechanical technology	C2	C3										
	CET305	Project Part- 1	C3	C4	C5		P5		A4	A5	A4	A5	C4	
6.	CET306	Geotechnical	C4, P3			C2								

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards													
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels										
			1	2	3	4	5	6	7	8	9	10	11	12
		Investigation and Foundations												
	CET307	Irrigation Technology	C3	C4										
	CET308	Construction of Steel Structures	C2		C5						P3,A2			
	CET309	Quantity Surveying and Estimation		C3,C3			P4				A2			
	CET310	Maintenance and Repair of Civil Works		C4		C2					P3			
	CETM302	Technopreneurship						C2			C4			
	CET311	Project Part-II			C6	C4	C3			A5	A4	A5	A4	P6
7.	CET401	GIS and remote Sensing	C2										C2, P4	

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards

Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels											
			1	2	3	4	5	6	7	8	9	10	11	12
	CET402	Ground Improvement Techniques	C2			P3								
	CET403	Design Assessment Tools	C2		P4									
	CET404	Building Codes and Compliance	C2		C3									
	CET405	Smart Technologies for Facilities Management	C2				C3							
	CET406	Construction Project Administration		P3								C3	C4	
	CET407	Drainage Technology				C4			C3					
	CET408	Applied	C2	C4		P4					A2			

Courses Vs PLOs for 22 & 23 BSc-CET (Civil) Batch and onwards													
Semester No.	Course Code	Course Title	Learning Domains and Taxonomy Levels										
			1	2	3	4	5	6	7	8	9	10	11	12
		Hydraulics												
	CET409	Water Supply Systems	C2	C4,P3										

Title of Course:	**:**	**Introduction to Computer Fundamentals (1 + 2)**			
Course Code	**:**	CS123			
Semester	**:**	1st			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	21 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 20% Mid Semester Examination 60% Final Written Examination		40% Sessional Work, ---------- 60% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	1	**Pr**	2
Minimum Contact Hours	**:**	**Th**	16	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Identify** the components of a computer system	C1	1
2	Theory	**Describe** the basic knowledge of commonly used computer applications such as Word, Excel, PowerPoint and Visio.	C2	1
3	Practical	**Develop** web pages of using HTML Tag tables, div layout, images , Codes, links, HTML Forms.	P5	5
4	Practical	**Prepare** problem solving skills through the use of flow charts and algorithms and develop small scale computer programs.	P2	5

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To assemble or disassemble computers and plug-in devices, Enable students to design an optimal computer system environment as per need of customer, Pros and cons of

computer business and applications.

COURSE OUTLINE:

- **Basic terminology**:

Computer, user, hardware, software, chip, program,

- **Input**:

Data, instructions (programs, commands, user responses),

- **Output:**

Text, graphics, video, audio,

- **Types of computers:**

Personal, notebook, handheld, PDA, internet appliance, server, mainframe, supercomputer.

- **Types of Programming Languages:**

Generation of computers , Programming languages, Machine, assembly, High-level.

- **Key terms:**

VLSI, microprocessor, microcomputer, Computer Software: Terms: file, menu, font, voice recognition, FAQ, online help, wizard, software suite, single-user license, site license, application window, dialog box, clip art, cross-platform application, Application software, Word processing, Spreadsheet: cell, function, recalculation, charting,

- **C language:**

Introduction to C, Variables and constant, operators, Input/output statement, Decisions, Loops, Functions, Arrays, Pointers.

- **Database:**

Record, field, query, using MS Access/SQL, accounting software,

- **Graphics:**

Computer Aided Design (CAD), desktop publishing, paint/image, multimedia, web authoring,

- **Operating System:**

System software, Operating System (OS), Booting (startup), Cold vs. warm, BIOS, Steps in booting, Utility programs: file viewer, file compression, backup, screen saver, disk scanner, disk defragmenter, Computer hardware, System unit Terms: motherboard, chip, memory, storage, expansion slot (plug and play), port (serial vs. parallel), bus (expansion bus), power supply, Central Processing Unit (CPU), Machine cycle (fetch, decode, execute, store), Memory, Volatile vs. nonvolatile, RAM vs. ROM, Cache, Hard disk, Tracks, sectors, platters, RAID (mirroring and striping), Internet hard drive, Compact disks (and drives), PC Cards, Miniature mobile storage (Compact Flash, Memory Stick, Micro drive, Smart Media),

- **Devices:**

Keyboard, Pointing Devices, Others: trackball, touchpad, pointing stick, light pen, touch screen, stylus, Handwriting recognition software, Sound, Image: Digital camera, Scanners (flatbed, optical readers), Optical readers, Optical character recognition (OCR), bar code scanner, Optical Mark Recognition (OMR), Video: Web cam, PC Video camera, Output Devices, Display device, CRT monitor, Liquid Crystal Display (LCD) – passive versus active matrix, Gas plasma monitor, Printer and its types: Impact printers, Dot matrix printer, Line printer, Plotter, Non-impact printers, Ink-jet, Laser, data projector, fax machine (fax modem), Internet, E- commerce, Ethics and social issues, Privacy and security

PRACTICAL WORK TO BE CARRIED OUT:

1) To know about Computers, their operation and HSE (Health, Safety and Environment) measures.
2) To understand basic machines organization including motherboard, memory, I/O cards, networking devices, Computer peripheral devices
3) To practice Operating Systems, Microsoft Windows
4) To use Microsoft Office i.e. MS Word, MS Power Point, MS Excel.
5) To practice various Office Tools & Overview of different browsers with emphasis on PowerPoint.
6) To use Microsoft Vision
7) To use HTML basics. Create page using HTML.
8) (a) To Practice for Loading & Unloading Turbo C software interface and identify its menu bar.
   (b) To create, edit and save a source program.
   (c) To compile, link and execute a program.
9) To prepare a C-Language program and perform the arithmetic operations by using all
   arithmetic operators. Also print the result on the screen.
10) (a) To prepare a C-Language program to exchange the values of two variables and to print their actual and exchanged values.
    (b) To prepare a C-Language program to input a number calculate the cube of the number and print the result on the screen.
11) (a) To prepare a C-Language program to calculate area of rectangle, when length & width are given.
    (b) To prepare a C-Language program to calculate the area of a circle, when radius and diameter is given.
12) (a) To prepare a C-Language program to input a number if the number is divisible by 3 then print the message on the screen that " the number is divisible by 3" use " block if statement".
    (b) To prepare a C-Language program to perform simple arithmetic operation by using switch statement.
13) To prepare C-Language programs using IF-THEN-ELSE and For Loop statement.
14) To prepare a C-Language program by using an Array.
15) To prepare a C-Language program by calling functions.
16) To perform an open-ended lab.

RECOMMENDED BOOKS:

1) Peter Norton, "Introduction to Computers", Latest Edition
2) Misty E. Vermaat, "Discovering Computers", Shelly Cashman Series, Latest Edition.
3) Robert Lafore ,"Turbo C" ,Latest Edition.

Approval:	Industrial Advisory Board	Res No. 5 (b)	Dated: 01/04/2021
	Board of Studies	Res.No. 3.1	Dated: 10/04/2021
	Board of Faculty	Res.No. : 1.5	Dated: 19/07/2021
	Academic Council	Res.No. : 100.18	Dated: 24/08/2021

Title of Course:	**:**	**Civil Engineering Drawing (1 + 2)**			
Course Code	**:**	CT 113			
Semester	**:**	1st			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	21 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 20% Mid Semester Examination 60% Final Written Examination		40% Sessional Work, ----------, 60% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	1	**Pr**	2
Minimum Contact Hours	**:**	**Th**	16	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Understand** the basic knowledge of engineering drawing skills	C2	1
2	Practical	**Apply** the techniques of engineering drawing in architectural drawings of civil engineering structures.	P3	2
3	Practical	**Draw** the structural drawings of various building components	P4	3

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To enable students to learn fundamentals and principles of Engineering Drawing
- To enable students to draw orthographic projections and sections.
- To lean broader aspect of civil engineering drawing.

- To have skills to prepare architectural, structural drawings.

COURSE OUTLINE:

- **Introduction to Engineering Drawing:**
  Isometric drawing, orthographic, projection of points, lines and planes or multi-view drawing, dimensioning, sectioning, different drawing tools and software

- **Architectural Drawing:**
  Typical architectural drawing of a building: (site plan, building elevations, floor plan of each floor, basement plan and roof plan); house emergency floor plan; electrical floor plan ; air conditioning duct floor plan ; plumbing floor plan ; foundation floor plan (footing); foundation floor plan (pile).

- **Structural Drawing**
  Introduction to structural detailing drawings, structural framing plan; Beams; Columns and Foundations; Staircase; Slabs

PRACTICAL WORK TO BE CARRIED OUT:

1) To know about different drawing instruments and their usage in drawing and introduction to HSE measures.
2) To draw Regular Polygons by Universal Method (with given dimensions).
3) To draw Isometric Views of given objects.
4) (a) To draw Isometric View of the given stairs steps.
   (b) To draw Oblique View of the given stairs steps.
5) To draw Oblique View of a Beam resting on two Columns.
6) (a) To draw Development Drawing of a Cube and Cylinder.
   (b) To draw Development Drawing of a Cone.
7) To draw different forms of Rivet Heads.
8) To draw a Plan and section of isolated and combine footing showing reinforcement also draw the Schedule of Footing.
9) To draw a four storied Building Column's elevation and cut section at each floor reducing reinforcement and cross-section of column.
10) To draw Schedule of Beam also draw Typical Elevation of Beam , showing Bottom bar, Extra bottom bar, Hanger bar, Top bar, Extra Top bar, and rings.
11) To draw single span Beam Elevation and its Section showing reinforcement using bent up bar.
12) To draw a three span RCC Beam elevation and its section showing reinforcement also develop Schedule of Beam.
13) To draw a Plan and X-section of single span RCC Slab, showing reinforcement.
14) To draw Plan and X-section of one way slab of three spans showing reinforcement.
15) To draw a Plan of 120 sq. yard residential bungalow.
16) To perform Open-ended lab.

RECOMMENDED BOOKS:

1) Engineering Drawing by N.D. Bhatt (53rd Edition2014) Charotar Publisher (Latest Edition).
2) Drawing for Engineering By Paul Smith (Latest Edition).
3) Basics of Engineering Drawing By Zahid Ahmad Siddique, 2nd Edition, M/S Technical Publisher Lahore (Latest Edition).
4) Civil Engineering Drawing by Gurcharan Singh (Latest Edition).

Approval:	Industrial Advisory Board	Res No.: 5 (b)	Dated: 01/04/2021
	Board of Studies	Res.No. : 3.1	Dated: 10/04/2021
	Board of Faculty	Res.No. : 1.5	Dated: 19/07/2021
	Academic Council	Res.No. : 100.18	Dated: 24/08/2021

Title of Course:	**:**	**Surveying and Leveling (2 + 2)**			
Course Code	**:**	CT 124			
Semester	**:**	1st			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	21 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 20% Mid Semester Examination 60% Final Written Examination		40% Sessional Work, ----------, 60% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	2
Minimum Contact Hours	**:**	**Th**	32	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Describe** surveying instruments used in linear and angular measurement for computing the area of plots.	C2	1
2	Theory	**Prepare** the L-section and X-section using the computation of levels.	C3	3
3	Practical	**Practice** various surveying instruments used in linear and angular measurement	P3	5

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Society:		12	Lifelong Learning:	

OBJECTIVES:

- To develop an understanding of surveying & leveling theory and practice.
- To develop an ability to translate survey information for design and construction purposes.
- To develop a skill in the use of modern survey instruments.

COURSE OUTLINE:

Introduction:

- Introduction to surveying and its applications
- Theory of errors and Weights: quality of observations, weighted observations, distribution, & adjustment of errors. Most probable value.
- Introduction to leveling, precise leveling, profile leveling, errors and corrections in leveling, plotting L-section and X-section ----Triangulation, trilateration, field procedures and application, EDM, strength of figure, computation and plotting.
- Curves: Various types of curves with application : simple circular curve, compound curves, transition curves, vertical curve and reverse curves,
- Design and layout of curves.
- Tachometry, system of tachometry, applications of tachometer in surveying, computation of horizontal and vertical measurements.
- Hydrographic surveying: Horizontal and vertical controls, sounding and shorelines.
- Introduction to GPS.
- Introduction to remote sensing and GIS in surveying.

PRACTICAL WORK TO BE CARRIED OUT:

1) To learn about the Surveying Lab facilities, precautions for handling the instruments, HSE (Health, Safety and Environment) measures
2) To study and use of conventional instruments & Total Station.
3) To locate various objects by chain surveying and determine offsets
4) To range out the survey line by direct ranging and establish the intermediate.
5) To make temporary adjustment of automatic level and reading of a leveling staff.
6) To practice leveling and computation by collimation and rise and fall method.
7) To perform temporary adjustment of theodolite
8) To determine the horizontal distance between the points by tachometer when the line of sight is straight.
9) To determine the horizontal distance between the points by tachometer when the line of sight is inclined, and staff is held vertical
10) To determine the elements of simple circular curve on the field from collection and analysis of data
11) To determine the elements of reverse curve on the field from collection and analysis of data
12) To determine the elements of composite curve on the field from collection and analysis of data.
13) To perform profile and precise leveling.
14) To determine the elements of vertical curve on the field from collection and analysis of data
15) To measure the horizontal distance between two points on the Sloping Ground by measuring angle of slope
16) To perform Open-ended lab.

RECOMMENDED BOOKS:

1) Surveying Theory and Practice by R. E. Davis, J. Anderson, F.S. Foote, McGraw-Hill (Latest Edition).
2) Surveying by Jack C. Mc Cormac (Latest Edition).
3) Schaum's Outline Series of Introductory Surveying by R. H. Wirshing, Roy Wirshing, Jaews R. Wirshing (Latest Edition).
4) Surveying with Construction Applications by Barry F. Kavanagh, Prentice Hall (Latest Edition).
5) Plane and Geodesic Survey Vol. I and II by David Clarck, Trans-Atlantic Publications (Latest Edition).

Approval:	Industrial Advisory Board	Res No. 5(c)	Dated: 01/04/2021
	Board of Studies	Res.No. 3.2	Dated: 10/04/2021
	Board of Faculty	Res.No. : 1.5	Dated: 19/07/2021
	Academic Council	Res.No. : 100.18	Dated: 24/08/2021

Title of Course:	**:**	**Applied Mechanics (2 + 1)**			
Course Code	**:**	CT 133			
Semester	**:**	1st			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	21 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 20% Mid Semester Examination 60% Final Written Examination		40% Sessional Work, ----------, 60% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** the two-dimensional Force System and Equilibrium conditions by applying the basic principles of statics.	C2	1
2	Theory	**Apply** the fundamental concepts of kinetics and kinematics to the analysis of a body when subjected to different types of motion.	C3	2
3	Practical	**Demonstrate** the external behavior of bodies subject to force system and equilibrium.	P1	4

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- The objectives of this course is to make the student:
- Familiar with all relevant physical properties and fundamental laws governing the behavior of materials and structures

- Understand relationships of physical processes, kinetics, and kinematics. To develop skills to use the basic principles of mechanics in technology applications.

COURSE CONTENTS

- **Introduction to statics:**
  Mechanics: Basic concepts; Scalar and vector; Vector addition, subtraction and product, concept and unit of measurements of mass, force, time, space
- **Force system:**
  Introduction; Two-dimensional force system; Rectangular components; Law of triangle, parallelogram, moment, couple, resultants; solution of problems.
- **Equilibrium:**
  Equilibrium in two dimensions; Equilibrium conditions; free body diagram; solution of problems.
- **Friction:**
  Introduction; Types of friction; Laws of solid friction; Co-efficient of friction, Solution of problems
- **Kinematics of rectilinear and curvilinear motion:**
  Introduction; Displacement; Types of motion; Speed, velocity, acceleration; Equation of motion under uniform acceleration; Normal and tangent acceleration, Solution of problems
- **Work and energy:**
  Work, Energy, Power, Impulse; Momentum; Simple harmonic motion and free vibration.

PRACTICAL WORK TO BE CARRIED OUT:

1) To learn about Mechanics Lab and HSE (Health, Safety and Environment Measures)
2) To determine the resultant of forces.
3) To study the law of moment and equilibrium conditions.
4) To determine the reaction of a simply supported beam through load cell.
5) To determine the tension in the simple cable through load cell.
6) To determine the reaction of a simply supported truss through load cell.
7) To study the projectile motion using photogate.
8) To study acceleration on an inclined plane using photogate.
9) To study Newton's second law of motion.
10) To verify the forces at different members of Jib Crane.
11) To determine the co-efficient of friction between 3 pairs of Rubber Surface, (Wood Glass, Rubber, Leather and Glass).
12) To Determine The Tension In Various Points Of A Hanging Rope Loaded At Different Points.
13) To Determine center of gravity (centroid) of various objects by analytical solution and experimental Observations.
14) To verify the principle of moments.
15) To determine the reaction of a simply supported beam by Experimental Observation (using spring balances), Analytical Solution (using condition of equilibrium) and Graphical Solution (using Funicular Polygon)
16) To perform Open-ended lab.

BOOKS RECOMMENDED:

1. Engineering Mechanics by R.S. Khurmi (Latest Edition).

Approval:	Industrial Advisory Board	Res No. 5(c)	Dated: 01/04/2021
	Board of Studies	Res.No. 3.3	Dated: 10/04/2021
	Board of Faculty	Res.No. : 1.5	Dated: 19/07/2021
	Academic Council	Res.No. : 100.18	Dated: 24/08/2021

Title of Course:	**:**	**Concrete Technology (2 + 2)**			
Course Code	**:**	CT 134			
Semester	**:**	2nd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	21 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 20% Mid Semester Examination 60% Final Written Examination		40% Sessional Work, ----------, 60% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	2
Minimum Contact Hours	**:**	**Th**	32	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** various properties of concrete and its ingredients and effects of various factors on concrete	C2	1
2	Theory	**Design** concrete mixes considering various parameters using standard guidelines	C6	3
3	Practical	**Perform** laboratory tests on concrete and its ingredients	P3	3

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To develop an understanding of the composition and behavior of plain concrete.
- To understand various methods of proportioning of constituent materials for a required concrete quality.
- To analyze the problems of transportation, pouring, bleeding of concrete.

- To understand methods of curing and compaction and factors affecting strength of concrete.
- To know the benefits of testing of concrete and to understand the procedure of quality control.

COURSE OUTLINE:

- **Concrete Properties and Its Behavior:**
  Properties of aggregates, cement and concrete, properties of fresh and hardened concrete, strength, elastic behavior, shrinkage and creep and durability to chemical and physical attacks. Methods of testing concrete cylinders and cubes in compression. Effects of impurities in water and in aggregates on the performance and durability of plain and reinforced concrete. Effect of water/cement ratio upon workability and strength of concrete.

- **Mix Design:**
  Requirements of cube cylinder strength, workability, and aggregate size. Prescribed mix, design mix and the effect of varying proportions of the component parts. Procedure for design of concrete mix (ACI, British Standard Specifications and Road Note No.4). Laboratory and site testing for assessing the quality, performance and strength of a design mix.

PRACTICAL WORK TO BE CARRIED OUT:

1) To learn about Material Testing Lab and HSE (Health, Safety and Environment Measures)
2) To find organic impurities and water absorption of aggregates
3) To determination of specific gravity and bulk densities of aggregates, aggregate gradations.
4) To perform sieve analysis of coarse aggregate.
5) To cast specimens for varying w/c ratio and bulk densities, slump test and casting 6" cubes and cylinders.
6) To measure effect of w/c ratio on strength of concrete (compressive strength test on cubes and cylinders).
7) To determine soundness of cement by Le-Chatelier's apparatus
8) To prepare test specimens from hand mixed, machine mixed and hand compacted concrete.
9) To perform compression tests on specimens as (5) above and making comparisons.
10) To compare strength of cube and cylinder.
11) To perform concrete Mix design by ACI 211.1-91 method.
12) To cast beam specimens and test the specimen of cubes and cylinders.
13) To perform modulus of rupture test on beam specimens.
14) To determine effects of Admixture - Accelerator, Retarder, Super Plasticizer
15) To perform nondestructive testing - Rebound Hammer test.
16) To perform an open-ended lab.

RECOMMENDED BOOKS:

1) Properties of Concrete by A. M. Neville; Wiley John & Sons. (Latest Edition).
2) Concrete Design by Zahid Ahmad Siddiqi, Help Civil Engineering Publishers, Lahore, 2009. (Latest Edition).
3) Design of Concrete Structures by H. Nilson, McGraw-Hill. (Latest Edition).
4) Reinforced Concrete - Design & Behavior by C. K. Wang &Salmon (Latest Edition).
5) Structural Concrete Theory and Design. By M. Nadim Hassoun & Akthem Al

Manaseer. (Latest Edition).

Approval:	Industrial Advisory Board	Res No. 5(d)	Dated: 01/04/2021
	Board of Studies	Res.No. 3.4	Dated: 10/04/2021
	Board of Faculty	Res.No. : 1.5	Dated: 19/07/2021
	Academic Council	Res.No. : 100.18	Dated: 24/08/2021

Title of Course:	**:**	**Materials and Methods of Building Construction (2 + 2)**			
Course Code	**:**	CT 144			
Semester	**:**	2nd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	21 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 20% Mid Semester Examination 60% Final Written Examination		40% Sessional Work, ----------, 60% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	2
Minimum Contact Hours	**:**	**Th**	32	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Describe** different materials and their characteristics used in building works.	C2	1
2	Theory	**Apply** different methods used in building construction	C3	3
3	Practical	**Perform** various laboratory and field test of materials.	P3	4

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To develop an understanding of the properties, uses and behavior of the building materials, standards for material quality, various tests on materials.
- To develop the basic understanding of construction techniques and methods of building construction with particular reference to R.C. work, brick work, flooring, damp-proofing, roofing and stairs.

COURSE OUTLINE:

- **Bricks, Blocks and Tiles:**
  Manufacture of bricks/blocks and its classifications, standard tests of bricks/blocks and characteristics of good bricks/blocks, process of manufacture of tiles, Ceramic materials.

- **Stones:**
  Characteristics of good quality stones, dressing of building stones, properties and uses of common construction stones used in Pakistan. Location of stone queries in Pakistan.

- **Lime, Cement and Timber:**
  Test and uses of lime. Methods of manufacture and storage of cement in different conditions. Classification and grading of sand and its bulking, cement sand mortars used for building construction. Characteristics, properties and performance of Pakistani timber used in construction. Seasoning and preservation of wood. Use of plywood, hard board and chipboard in construction.

- **Paints and Varnishes:**
  Types of paints, Composition, preparation and application of paints, plaster, varnishes and distempers in building works.

- **Metals:**
  Manufacture, characteristics and uses of Ferrous and Non-Ferrous metals and their alloys. Composition and uses of mild steel, cast iron, brass and aluminum in buildings.

- **Glass and Plastics:**
  Composition, varieties, properties and uses of glass, plastics, laminates and adhesives in constructions. Properties and uses of asphalt, bitumen, rubber, asbestos and its products, plastic pipes, reinforced plastics.

- **Methods of Construction:**

  Bonds in brick masonry and their formation in building construction, corbel, cornice, string course, parapets and slip joints. Masonry block. Stone masonry, Uses of stone in civil engineering. Use of Gabion walls. Scaffolding work design and its importance in construction work. R. B. beams, columns, lintels and slab construction in buildings. ASTM Standards and testing of bricks.

  Hand tools for construction. Foundation for walls and piers. Load bearing walls in brick and masonry construction, composite walls cavity construction, concrete framed structures panel walls, and external finishes. Reinforced concrete, materials in roof and floor construction, and floor finishes. Internal walls and partitions, surface finishes to internal walls and ceiling, doors and windows, staircases, damp proofing of walls and ceiling. Fire resistant construction. Tunnel and Cofferdams construction. Formwork for slabs, beams, columns & walls, etc. and its design. Formwork for shells. Standards, inspection & quality control of materials.

PRACTICAL WORK TO CARRIED OUT:

1) To determine the normal consistency of a given sample of cement.
2) To perform fineness test of various sands.
3) To perform sieve analysis of fine aggregates.
4) To perform fineness test of Cement.
5) To prepare cement mortar for different water cement ratios.
6) To prepare cement concrete for different grades.
7) To perform compaction factor test of cement concrete
8) To determine of initial and final setting time of cement.
9) To identify standard sizes of brick and blocks.
10) To determine water absorption of a brick and stone.
11) To determine water content in coarse and fine aggregates.
12) To determine efflorescence of brick.
13) To determine compressive strength of brick/block.
14) To perform impact test of different civil engineering materials.
15) To perform soundness, hardness and toughness tests for various civil engineering materials.
16) To perform open-ended lab.

RECOMMENDED BOOKS:

1) Materials of. Construction by R. C. Smith and C. K. Andres, ISBN: 0070585040, McGraw Hill. January 1987 (Latest Edition).
2) Fundamental of Building Construction: Material and Methods, by Edward B. Allen, (Latest Edition).
3) Building Construction Vol. I to Vol. IV by Mckay (Latest Edition).
4) Building Construction by Mitchall (Latest Edition).
5) Building Construction by Huntington (Latest Edition).
6) Civil Engineering Materials by Neil Jackson (Latest Edition).
7) Construction Materials by P. D. Domone, University College, London (Latest Edition).

Approval:	Industrial Advisory Board	Res No. 5(a)	Dated: 01/04/2021
	Board of Studies	Res.No. 3.5	Dated: 10/04/2021
	Board of Faculty	Res.No. : 1.5	Dated: 19/07/2021
	Academic Council	Res.No. : 100.18	Dated: 24/08/2021

Title of Course:	**:**	**Evolution of Architecture and Engineering (2 + 0)**			
Course Code	**:**	CET 201			
Semester	**:**	3rd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		N/A	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** the evolution of architecture in the light of historic, social, and cultural contexts.	C2	6
2	Theory	**Determine** modern architectural trends and use of advanced materials	C3	1

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:	√	12	Lifelong Learning:	

OBJECTIVES:

- To know about Architecture and its importance in civil engineering.

COURSE CONTENTS:

General introduction to history of architecture, development of various cultures and civilizations from the prehistoric to the present-day world with emphasis on building types of Egyptian architecture and Persian empire, Origins and development of Persian art and architecture, example of architecture (Palaces, Temples, Tombs) and city planning Mesopotamian Architecture: Characteristics of the valley of the river Tigris and Euphrates, people and their culture, Influences on the art and architecture of Mesopotamia. Examples of Architecture (palaces, temples, and ziggurats) and city planning.

Indus Valley Civilization: its location, influences on architecture, examples of the Indus valley architecture and city planning.

European Civilization & its Buildings: Greek Period: Greek civilization, location, and influences on its architecture, Hellenic and Hellenistic Greece, Example of Greek architecture.

Muslim Civilization: Emergence and development of Islamic Architecture. Geographical, climatic, religious, social, historical aspects of architecture. A brief survey of architectural developments during Umayyad, Abassid, Fatmid, Spanish, Ottoman, Persian and Mughal dynasties.

Modern Civilization: Developments in architecture colonial period in Colonies and their impact on Traditional architecture. Examples of colonial architecture from North Africa and Indian sub-continent Modern Movement in Architecture, Post Modern Architecture, Deconstruction.

Architectural theories: standards, Modern buildings, construction materials, and architectural complexes.

Recommended Books

1. Owen Hopkin, Architectural styles a visual guide, Laurence King Publishing, Latest edition.

2. Sir Banister Fletcher's, A History of Architecture, Bloomsbury Publishing, Latest edition.

3. R. Furneaux Jordan, A concise history of Western architecture, Harcourt Brace Jovanovich, Latest edition.

4. Hamlyn Paul. World Architecture: An illustrated history, Latest edition.

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**:**	**Environmental Technology (Th + Pr) (1 + 1)**			
Course Code	**:**	CET 202			
Semester	**:**	3rd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ---------- 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**State** the laws, acts and standards being followed to protect the environment.	C1	7
2	Theory	**Describe** the fundamental components of sewer, sewerage treatment, air, and noise pollution systems.	C2	7
3	Theory	**Solve** the fundamental components of sewer and various types of pollution factors.	C3	2
4	Practical	**Demonstrate** the effect of the parameters for the water quality.	P3	2
5	Practical	**Respond** actively during lab work	A-2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	√
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist &		12	Lifelong Learning:	

	Society:				

OBJECTIVES:

1. To introduce basic concepts relating to the provisions of water supply and wastewater collection facilities.

2. To enable students to design water supply and wastewater collection systems.

COURSE OUTLINE:

Introduction: Introduction to Environment; Environmental Impact Assessment (EIA); Environmental Protection Agencies (USEPA and PEPA), Procedure to conduct EIA of civil engineering projects. National Environmental Quality Standards (NEQs).
Environmental Pollution: Pollution and its Types; Sources, Sampling, Monitoring, Mitigation, and Effects; Atmosphere and Atmospheric Layers. Global Warming and its Causes; Green House Gases.
Solid Waste Management: Introduction to Solid Waste (SW) and its Management; Types and Sources of SW generation; Collection & Transportation of SW; and Disposal. Methods to Treat SW; Environmental Problems Caused by SW.
Wastewater: Introduction to Wastewater and its Sources; Estimation of Wastewater Generation; Collection and Conveyance/Transportation of Wastewater; Types of Containments Present in the Wastewater; Treatment Methods of Wastewater; Recycling Applications of Wastewater.
Sewers: Classification of Sewage and Sewer Systems; Combined and Separate Sewer Systems; Sewer Appurtenances and Sewer Testing.

PRACTICAL WORK TO BE CARRIED OUT:

1. Composition of solid waste (percentage) On-Campus Activity.
2. To determine the amount of Settleable Solids (SS) in waste sample (by Imhoff Cone Method).
3. To determine the amount of Total Dissolved Solids (TDS) in wastewater sample.
4. To determine the amount of volatile suspended solids (VSS) in wastewater sample (by gravimetric method).
5. To determine the amount of Total Suspended Solids (TSS) in wastewater sample (by Gravimetric Method).
6. To determine the Biological Oxygen Demand (BOD) of wastewater sample
7. To determine the Chemical Oxygen Demand (COD) of wastewater sample (Colorimetric Method)
8. Determination of Dissolve Oxygen (DO) by Direct Method/Probe Method
9. Moisture content Determination (by direct weight loss method).
10. NOx and SOx, COx and H_2S by hand meters

RECOMMENDED BOOKS:

1. Revelle, Charles S. Civil and Environmental Systems Engineering. 2nd Edition.
2. Sharma. Comprehensive Environmental Studies. Latest Edition
3. Reinhart. Solid Waste Engineering. Latest Edition.

4. S.C RANGWALA. Fundamentals of Water Supply and Sanitary Engineering. Latest Edition.

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**Fluid Mechanics (Th + Pr) (2 + 1)**			
Course Code:	CET 203			
Semester:	3rd			
Technology:	Civil Engineering Technology			
Effective:	22 – Batch and onwards			
Pre-requisite:	Nil			
Co-requisite:	Nil			
Assessment	**Theory**		**Practical**	
	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**Th**	2	**Pr**	1
Minimum Contact Hours	**Th**	32	**Pr**	48
Marks	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

S. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** the basic concept of fluid statics, kinematics, and dynamics.	C2	1
2	Theory	**Solve** various problems related to fluid at rest and motion.	C3	2
3	Practical	**Conduct** a different experiment to verify the theoretical principles of fluid mechanics.	P4	4
4	Practical	**Contribute** actively to the lab work of basic fluid mechanics.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge	√	7	Environment and Sustainability	
2	Problem Analysis	√	8	Ethics	
3	Design/Development of Solutions		9	Individual and Teamwork	√
4	Investigation	√	10	Communication	
5	Modern Tool Usage		11	Project Management	
6	The Engineering Technologist &		12	Lifelong Learning	

	Society				

OBJECTIVES:

1. To provide a broad concept of fluid mechanics.
2. To enable students to solve problems relating to pipe flow and open channel flow.

COURSE OUTLINE:

Introduction: Fluid mechanics, hydrostatics, kinematics, hydrodynamics, hydraulics, solids and fluids, liquids and gases, units, and dimensions.

Physical properties of fluids: Specific weight, density, specific volume, surface tension, compressibility, viscosity, units of viscosity, measurement of viscosity, Newton's equation of viscosity.
Fluid Statics: Pressure intensity and pressure head, specific weight relationship, absolute and gauge pressure, measurement of pressure, Piezometer, Manometer, Pressure Transducers. Differential manometer and Bourden gauge. Forces on submerged planes and curved surfaces and their applications. Buoyancy and floatation, Equilibrium of floating and submerged bodies.
Fluid Kinematics: Steady and unsteady flow, laminar and turbulent flow, uniform, and non-uniform flow. Path line, streamlines and stream tubes, Velocity and discharge, Equation of continuity for compressible and incompressible fluids.
Hydrodynamics: Different forms of energy in a flowing liquid, head, Bernoulli's equation and its application, Energy line and Hydraulic gradient line, free and forced vortex.
Flow Measurement: Orifices and mouthpieces, Weirs and notches, Pitot tube and pitot-static tube, Venturimeter, Salt velocity method, Colour velocity method, Radioisotope methods.
Uniform Flow in Open Channels: Chezy's and Manning's equations, The most economical channel sections.

Steady Flow through Pipes

Losses in pipelines, minor and major losses, Darcy-Weisbach equation for major loss of head in pipes, Pipes in series and parallel, Transmission of energy through pipes.

PRACTICAL WORK TO BE CARRIED OUT:

1. Introduction to Practical contents, Equipment, and HSE (Health, Safety and Environment) measures.
2. To perform an experiment for determination of the viscosity of a given fluid (oil/water) by using falling sphere type viscometer.
3. To check accuracy of Bourden Gauge through its calibration by means of dead weight apparatus.
4. To conduct experiment for the magnitude of Hydrostatic force on partially submerged surface and locate center of the pressure.
5. To conduct an experiment for the magnitude of Hydrostatic force on fully submerged surface and locate center of the pressure.

6. To conduct experiment for the metacentric height and locate the positions of various important points of a floating body.
7. To conduct experiment for measurement of the pressure using Manometer.
8. To perform experiment for Study of Laminar, Transitional and Turbulent Flow using Reynold's concept equipment.
9. To conduct an experiment for coefficient of discharge of rectangular and triangular notches.
10. To conduct an experiment for the hydraulic coefficients of an orifice.
11. To verify Bernoulli's theorem for steady flow of water.
12. To measure the flow of incompressible fluid in pipes by Flow Meters.
13. To determine the coefficient of weir for: (a) Broad crested weir; (b) Sharp crested weir; and (c) Ogee weir

RECOMMENDED BOOKS:

1. Fluid Mechanics for Civil Engineers by N. B. Webber, Chapman & Hall, (Latest Edition).
2. Fluid Mechanics with Engineering Applications by Dougherty, Franzini and Fennimore, McGraw Hill, New York. (Latest Edition).
3. An Introduction to Engineering Fluid Mechanics by J. A. Fox, Macmillan Company (Latest Edition)
4. Mechanics of Fluids by B. S. Massey, Wan Nost Reinhold International Rand hold Company Ltd., London (Latest Edition).

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**:**	**Mechanics of Solids (Th + Pr) (2 + 1)**			
Course Code	**:**	CET 204			
Semester	**:**	3rd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Solve** problems related to simple stress and strain in materials subjected to axial forces.	C2	1
2	Theory	**Analyze** simple beams subjected to simple bending loads and explain torsion and energy theory.	C4	2
3	Practical	**Perform** experiments related to the mechanical properties of materials.	P2	9
4	Practical	**Justify** the applications of experiments related to stress strain and deflection of materials.	A3	10

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation:		10	Communication:	√
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To develop an understanding of problems related to simple stress and strain in materials subjected to axial forces.
2. To compute stresses in beams subjected to simple bending loads and torsion.

3. Understanding of strain energy concepts and behavior of columns.

COURSE OUTLINE:

Simple stress and strain

Stress, strain and Hooks Law, Deformation of a body due to self-weight and force acting on it, Principle of superposition, Deformation in the bars of different sections, Stresses in determinate and indeterminate structures, Thermal stress in simple and composite bars, Elastic Constants and their relations.

Analysis of Beams

Centroid of plane figures (Symmetrical and Unsymmetrical sections), Second moment of area/Moment of inertia of different composite sections; Product of Inertia, Principal stresses and Principal Moment of Inertia, Theory of simple bending, Bending stress and determination of flexural formula.

Strain Energy

Strain energy stored in a body due to gradual, sudden and impact loads, Theory of torsion of solids and hollow circular shafts.

Column and Struts

Columns, Types, and different formulae for critical load like Euler's and Rankine's formula.

PRACTICAL WORK TO BE CARRIED OUT:

1. To study the stress strain curve of different materials.
2. To study the different stresses on the object.
3. To find the elastic modulus of different materials.
4. To study the yield strength and bending test on steel.
5. To study the yield strength and bending test on Wood.
6. To study the yield strength and bending test on Concrete.
7. To determine the principal stress using strain rosette and graphical methods (Mohr's Circle).
8. To study the biaxial bending behavior of various structural and non-structural shapes.
9. To study the stress trajectories for the wooden beam element.

RECOMMENDED BOOKS:

1.Craig, R. R. (2011) Mechanics of Materials, 3rd Edition, John Wiley and Sons (Latest Edition).

2. Beer, F. P., E. R. Johnston, J. T. DeWolf, and D. F. Mazurek (2011) Mechanics of Materials, (Latest Edition) McGraw Hill.

3. Hibbeler, R. C. (2011) Mechanics of Materials, Prentice Hall (Latest Edition).

4. Gere, J. M., and B. J. Goodno (2012) Mechanics of Materials, Brief edition, Cenage learning (Latest Edition).

5. Case, J., L. Chilver, and C. T. F. Ross (1999) Strength of Materials and Structures, (Latest Edition) Edward Arnold.

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**:**	**Geology (Th + Pr) (1 + 1)**			
Course Code	**:**	CET 205			
Semester	**:**	3rd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Describe** basic concepts of geology, formation of rocks and structural features of strata	C1	1
2	Theory	**Apply** knowledge of geology in civil engineering	C3	1
3	Practical	**Perform** various experiments of geology related to rocks identification and strength.	P3	9
4	Practical	**Contribute** actively to the lab work.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To understand basic concepts of geology, formation of rocks and structural features of strata

2. To be able to apply knowledge of basic concepts of geology in civil engineering projects

COURSE OUTLINE:

Introduction

Introduction to Geology, Importance of 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.

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. Estimation of RQD, TCR, SCR and Fracture Index using given rock core samples
5. To determine the compressive strength of rocks using Schmitt hammer.
6. To determine the different properties of rock core by ultrasonic pulse wave.
7. To determine the tensile strength of rocks in UTM machine.
8. To determine the slake durability index (Weathering) of rocks.
9. To determine the presence of carbonates in rocks using acid test.
10. To observe the folds using sand box.
11. To observe the different types of faults using sand box.
12. To distinguish the folds and faults in rocks at site.
13. To prepare drawing of Cross Sections from Geological maps.
14. To perform open ended lab project.

RECOMMENDED BOOKS:

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

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	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**:**	**Applied Chemistry (Th + Pr) (2 + 1)**			
Course Code	**:**	NSC 201			
Semester	**:**	3rd			
exvcTechnology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ---------- 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**To apply** knowledge of chemistry in various industrial process for civil engineering materials.	C1	1
2	Theory	**To introduce** students with thermodynamics and physico-chemical properties of water to analyze water quality.	C2	2
3	Practical	**Perform** experiments and carry out calculations to determine conductivity, boiling point, PH, concentration, etc.	P1	1
4	Practical	**Contribute** Actively during lab work.	A2	**9**

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge	√	7	Environment and Sustainability:	
2	Problem Analysis	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation		10	Communication:	
5	Modern Tool Usage		11	Project Management:	

6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

COURSE OUTLINE:

Introduction: Periodic table, Atoms and molecules structure, Introduction to chemical equation and calculations, Types of Chemical Reactions, Basic concept of Chemical bonding.

Properties of Gas & Liquids: Gas Laws, Kinetic gas equation, Surface Tension, Viscosity, Osmosis, Osmotic Pressure, pH-Buffer solution, Spectrophotometer, Basic concepts of Colloidal Chemistry.

Fuels & Lubricants: Types of fuels, classification of fossil fuels, relative merits of gaseous, liquid and solid fuels, Calorific values, Determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples, Definition and properties of Lubricants, mechanism, industrial application and its function in bearings, and Synthetic lubricants.

Corrosion and its Control: Definition of corrosion and factors affecting corrosion rate. Metal coatings, Inorganic coatings, Organic coatings – use of paints varnishes and enamels, Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing).

Electro and Thermo chemistry: Laws of Electrolysis, E.M.F. series, corrosion (Theories, inhibition & protection), Chemical thermodynamics, Hess's Law, Heat of reaction, Relation between H and U measurement of heat reaction.

PRACTICAL WORK TO BE CARRIED OUT:

1. Introduction of the common apparatus, glassware's and chemical reagents used in chemistry lab.
2. Determination of heat of neutralization of an acid with a base.
3. Demonstrate the conductivity of different solutions.
4. Demonstrate the electroplating of copper metal on iron strip using copper sulphate solution.
5. Study the reactive strength of cement constituents.
6. Determine the boiling point of Ethyl alcohol.
7. Purification of impure copper sulphate by crystallization.
8. To perform electrolysis of water to produce hydrogen gas and oxygen gas.
9. Determine the concentration of given solution of HCl.
10. Determine the pH of the given solutions.

Recommended Books:

1. Dara, S.S.; A Textbook of Engineering Chemistry (Tenth Edition) ; S.Chand, 2003.

2. Kuriacose, J.; Chemistry in Engineering and Technology (Vol. 1& 2); McGraw Hill, 1984.

3. Barrow, M. Gordon; Physical Chemistry (Fifth Edition); McGraw Hill, 1984.

4. March, Jerry.; Advance Organic Chemistry Reaction Mechanism and Structure (Forth Edition); John Wiley & Sons New York, 2004.

5. W. kemp; Organic spectroscopy (III Edition) PALGRAVE, 2002.

6. Puri B.R., Sharma L.R., Pathania M.S.; Principles of Physical Chemistry; Vishal Publishing Co. (42nd Edition).

7. Instrumental Methods of Analysis by Hobert H.Willard D.L. Merrit & J.R.J.A. Dean, Frank A.Settle; (Latest Edition) Wadsworth Publishing Company.

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	Board of Faculty	Res. No. 1.3(b)	Dated: 29-11-2023
	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**:**	**Professional Ethics (Th + Pr) (2+ 0)**			
Course Code	**:**	HUM 201			
Semester	**:**	3rd			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		N.A	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**To understand** professional ethics and its compliance with particular reference to construction industry and the role of civil technologist.	C2	8
2	Theory	**To analyze** unethical situations/ ethical dilemmas and perform ethical decision making throughout their technology careers in various positions.	C4	12

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	√
3	Design/Development of Solutions:		9	Individual and Teamwork:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	√

OBJECTIVES:

1. Identify the nature of Professional Ethics in terms of Legal, Historical and Personal definitions

2. Understanding the value of professional ethics

3. Resolving the ethical dilemmas using common ethical values and identifying possible actions to be taken in response

4. Assessing the probable consequences**.**

COURSE OUTLINE:

Fundamentals of Ethics in Profession: Understanding Moral and Ethical values and its significance, the values and behavior drive ethical decision making, Professionalism, Professional Ethics vs. Law, Professional Ethics in organizations, Professional Ethics and Civil Technologist.

Ethical Dilemmas and Decision Making: Methods for ethical decisions, Ethical Dilemmas and Taking Decisions, Conflicts of interest and managing risk, Moral Development Theories, Heinz Dilemma

Professional Ethics in the Context of Construction Industry: Professional Ethics in various phases of Project Life Cycle (such as feasibility, planning, design, procurement, construction, facilities management) with particular emphasis on Professional Ethics pertinent to the Role of Civil Technologists (e.g. technology implementation, customization, new technology development, etc.), Codes of Professional Ethics for Civil Engineers/ Technologists and their Compliance; Professional Ethics of Construction Quality, Safety and Health; Professional Ethics in Procurement; Professional Ethics in Construction Planning, Execution, Coordination, Supervision and Contract Administration; Dispute Resolution in Construction Projects, Rights and Responsibilities such as Collegiality, Collective bargaining, occupational crime, Unionism and Professionalism, Case Studies of Ethical Dilemmas and Good Practice in the Built Environment.

Broader Application of Professional Ethics: Ethical leadership, Professional Ethics in the Global Context of Built Environment, Emerging Topics in Professional Ethics, Ethics in developing Intellectual Properties

RECOMMENDED BOOKS:

1. Professional Ethics for the Construction Industry – Rebecca Mirsky and John Schaufelberger, Routlege, Latest Edition.
2. Ethics for the Built Environment – Peter Fewings, Latest Edition

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	Academic Council	Res. No. 106.3(xxv)	Dated: 14-12-2023

Title of Course:	**:**	**Transportation and Highway Technology (Th + Pr) (2 + 2)**			
Course Code	**:**	CET 206			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	2	**Pr**	2
Minimum Contact Hours	**:**	**Th**	32	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** concepts of transportation systems and its planning.	C2	1
2	Theory	**Use** fundamental concepts of Highway geometry, traffic operations and Highway Design for effective traffic system implementation.	C3	1
3	Practical	**Practice** use of equipment to investigate the properties of aggregate, bitumen, and Hot Mix Asphalt.	P3	4
4	Practical	**Practice** basic tools and commands of traffic operations	P4	5
5	Practical	**Respond** actively during lab work.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To develop an understanding of the fundamentals of highway geometry and to apply it in the design of Highways.

2. To produce an ability to use the survey works in the development of layouts of Highways.

COURSE OUTLINE:

Introduction to Transportation Systems and Planning

Modes of transportation, Principles of planning for communication facilities (road network, rail-road network & airport, port, and harbor facilities), Planning process and mode choice decisions, Overview of Mass Transit Systems.

Geometric Features of Highway

Functional classification of roads. Design controls of Vehicle, Speed, Driver, Volume and Sight Distances

Horizontal and Vertical Alignments

Horizontal curves, Vertical Curves, Transition, curves, Grades Super-elevation, Attainment of super elevation.

Pavement Types and Loads

Types of Pavements, Pavement Layers, Wheel loads, Equivalent Single Axle load, Repetition & impact factors, Constructions / Maintenance of pavement, Construction Equipment.

Pavement Construction and Equipment

Construction Techniques, Mixing of Asphalt, Compaction of layers, Construction Equipment used in field.

Traffic Operations

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

PRACTICAL WORK TO BE CARRIED OUT:

1. To determine the Los Angeles abrasion value (% wear) of aggregate sample.
2. To determine the flakiness and elongation index of aggregate.
3. To determine the aggregate impact value of the given aggregate sample.
4. To determine the soundness of the aggregate using different chemicals.
5. To determine specific gravity, flash & fire point, and ductility of bitumen.
6. To determine penetration grade and softening point of bitumen.
7. To determine aggregate gradation used for job mix formula considering different standard specifications.
8. Open-ended Lab: To determine volumetrics of Hot Mix Asphalt
9. Perform traffic survey to analyze the spot speed on selected road using different methods.
10. To carry out intersection traffic count including turning movement on an intersection using manual and camera technique.
11. To calculate Peak hour factor, ADT, AADT of any selected road section.
12. To calculate intersection delay at any selected signalized intersection.
13. To carry out parking study in any parking lot.

RECOMMENDED BOOKS:

1. The Design and a performance of Road Pavement, David Croney, HMSO London, Latest

Edition
2. Highway Engineering, Justo and Khanna, Publication Company, Delhi, Latest Edition
3. Traffic engineering and Design, R. J Salter, McGraw Hill Book Company, Latest Edition
4. ASHTO Standards, Vall& Valli, Latest Edition
5. Traffic & Highway Engineering, Nicholas J Garber lester H. Hoel, Latest Edition
6. Highway Engineering, Paul H. wright / Karen K Dixon, Latest Edition

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	Academic Council	Res. No. 106.10(iii)	Dated: 14.12.2023

Title of Subject:	:	**Soil Mechanics (Th + Pr) (01 + 02)**			
Course Code	:	CET 207			
Semester	:	4th			
Discipline	:	Civil Engineering Technology			
Effective	:	22 – Batch and onwards			
Pre-requisite	:	Nil			
Co-requisite	:	Nil			
Assessment	:	Theory		Practical	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	:	Th	1	**Pr**	02
Minimum Contact Hours	:	Th	16	**Pr**	32
Marks	:	Th	50	**Pr**	100

Course Learning Outcomes:

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

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Discuss** fundamentals of soil properties, behavior, and classification systems.	C2	1
2	Theory	**Solve** various problems related to soil permeability, consolidation and shear strength.	C3	2
3	Practical	**Perform** various experiments of soil mechanics related to index properties, permeability and shear strength of soil.	P5	9
4	Practical	**Respond** actively to experimental work.	A2	1

Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	√
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To develop a basic understanding of the composition, classification, structure and properties of soils.
2. To obtain knowledge of application of soil as a construction material
3. To acquire laboratory skills for determination of soil properties.

COURSE CONTENTS:

Introduction: Importance of mechanics of soils in Civil Engineering Technologists.

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, 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.

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

Consolidation: Introduction to Consolidation, Laboratory consolidation tests, Graphical representation of data, Compression index, Coefficient of compressibility, Calculation of voids ratio and coefficient of volume change, Degree of consolidation, Primary and secondary consolidation, Determination of pre-consolidation pressure and over consolidation ratio, Normally and pre-consolidated clays.

Shear Strength: Shear strength parameters of soils, shear strength of cohesive and cohesion less soil, Laboratory measurement of shear strength parameters: shear box test, unconfined compression test, vane shear test and tri-axial shear test.

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
d). Speedy Moisture Tester e). 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 and pipette analysis.
6. To determine the liquid limit of fine-grained soil by Casagrande Apparatus and or Fall Cone (Penetrometer) Method
7. To determine the liquid limit of fine-grained soil by.
8. To determine the shrinkage limit of fine-grained soil.
9. To determine the specific gravity of fine-grained soil by Density Bottle Method.
10. To determine the coefficient of permeability of coarse-grained soil by Constant Head Method.
11. To determine the coefficient of permeability of fine-grained soil by Falling Head Method.
12. To determine consolidation parameters of saturated fine-grained soil by One Dimensional Consolidation Test.
13. To determine free swell of clayey soils.
14. To determine the minimum and maximum dry density of cohesion less soil sample by Vibrating Table.
15. To determine the shear strength parameters of sandy/clayey soil by Direct Shear Box Test.

16. To determine the shear strength of clayey soil by Un-Confined Compression Test and Pocket Penetrometer Test.
17. To determine the shear strength of a clayey soil by Laboratory Vane Shear Test.
18. To determine shear strength of fine grained and coarse-grained soils by CU/CD/UU-Tri-Axial Test.
19. To determine sand equivalent value of sand.
20. To perform the open-ended lab.

RECOMMENDED BOOKS:

1. Principles of Geotechnical Engineering, Das, B.M, Brook/Cole. Latest Edition
2. Introduction to Soil Mechanics Laboratory Testing by Dante Fratta, Jennifer Aguettant and Lynne Roussel-Smith, Latest Edition.
3. Fundamentals of Soil Mechanics, M. Siddique Qureshi and Aziz Akbar, Latest Edition.

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	Board of Faculty	Res. No: 1.3(b)	Dated: 29.11.2023
	Academic Council	Res. No. 106.10(iii)	Dated: 14.12.2023

Title of Course:	**:**	**Structural Principles (Th + Pr) (2 + 0)**			
Course Code	**:**	CET 208			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		N.A	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Analyze** beams and frames and trusses.	C2	2
2	Theory	**Compute** deflections and slopes in determinate and indeterminate structures.	C3	2

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To calculate deflections and slopes in determinate structures.

COURSE OUTLINE:

Introduction to structural analysis:
Definition, types of structures, structural idealization, loads. Free body concept, conditions of support and attachment to other bodies. Support reactions under different types of loading. Introduction to shear force and bending moment diagrams. Determinacy,

indeterminacy, and stability of structures. Analysis of determinate beams, frames, and trusses. Common types of trusses, classification of coplanar trusses. Method of joints, method of sections and graphical method for analysis.

Analysis of Statically Determinate Rigid jointed plane frame:

Determinacy and stability of plane frames. Analysis, (sign convention etc.), Shear & bending moment diagrams of frames.

Deflection in beams and frames

Deflection diagrams and elastic curves, various methods to compute deflections in beams and frames, by -Double integration, Moment area, Conjugate beam Unit load method and theory of Castigijliano.

RECOMMENDED BOOKS:

1. Engineering Mechanics by R.C. Hibbeler (Latest Edition).
2. Engineering Mechanics Statics and Dynamics, J.L. Mariam & L.G. Kraige (Latest Edition).
3. Vector Mechanics for Engineers, Ferdinand P. Beer and E. Russel Johnston Jr, (Latest Edition).

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Title of Course:	**:**	**Computer Aided Drawing and BIM (Th + Pr) (1 + 2)**			
Course Code	**:**	CET 209			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		50% Sessional Work, ----------, 50% Final Lab. Examination	
Credit Hours/week	**:**	**Th**	1	**Pr**	02
Minimum Contact Hours	**:**	**Th**	16	**Pr**	96
Marks	**:**	**Th**	50	**Pr**	100

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Understand** development of computer aided Architectural and structural 3D drawings of basic nature including architectural and structural.	C2	5
2	Theory	**Apply** BIM Models up to 5D of basic nature architectural and structural.	C3	5
3	Practical	**Describe** different commands and tools in CAD and BIM	C1	1
4	Practical	**Practice** CAD and BIM software to develop building and structural drawings.	P3	5

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Teamwork:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

1. To enhance the capabilities of student to independently prepare the building drawings and develop an ability to analyses and design structures by commercially used computer packages

COURSE OUTLINE:

Computer Aided Drawing using Revit:

Overview of Revit, Core Concepts, Understanding the Process of Developing 3D Architectural and Structural Models in Revit, Different Perspectives of 3D Models, develop proficiency in Autodesk Revit software, Understanding architectural building models with structural and MEP systems.

BIM:

BIM Fundamentals: BIM Overview; BIM vs. Traditional CAD; Common BIM Terminology; Value of BIM; BIM as a Communication and Collaboration Tool; BIM Benefits; Typical BIM Process; BIM Implementation Needs and Challenges, Understanding the role of BIM in sustainability; Analyzing energy performance; Implementing green design strategies, Discussion on BIM Benefits, Clash detection between models of different disciplines.

BIM Technology: Phased Structure of a BIM project; Common BIM Applications; Develop understanding of how BIM models are integrated with schedules, Developing Templates for Estimating (5D), Walkthroughs/ Flythroughs/ Animation, Presentation Issues/ Rendering.

PRACTICAL WORK TO BE CARRIED OUT:

1. Orientation to Revit Environment (Architectural Perspective), Starting a Project and Modelling Basics
2. Setting Up a Project (Create a Revit project file and template Set up project parameters and units)
3. Setting Up Walls (Exterior and Interior walls), Doors, Windows, Floors, Roofs, and Ceilings.
4. Setting Up Plumbing and Mechanical Systems Including HVAC ducts, vents, and equipment
5. Setting up electrical systems (Electrical wiring, circuits, panels, light fixtures, and switches)
6. Setting the dimensions, detail drawing from views, Camera views and walkthroughs Photorealistic rendering.
7. Creating and editing families in Revit (using Family tool in Revit and Creating and editing layers)
8. Developing 3D Architectural Model of single unit (80-120 Sq-Yd) including plan, section and elevation. The following components of Revit to be covered while developing the 3D Model:
9. Links; Imports and Groups, Sketch Based Modelling Components Stairs and Complex Walls
10. Visibility and Graphics Controls
11. Rooms, Schedules and Tags, Annotation and Details
12. The Basics of Families Sheets, Plotting and Publishing
13. Developing 3D Structural Model of single unit (80-120 Sq-Yd) including foundation layout and details, plinth beam layout and details, framing plan and reinforcement details of slabs and beams
14. Estimating Quantities of 3D Model including Architectural and Structural of single unit (80-120 Sq-Yd)
15. Understanding the basics of Navisworks, the interface of Navisworks and introduction to the BIM clash detection.
16. Development of Schedule and Cost of 80 Sq-Yd House on MS Excel/ MS Project/

Primavera/

17. Integration of Schedule with Architectural Model of 80 Sq-Yd House on Navisworks
18. Developing 5D Model of 80 Sq-Yd House
19. Developing Simulation of 5D BIM Model and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, Quantization Noise, Signal to Quantization Noise Ratio, Pulse code Modulation, Delta Modulation, Frequency Shift Keying, Phase Shift Keying.
20. Open Ended Problem

RECOMMENDED BOOKS:

Autodesk manual (Latest Edition).

Approval:	Industrial Advisory Board	Res. No. 4(ii)	Dated:01.11.2023
	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No: 1.3(b)	Dated: 29.11.2023
	Academic Council	Res. No. 106.10(iii)	Dated: 14.12.2023

Title of Course:	**:**	**Fundamentals of Applied Economics (Th + Pr) (2 + 0)**			
Course Code	**:**	NSC 202			
Semester	**:**	4th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	20% Sessional Work, 30% Mid Semester Examination 50% Final Written Examination		N. A	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Understand** economics, its key sub-domains, and its relationship with micro and macro indicators	C2	6
2	Theory	**Understand** the relationship of economics with the civil and construction industry	C2	6
3	Theory	**Analyze** cost benefit of technology solutions related to civil engineering and construction industry	C4	6

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:	√	12	Lifelong Learning:	

OBJECTIVES:

- To familiarize students with the basic Concepts of Economics in engineering.
- To enable the students to make better economic decisions in their course of action.

COURSE CONTENTS

- Basic Concepts and Principles of Economics
- Thinking like an Economist
- Overview of Macro and Micro Economic theories
- Market Forces of Supply and Demand
- Elasticity and its Application
- Government Economic and Interest Policies
- Price-supply-demand-relationship
- Efficiency vs Equality
- Firm Behavior and Organization of Industry
- Introduction to construction industry economics
- Nature of construction firms and construction industry
- Micro economic principles for construction business
- Macro-economic concepts and their relevance to the construction industry
- Time Value of Money Concept
- Role of Technologist in Economics and Decision Making
- Earned Value Analysis
- Economical Appraisal Methods and Applications in civil construction projects
- Cost benefit analysis of technology solutions in civil engineering and construction industry domains
- Construction project supply chains

BOOKS RECOMMENDED:

1. Principles of Economics. N. Gregory Mankiw. Latest Edition. South Western Cenage Learning (Latest Edition).
2. The Economics of the Construction Industry. Gerald Finkel. Routlege(Latest Edition).

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	Board of Studies	Res. No. 2.1	Dated:07.11.2023
	Board of Faculty	Res. No: 1.3(b)	Dated: 29.11.2023
	Academic Council	Res. No. 106.10(iii)	Dated: 14.12.2023

Title of Course:	**:**	**Hydrology (1 + 1)**			
Course Code	**:**	CET301			
Semester	**:**	5^{th}			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment		**Theory** Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks	**Practical** Lab Rubrics: 30 % Open Ended Lab/Mini Project: 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory		
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	3
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**ANALYZE** the occurrence, movement, and distribution of water in the atmosphere, on and below the ground surface.	C4	4
2	Theory	**APPLY** the principles of groundwater movement for lifting of sub-surface water.	C3	3
3	Practical	**DEMONSTRATE** experimental investigations related to various hydrological parameters.	P3	9
4	Practical	**SOLVE** the measured hydrological parameters	A2	1

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	

6	The Engineering Technologist & Society:	√	12	Lifelong Learning:	

OBJECTIVES:

- To be able to analyze the occurrence, movement, and distribution of water in the atmosphere, on and below the ground surface.

COURSE CONTENTS:

- **Introduction:** Hydrology, Hydrologic cycle, Hydrologic equation.

- **Hydrologic Processes and their Computation:** Wind, Temperature, Relative humidity, Solar radiation, Precipitation, Evaporation, Transpiration, Evapotranspiration, Runoff, and their measurement/estimation. Data networks, Telemetry systems and Remote sensing. Analysis and application of Hydrograph and Unit hydrograph.

- **Floods- Estimation, Routing and Control:** Types of floods based on flowrate, Estimation of peak flood, Flood forecasting and warning.

- **Groundwater and Well Hydraulics:** Basic terminology, Types of aquifers, Yield of a well, Well losses, Specific capacity of well, Interference among wells.

- **Tube Wells:** Types and Parts of tube well, Tube well construction.

PRACTICAL WORK TO BE CARRIED OUT:

1. To measure daily evaporation using evaporation pan.
2. To measure daily minimum and maximum temperature.
3. To measure wind speed and direction using anemometer and wind vanes.
4. To measure relative humidity.
5. To measure rainfall depth of a storm event using non-automatic rain gauge
6. To obtain rainfall hyetograph of a storm event using an automatic rain gauge.
7. To study the rainfall-runoff characteristics of a long duration single storm rainfall along with multiple storm rainfalls.
8. To study the effects of reservoir storage on runoff hydrograph.
9. To study the rainfall-runoff characteristics of an urban catchment.
10. To draw a drawdown curve for a single well in an unconfined aquifer pumping at a constant discharge.
11. To draw a drawdown curve for a single well in a confined aquifer pumping at a constant discharge.
12. To observe drawdown at the observation wells using water level indicator while investigating the pumping test of a tube well
13. Introduction and application of latest GIS software in hydrology.
14. To perform an Open-ended lab.

Recommended Books

1. Engineering Hydrology-An Introduction, Abdul Razzaq Ghumman, Abd ur Rehman Printers Islamabad
2. Hydrology for Engineers, R. K. Linsley, Max A. Kohler, and Joseph L. Paulhus McGraw-Hill Education (ISE Editions); Latest Edition.
3. Hydrology: Principles, Analysis and Design, H. M. Raghunath, New Age International Publishers, India, Latest Edition.

4. Introduction to Hydrology, Warren Viessman, Jr. and Gary L. Lewis, Prentice Hall, Latest Edition
5. A Textbook of Hydrology, Dr. P. Jaya Rami Reddy, University Science Press, India, Latest Edition.

Approval:	Industrial Advisory Board	Res No. 9.5	Dated: 09/05/2024
	Board of Studies	Res. No.2.4	Dated: 29/05/2024
	Board of Faculty	Res. No. 3.1	Dated: 19/08/2024
	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Reinforced and Pre-stressed Concrete (2 + 1)**			
Course Code	**:**	CET302			
Semester	**:**	5th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project: 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	3
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Describe** basic knowledge on design of reinforced and pre-stressed concrete structural members	C2	1
2	Theory	**Apply** design method for design of reinforced and pre-stressed concrete members using different codes.	C4	3
3	Practical	**Conduct** various laboratory and field experiments related to fresh/hardened reinforced and pre- stressed concrete.	P4	9
4	Practical	**Contribute** in team work considering the environmental impact, safety, and responsible use of resources in conduct of Lab and field experiments.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	

2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	√
4	Investigation:		10	Communication:	

5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To understand basic knowledge on design of reinforced concrete structures.
- To be able to apply ultimate strength design method for design of reinforced concrete members using different international codes.

COURSE CONTENTS:

- **Reinforced concrete:**
  Basic principles of Reinforced concrete design, Basis for design and code constraints and associated assumptions, Design methods of reinforced concrete members, Basic concept of ultimate strength design method, Balanced, under reinforced and over reinforced section, Behavior of reinforced concrete members in flexure, Shear Stresses in Concrete Beams, Shear Cracking of Reinforced Concrete Beams, Web reinforcement, Behavior of Beams with web Reinforcement, Development Lengths for Tension Reinforcing, Development Lengths for Bundled Bars, Hooks, Bar cut off requirements, procedure for curtailment in continuous beams, development length with standard hooks, Preparation of working drawings of structural elements. Details of bar bending and preparation of schedules, Congested reinforcement and its placement techniques, provision of construction joint in flexural members and compression members, shapes of construction joints, Formwork and shuttering requirements, sizes, and types, shoring and scaffolding, advantages and disadvantages, design of formwork for RC members.

- **Prestressed Concrete**
  Basic concepts of prestressing, Methods of prestressing, Advantages and applications of prestressed concrete, Materials required for prestressed concrete, Analysis and assessment of prestressed concrete members based on stress and load balancing concept, short term and long-term deflections, Losses of prestress, Immediate and time dependents losses, lump sum and detailed estimation of prestress losses, Shapes of precast units, single tee, double tee, and hollow core-sections. Casting and curing of units. Typical joints for precast elements. Erection methods, precast units, and their specifications.

PRACTICAL WORK TO BE CARRIED OUT:

1. To determine the flexural strength of RCC concrete beams using centre-point loading method.
2. To determine the flexural strength of RCC concrete beams using third-point loading method.
3. Casting of reinforced concrete beam specimens and testing specimen for observation of flexural and shear cracks.

4. Making form work for precast concrete members and grills and casting of the specimens.
5. Study of equipment and machinery for pre-stressed concrete industry
6. Casting and testing of specimens of pre-stressed concrete units.
7. Casting and testing of specimens of precast RC concrete units.
8. Test for evaluation of structures (visual inspection and rebound hammer)
9. Open ended lab.

Recommended Books

1. Design of Concrete Structures by H. Nilson, McGraw- Hill.
2. Reinforced Concrete – Design & Behavior by C. K. Wang & Salmon.
3. Pre-stressed Concrete Structures by T. Y. Lin, Ned H. Burns, (Latest Edition).
4. PCI Design Handbook: Precast & Pre-stressed Concrete by Precast/Pre-stressed Concrete Institute, (Latest Edition).
5. Pre-stressed Concrete Design by Computer by R. Hulse, W.H. Mosley, (Latest Edition).

Approval:	Industrial Advisory Board	Res No. 9.5	Dated: 09/05/2024
	Board of Studies	Res. No.2.4	Dated: 29/05/2024
	Board of Faculty	Res. No. 3.1	Dated: 19/08/2024
	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Construction Equipment and Job site Practices (2 + 1)**			
Course Code	**:**	CET303			
Semester	**:**	5^{th}			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project: 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	3
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**ANALYZE** Heavy construction equipment productivities	C4	2
2	Theory	**APPLY** Project Control Plans for effective site management.	C3	11
3	Practical	**CONDUCT** various experiments for estimation, layout planning, material management and onsite inspection (or video assisted) productivity studies.	P4	9
5	Practical	**CONTRIBUTE** in Lab and field assignments by understanding the value of teamwork and effective communication in job site practices.	A3	10

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:	√	10	Communication:	√
5	Modern Tool Usage:		11	Project Management:	√
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To apply equipment control plans for effective site management.

COURSE CONTENTS:

Construction Equipment: Brief Discussion on Use, Productivity of Equipment for Heavy Construction Operations, including; Tractors, Dozers, Scrapers, Motor Graders, Power Shovels, Off-Road Haulers, Front-End Loaders, Backhoes, Draglines, Trenchers, Rock Drilling Equipment, Crushers, Conveyors. Vertical concreting equipment; Crane and Bucket, Concrete Pumps, Concrete Conveyors, Pavement operations; concrete paving; asphalt paving; rehabilitating old pavement' Pile driving operations.

Jobsite Practices: Preparing Crew Assignments, review of submittals, shop drawings and samples, procurement schedule, subcontractor submittals, diaries log, accident reports, progress photographs, video-recordings, time-lapse photography, material logs, equipment logs, jobsite layout including; material and equipment handling, material storage, temporary facilities, jobsite security, fencing, access roads, job site tagging, projects in congested sites, labor organization and records, implementation of jobsite safety plan, cleaning and construction waste management, onsite material testing and inspection, implementation of environmental plan.

PRACTICAL WORK TO BE CARRIED OUT:

1. Onsite (or videorecording) productivity study of front shovel operations.
2. Onsite (or videorecording) productivity study of backhoe/excavator operations.
3. Onsite (or videorecording based analysis) productivity study of loader operations.
4. Onsite (or videorecording based analysis) productivity study of dragline operations.
5. Onsite (or videorecording based analysis) productivity and conduct study of dozer operations.
6. Concrete pump productivity
7. Pile load capacity calculation.
8. Estimating asphalt plant production.
9. Development of a jobsite layout for a real site.
10. Development of a time-lapse photographic jobs-site record.
11. Development of material tagging track and trace mechanism/system for a large construction project site.
12. Perform on-site quality inspections test for cement bags, aggregate, and steel etc.
13. Open ended lab.

Recommended Books

Approval:	Industrial Advisory Board	Res No. 9.5	Dated: 09/05/2024
	Board of Studies	Res. No.2.4	Dated: 29/05/2024
	Board of Faculty	Res. No. 3.1	Dated: 19/08/2024
	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Human Skills (2 + 0)**			
Course Code	**:**	CETH301			
Semester	**:**	5th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**EXPLAIN** required skills of career foresightedness and relationship building	C3	10
2	Theory	**DEMONSTRATE** productivity improvement, empowerment skills, mobility and engagement	C3	8

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	√
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	√

5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To have the knowledge of career foresightedness, relationship building, productivity improvement, empowerment skills, teamwork, mobility and engagement.

COURSE CONTENTS:

Career Foresightedness

Understanding Career Growth Patterns in Technology Domain, Identifying Gaps in Personal and Professional Competence, Making Right Career Choices and Developing a Career Plan, Persistence and Continuous Improvement; Learning, Unlearning and Relearning

Productivity Improvement

Time Management, Creative Problem Solving, Critical Thinking, Goal Setting and Getting Things Done, Personal Performance Management and Achieving Excellence

Relationship Building

Emotional Intelligence, Negotiation Skills, Body Language Basics, Professional Etiquette, Conflict Resolution, Interpersonal Skills, Managing Cultural Diversity, Networking, Using Social Media Effectively

Empowerment Domain

Vision and Strategic Thinking, Ethics and Value System, Leadership and Influence, Assertiveness, Using Mentorship, Taking Initiative, Becoming a Change Agent and Leading Change, Developing and Sustaining a Positive Attitude

Mobility and Engagement

Teamwork and Coordination Skills, Kaizen and Lean Mindset, Value Chain Approach to Problem Solving, Creating a Win-Win Situation and Developing a Business Case

Recommended Books

1. Various Handouts, Reading Materials, cases and exercises to be used to cover the various aspects of the course.
2. People Skills for Engineers, Tony Munson, Kindle Store publishers, 2018.
3. Advances in the Human Side of Service Engineering, Published October 23, 2019 by CRC Press

Approval:	Industrial Advisory Board	Res No. 9.5	Dated: 09/05/2024
	Board of Studies	Res. No.2.4	Dated: 29/05/2024
	Board of Faculty	Res. No. 3.1	Dated: 19/08/2024
	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Subject	**:**	**Construction Planning and Management (1+1)**			
Course Code	**:**	CETM301			
Semester	**:**	5th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**DESCRIBE** primary theoretical knowledge of construction management in the field of civil engineering technology	C2	11
2	Theory	**APPLY** the knowledge of deterministic and probabilistic models for project planning and scheduling.	C3	11
3	Practical	**PERFORM** practical related to planning and scheduling using relevant software.	P3	3

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:		10	Communication:	

5	Modern Tool Usage:		11	Project Management:	√
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To apply the knowledge of deterministic and probabilistic models for project planning and scheduling.

COURSE CONTENTS:

Basic concepts of project management, Funcations and dials of project management, Construction Project Management, Introduction and overview of the subject, Objectives of Management, Levels of Management, Organizational Hirecarchy. Project Roles, Responsibilities & Skills of Project Manager, Identification of Project, Preparation and approval procedure of PC-1, PC-II, PC-III & PC-IV, Project design, project development and project documentation, Project Life Cycle, SWOT analysis, PEST analysis and PESTLE analysis, Feasibility studies of the Project, Procurement process, contractual relationship & contract types, terms and conditions of contract, conditions of contracts, Project **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.),

RACTICAL WORK TO BE CARRIED OUT:

1. Onsite (or video recording) productivity study of front shovel operations.
2. Onsite (or video recording) productivity study of backhoe/excavator operations.
3. Onsite (or video recording based analysis) productivity study of loader operations.
4. Onsite (or video recording based analysis) productivity study of dragline operations.
5. Onsite (or video recording based analysis) productivity and conduct study of dozer operations.
6. Concrete pump productivity
7. Pile load capacity calculation.
8. Estimating asphalt plant production.
9. Development of a jobsite layout for a real site.
10. Development of a time-lapse photographic jobs-site record.
11. Development of material tagging track and trace mechanism/system for a large construction project site.
12. Perform on-site quality inspections test for cement bags, aggregate, and steel etc.
13. Open ended lab.

Recommended Books

Approval:	Industrial Advisory Board	Res No. 9.5	Dated: 09/05/2024
	Board of Studies	Res. No.2.4	Dated: 29/05/2024
	Board of Faculty	Res. No. 3.1	Dated: 19/08/2024
	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Electro-mechanical Technology (2 + 0)**			
Course Code	**:**	CET304			
Semester	**:**	5th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		-	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Understand** construction and working principles of capacitors, batteries, diodes, and transistors	C2	1
2	Theory	**Apply** various energy conversion systems used in thermodynamics equipment.	C3	2

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To understand the construction and working principles of capacitors, batteries, diodes, and

transistors

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COURSE CONTENTS:

Part-1

Electrostatic: Concept of Electric filed. Equipotential surfaces. Permittivity. Electric stress, stored energy, motion of a charged particle in a uniform electrostatics field, calculation of capacitance.

Electromagnetism: Concept of magnetic field Permissibility, magnetic properties of ferromagnetic materials. The magnetic circuit. Generation of EMF, Faraday's of laws of electromagnetic induction.

Electric Circuit: Resistivity, Ohm's Law, Kerchief's laws, Simple D.C network problems, Temperature coefficient.

Alternating currents: Mean and RMS values, The effects of resistances, inductance and capacitance in an AA, Circuit, vertical representation power and power factor.

Secondary Batteries: Types construction, charging and discharging rate, efficiency, care and maintenance. Transformers: The magnetic circuit of transformers, Transformation ratio, voltage, current and power relationships. Electronics: Diode, transistors, and simple rectifier circuits.

Part-2

Introduction, gases and vapors, contents volume and pressure, PV diagram specific heat of gases and vapors. Laws of Boyle, Charles, Avogadro, Dalton. The two laws of thermodynamics. Heating of gases ,adiabatic expansion, expansion curves, cycles of operation,

A.S.E of cycle, reversibility, Carnot cycle sterling and Erickson Cycle, Joule, Otto and diesel cycle, Heat transformation into work, TS diagram, Heating of gas at constant volume and pressure. General case of change of entropy, Air compressor, Single stage compressor, volumetric efficiency formation of steam, Enthalpy of water and steam, Use of steam tables, Volume of super-heated steam, Introduction to IC engines, Classification and working cycle injection and ignition of fuel. Governing of IC engine volumetric efficiency and performance

Recommended Books

1. electrical technology, BL Theraja, 18th edition, McGraw Hill Book Company Electrical technology, H.U Ghes, 17th edition Knson Education Asian
2. Basic Electrical Engineering Science, Mc Kenzie Smith, ELBS edition Applied thermodynamics, Ryner Joel, Mc Graw Hill Company

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	Board of Studies	Res. No.2.4	Dated: 29/05/2024
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	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Geotechnical Site Investigation and Foundation (1 + 1)**			
Course Code	**:**	CET306			
Semester	**:**	6th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**INVESTIGATE** the construction site for geotechnical information.	C2	4
2	Theory	**ANALYZE** various problems in foundations and their solutions	C4	1
3	Practical	**PERFORM** various experiments to determine the geotechnical properties of soil used for foundation design	P3	1

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To be able to investigate the construction site for geotechnical information.

COURSE CONTENTS:

Compaction: Definition, 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 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.

Foundations: Purpose and types of foundations, Selection of foundation type, bearing capacities of foundation, Bearing capacity and settlements equations by various methods, Gross Bearing capacity and net pressures on footing, Plate load test, Pile load test.

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 Sand Replacement (Sand Cone) Method and or by Water Replacement/Oil Replacement Method.
7. To determine load settlement behaviour by Plate Load Test.
8. To perform Standard Penetration Test (SPT).
9. To collect UDS from clayey Strata.
10. To obtain shear strength parameters of the collected UDS sample.
11. To obtain consolidation parameters of the collected UDS sample.
12. To observer Percussion drilling Procedures in the field.
13. To observe rotary drilling in field.
14. To observe Pile load test and analysis the result.
15. To perform the open-ended lab.

Recommended Books

1. Foundation Engineering by B.M, Das, Brook/Cole. Latest Edition
2. Introduction to Soil Mechanics Laboratory Testing by Dante Fratta, Jennifer Aguettant and Lynne Roussel-Smith, Latest Edition.
3. Fundamentals of Soil Mechanics by M. Siddique Qureshi and Aziz Akbar, Latest Edition

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Title of Course:	**:**	**Construction of Steel Structure (1 + 1)**			
Course Code	**:**	CET308			
Semester	**:**	6th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations : 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Explain** specifications and design philosophy of structural steel members.	C2	1
3	Theory	**Design** different components of steel structures and develop shop drawing according to the latest code.	C5	3
4	Practical	**Perform** various experiments of structural steel.	P3	9
6	Practical	**Contribute** actively to the lab work.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	√
4	Investigation:		10	Communication:	

5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

Design components of steel roof truss and develop shop drawing according to the latest LRFD code.

COURSE CONTENTS:

Introduction: Loads, structural steels and their specifications, structural elements, steel vs. Concrete and timber, design specifications as per LRFD, structural layout, strength and stiffness considerations, and efficiency of cross-section, safety, and serviceability considerations. Steel structures at three different levels: the overall structural system (multi-story buildings, wide-span buildings, bridges, masts, and towers); the components of a structural system (floor systems, plate girders, frames, and beams); the details of structural components (connection types, welding, and bolting).

Construction Process: Steel Structures, History, Manufacturing and Fabrication of Steel, Steel Structures (Building and Other Structures), Properties & Shapes, Shop Drawings and Detailing, Steel Construction Process (Erection), Steel Construction Productivity.

Riveted/Bolted Connection: Riveting and bolting, their types, failure of riveted joint, efficiency of a joint, design of riveted joint, concentric riveted joints, advantages and disadvantages of bolted connections, stresses in bolts.

Welded Connection: Types of welded joints, welded joints subjected to eccentric loads, and simple, semi-rigid and rigid connections. **Tension and Compression Members:** Types of tension members, net area, net effective area for angles, tees, tension splice, and lug angles. Axially loaded columns, effective length, slenderness ratio, and allowable stresses, general specifications, laced and battened columns, built up compression members, eccentrically loaded columns, column splice, and encased columns. Column Bases, Introduction to Column Bases, slab base, gusseted base, column base subjected to moment, grillage foundation.

Flexural Members (Beams): Design criteria, permissible stresses, laterally supported beams and their design laterally unsupported beams, web buckling, web crippling, built up beams, encased beams, members subjected to bending and compression.

Plastic Theory for Steel Structures: Introduction, advantages and disadvantages, strength of tension and compression members, theory of plastic bending, plastic hinge mechanism, collapse load analysis, static and mechanism method, distributed loading.

Plate Girders: Introduction, weight and economic depth

Steel Bridges: Introduction to design of steel structural members in bridges

PRACTICAL WORK TO BE CARRIED OUT:

1. Draw stress strain curve using UTM.
2. Extract various mechanical parameters from stress-strain curve and compare them with standard values.
3. Draw the layout of different types of Rivet connections.
4. Draw the neat sketch of staggered joints and show pitch, gauge and edge distance.
5. Draw the plan and elevation of Grillage foundation.

6. Draw the plan and elevation of slab base.
7. Draw the neat sketch of column made by channel section with necessary arrangement of lacing and battening.
8. Draw the neat sketch of column made by angle section with necessary arrangement of lacing and battening.
9. Study the bucking of struts with different end conditions
10. To perform open ended lab project.

Recommended Books

1. Subramanya, N, Design of Steel Structures, N. Subramanian, Oxford University Press (2008).
2. Duggal, S.K. Limit State Design of Steel structures, McGraw Hill (2009) Reference Books:
3. Ajmani, A. L. and Arya, A. S., Design of Steel Structures, Nem Chand and Brothers (2000).
4. Dunham, C.W., Planning of Industrial Structures, John Wiley and Sons (2001).
5. Gary, W., Steel Designer's Manual, Prentice Hall (2008).
6. Glover, F., Structural Pre-cast Concrete, Oxford Publishers

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Title of Course:	**:**	**Irrigation Technology (2 + 0)**			
Course Code	**:**	CET307			
Semester	**:**	6th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		-	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**Examine** the various irrigation concepts and soil- water-crop relationships.	C3	1
2	Theory	**Analyze** problems related to irrigation canals and other hydraulic structures.	C4	2

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:
To be able to examine the various irrigation concepts and soil-water-crop relationships.
COURSE CONTENTS:

- **Introduction:** Definition, Necessity, Scope, Benefits, and ill effects of irrigation engineering.
- **Methods of Irrigation:** Pressurized and non-pressurized irrigation

methods, Factors affecting choice of irrigation methods, Uniformity coefficient.

- **Soil-Water-Crop Relationship:** Soil and its physical and chemical properties, Root zone soil water, Crops of Pakistan and Crop rotation.
- **Water Requirement of Crops:** Functions of irrigation water, Standards for irrigation water, Definition of some common terms, Factors affecting and improving duty, Classes of soil water, Equilibrium points-soil moisture tension, Depth of effective root zone, Depth and Frequency of irrigation, Evapotranspiration, Estimation of evapotranspiration, Irrigation efficiencies, Gross irrigation requirements, Use of computer models.
- **Canal Irrigation System:** 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.
- **Lined Channels:** Canal Lining and its types, permissible velocities in lined channels.
- **Diversion Head Works:** Weir and barrage, Types and components of diversion weir, Head regulator and cross regulator, Canal regulation and silt control at the head works, Silt excluders and silt ejectors.
- **Canal Outlets:** Definition, Types, Essential requirements and characteristics of outlets, Tail cluster and tail escape.
- **Water logging and salinity:** Causes and effects of water logging, reclamation of waterlogged soils, Drains and tube wells, Causes and effects of salinity and alkalinity of lands in Pakistan.

Recommended Books

1. Irrigation and Hydraulic Structures: Theory, Design and Practice, Dr. Iqbal Ali, Institute of environmental Engineering Research, NED University Karachi, Latest Edition.
2. Irrigation and Drainage Engineering, Iqtidar H. Siddiqui, Oxford University Press, Latest Edition.
3. Irrigation Engineering and Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers, Latest Edition.
4. Irrigation Technology by S R Bhakar and Y P Rao, Agrotech Publishing Academy, Latest Edition.

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Title of Course:	**:**	**Quantity Surveying and Estimation (2 + 1)**
Course Code	**:**	CET309
Semester	**:**	6th

Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	3
Marks	**:**	**Th**	50	**Pr**	48

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**APPLY** concept and skills for quantity take-off for different civil Engineering works.	C3	2
2	Theory	**DESCRIBE** various terms related to Quantity Surveying and Estimation	C3	2
3	Practical	**ORGANIZE** programmed spreadsheet-based cost estimates and bills.	P4	5
5	Practical	**RESPOND** to assigned tasks actively.	A2	9

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	

3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:		10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To be able to apply concept and skills for quantity take-off for different civil Engineering works.

COURSE CONTENTS:

Material Quantities Take-off: Working out earthwork quantities for various civil engineering constructions. Calculating quantities for road embankments in plain and hilly areas and for irrigation channels. Quantities for roads, buildings and their components, reservoirs, water supply, drainage projects, steel works and bridge construction. Estimates using computer spreadsheets

Rate Analysis: Scheduled and non-scheduled rates. Analysis of rates, abstract of costs. Significance of rate analysis and its application to market rates of material and labor. Rate analysis for various items of civil engineering works, contract and its types.

Cost Estimates: Systematic and logical approach to the estimating and costing of civil engineering works, rough cost & detailed estimates, bill of quantities and part bills for construction, costs and profit margins to be considered in the cost estimates. Estimates for roads, buildings, reservoirs, water supply, drainage projects, steel works and bridge construction. Estimates using computer spreadsheets.

PRACTICAL WORK TO BE CARRIED OUT:

1. Workout quantities for earthwork for site-grading and leveling using geometric cross- sectional/grid method.
2. Workout quantities for mass excavation for a raft footing,
3. Prepare Measurement sheet (MS) for 1:2:4 concrete for substructure of a building (Foundations, columns below plinth and plinth beams.)
4. Prepare Measurement Sheet (MS) for 1:2:4 concrete for columns above plinth roof beams, roof slabs and projections.
5. Prepare Bar Bending Schedule (BBS) for single span and multi-span beam reinforcement from given drawing.
6. Workout the quantities slab reinforcement from given drawing
7. Workout the quantities of overhead water tank concrete and its reinforcement.
8. Workout the quantities of RCC retaining wall concrete and its reinforcement.
9. Prepare material estimate for a single room complete in all respect.
10. Prepare Material List of a steel truss.
11. Prepare Material List of a metal frame structure (low-rise)
12. Prepare a detailed estimate of an RCC water overhead reservoir of 20,000 gallon capacity.
13. Prepare detailed estimate of a manhole.
14. Prepare detailed estimate of a septic tank and soakage pit.

15. Prepare bill of quantity and abstract of cost for a manhole and septic tank.
16. Estimate the quantities of all necessary items of work required for 1 Km flexible pavement
17. Estimate the cost of construction of Rigid Pavement.
18. Calculate the volume of earth work from contour map.
19. Calculate the volume of earth work for irrigation channel (i) fully in cutting (ii) partially in cutting and filling.

Recommended Books

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

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Title of Course:	**:**	**Maintenance and Repair of Civil Works (1 + 1)**			
Course Code	**:**	CET310			
Semester	**:**	6th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	3
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**RECOGNIZE** various defects in civil structures with respect to the design guidelines	C2	4
2	Theory	**EXAMINE** the advance materials and their utilization for the repairing of the structures.	C4	2
3	Practical	**PERFORM** different tests by using various repair and maintenance techniques	P3	9

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	

3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To recognize various defects in civil structures with respect to the design guidelines and examine the advance materials and their utilization for the repairing of the structures.

COURSE CONTENTS:

Need for Maintenance

Importance and significance of repair and maintenance of civil structures, meaning of maintenance, objectives of maintenance, factors influencing the repair and maintenance.

Factors Causing Deterioration (Sources, Causes, Effects)

Definition of deterioration/decay, Factors causing deterioration, their classification, Effects of various agencies of deterioration on various construction materials i.e., bricks, timber, concrete, paints, metals, plastics, stones.

Investigation and Diagnosis of Defects

Systematic approach/procedure of investigation, Sequence of detailed steps for diagnosis of structural defects/problems, List non-destructive and others tests on structural elements and materials to evaluate the condition of the structure and study of their most commonly used tests.

Buildings:

Types of Building Repair and Maintenance Services

- Day to Day Repairs.
- Special Repairs.
- Additions and Alterations.
- Preventive Maintenance.

Various types of retrofitting methods for repair and rehabilitation of concrete structure failure.

- Guniting.
- Shotcreting.
- Concrete Stitching.
- Resin Injections.
- Dry packing.
- Polymer impregnation.
- Vacuum impregnation.

Pavements and Bridges:

Routine maintenances activities are categorized into five levels: performance monitoring, preservative, functional concrete pavement repair (CPR), structural CPR, and remove and replace.

Distress Identification:

Preservative: Edge Drop-Off, Joint Failure, Joint Sealant Damage, Joint Separation, Longitudinal Cracks, Transverse Cracks.

Functional CPR: Bumps, Crack Spalling, Faulting, Joint Spalling, Settlement.

Structural CPR: Patch Deterioration, Pumping

Remove and Replace: Corner Break, Punchouts, Shattered Slabs

Hydraulic Structures:

Symptom of distress for hydraulic structure are: Active / passive cracks, sagging of members, swelling of concrete, discoloration, white/brown patches, spalling of concrete, exposure of bars and erosion of surface.

Selection of repair scheme based on factors such as type and extent of damage, environmental conditions, load intensity, accessibility, time constraints, availability of experienced agency, etc.

Few repair techniques are:

- Patching techniques
- Substitution of members
- Strengthening of existing members by Shotcreting
- Wrapping / bonding techniques
- Encasement with concrete / free flow micro concrete
- Chloride extraction / passivating technique
- Electro – chemical remedies
- Pressure grouting
- Providing waterproof barriers
- Surface protection

Materials for Repair, maintenance, and protection

Compatibility aspects of repair materials, State application of following materials in repairs.

PRACTICAL WORK TO BE CARRIED OUT:

The practical work will be conducted on the basis of theory.

Recommended Books

1. Building Defects and Maintenance Management by Gahlot P.S. and Sanjay Sharma; CBS
2. Publishers, New Delhi
3. Maintenance Engineering for Civil Engineers by Nayak, BS; Khanna Publishers, Delhi
4. Maintenance, Repair & Rehabilitation and Minor Works of Buildings (English, Paperback,
5. Varghese P.C.).

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	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Technoprenurship (2 + 0)**			
Course Code	**:**	CETM302			
Semester	**:**	6th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		-	
Credit Hours/week	**:**	**Th**	2	**Pr**	0
Minimum Contact Hours	**:**	**Th**	32	**Pr**	0
Marks	**:**	**Th**	50	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**UNDERSTAND** the concept of technopreneurship and characteristics of successful entrepreneurs.	C2	6
2	Theory	**ANALYZE** technopreneurship ideas by developing technopreneurship potential by carrying out work individually and in teams.	C4	9

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:	√	12	Lifelong Learning:	

OBJECTIVES:

- To recognize various defects in civil structures with respect to the design guidelines and examine the advance materials and their utilization for the

repairing of the structures.

COURSE CONTENTS:

Fundamentals of entrepreneurship: Definition of entrepreneur and entrepreneurship, Entrepreneurs versus inventors, Entrepreneurial process, Entrepreneurial Mind Set.

Creating and starting the venture: Sources of ideas, Methods of generating idea, Creative problem solving, Innovation, Opportunity recognition, Opportunity Analysis, Product Planning and Development Process.

Intellectual Property: What is intellectual property, Patents, Start-up without patent, Trademarks, Copyrights, Trade secret, Licensing **Fundamentals of Business Plan**: What is business plan, Who should write it, Scope and value of business plan, Information needs, Why some business plan fail

Writing the Business Plan: Introductory page, Executive summary, Environmental and Industry Analysis, Description of Venture, Production Plan, Marketing Plan, Organizational Plan, Assessment of Risk, Financial Plan.

Financing the Venture: Sources of capital-Debt or equity, Venture Capitalist, Valuing your company

Strategies for Growth: Growth strategies- market penetration, market development, product development and diversification, Implications for growth.

Recommended Books

1. Entrepreneurship, Robert Hisrich, Michael Peters, Dean Shepherd, 10th Edition
2. The guide to entrepreneurship by Michael Sycher, CRC Press, Boca Raton, Latest Edition

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	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**GIS and Remote Sensing (2 + 1)**			
Course Code	**:**	CET401			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations : 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**EXPLAIN** the basics of geographic information systems (GIS) for acquiring data to be used in different fields	C2	1
2	Theory	**DISCUSS** Remote Sensing as modern tool to acquire data	C2	11
3	Practical	**PRACTICE** use of Conventional and Advanced Surveying tools for acquiring data	P4	11

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	√
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- Understand the fundamental principles of GIS and Remote Sensing.
- Apply GIS and Remote Sensing techniques to analyze and solve civil engineering problems.
- Familiarize students with the ArcGIS platform and its applications.

COURSE CONTENTS:

- Introduction to geographic information systems (GIS) and remote sensing
- Use of GIS to accumulate primary and secondary spatial data for generating required maps
- Manage and analyze digital data in raster and vector formats
- Data storage, editing and retrieval techniques used in a GIS
- Spatial Data Analysis, Spatial queries and selections, Overlay operations (buffer, clip, intersect, etc.), Network analysis and routing
- Cartographic principles of scale, resolution, projection, and data management to a problem of a geographic nature
- Introduction to Remote Sensing: Definition, principles, and types of remote sensing platforms (satellites, aircraft, drones).
- Overview of different types of sensors (optical, thermal, radar) and their applications.
- Image acquisition process, geometric and radiometric corrections, and image enhancement techniques.
- Visual interpretation techniques supervised and unsupervised classification methods.
- Object-based image analysis, change detection, and time-series analysis.

PRACTICAL WORK TO BE CARRIED OUT:

1. Introduction to GIS software (e.g., ArcGIS, QGIS), Basic interface navigation and toolbars.
2. Data loading and layer management for GIS software.
3. Performing spatial analysis tasks such as proximity analysis, overly analysis, and network analysis.
4. To plot a geographic grid of graph paper from collected data (manual).
5. To survey a geographic area by using Handheld GPS device.
6. Practice to creating shape file and spatial database files from available data.
7. Familiarization with Remote Sensing software (e.g., ERDAS Imagine, ENVI), User interface, data management, and basic functionality
8. Visual interpretation of satellite imagery and aerial photos, Supervised and unsupervised classification exercises Accuracy assessment techniques
9. Visual interpretation of satellite imagery and aerial photos Supervised and unsupervised classification exercises Accuracy assessment techniques
10. Visual interpretation of satellite imagery and aerial photos Supervised and unsupervised classification exercises Accuracy assessment techniques
11. Open ended lab

Recommended Books

1. Qihao Weng. (2012). An Introduction to Contemporary Remote Sensing, 1st Ed, McGraw-Hill, U. K.
2. Law, Michael, Collins, Amy (2013). Getting to Know ArcGIS for Desktop for ArcGIS 10.1 (3rd/e). ESRI Press.

3. Campbell, James B. (2011). Introduction to Remote Sensing, 5th Ed. The Guilford Press.
4. Gibson, P. J (2000). Introductory Remote Sensing: Principles and Concepts Rutledge.
5. Lillesand, T. M. & Kiefer, R. W. (2010). Remote Sensing and Image Interpretation, 6th edition. John Wiley and Sons Inc.

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Title of Course:	**:**	**Ground Improvement Techniques (2 + 1)**			
Course Code	**:**	CET402			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**EXPLAIN** various soil improvement techniques, their applications.	C2	1
2	Practical	**PERFORM** various lab experiments e.g. shear strength, proctor and CBR on stabilized soil.	P3	4

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To understand various soil improvement techniques, their applications.

COURSE CONTENTS:

Principles and methods of ground improvement Surface Compaction; Deep Compaction; Vibro-Flotation; Preloading; Prefabricated Vertical Drains; Vacuum Drainage; Mechanically Stabilized Earth (Reinforced Earth), Granular Piles; Micro-Piles; Lime Stabilization; Cement Stabilization; Chemical Stabilization; Grouting; Geotextiles; Geo-synthetics and their uses ; Geo-reinforcement such as Geotextile and Geo- grid

RACTICAL WORK TO BE CARRIED OUT:

Related Field Visits including the following;

- soil compaction,
- stabilization by lime/cement/chemical,
- use and manufacturing of geotextiles/reinfor cement Open ended lab on soil stabilization

Recommended Books

1. Holtz, Christopher, and Berg, Geosynthetic Engineering, Bitech Publishers Ltd., Canada. (Latest Edition)
2. Bo and Choa Reclamation & Ground Improvement, Thomson Publishers, Singapore. (Latest Edition)

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Title of Course:	**:**	**Design Assessment Tools (1 + 1)**			
Course Code	**:**	CET403			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**EXPLAIN** different approaches for the design assessment.	C2	1
2	Practical	**DEVELOP** engineering structures using digital assessment tool, considering safe design limits	P4	3

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To understand different approaches for the design assessment.

COURSE CONTENTS:

Introduction

Requirements of low-cost, energy-efficient building design and construction methods that utilize more renewable resources. digital prototypes of buildings, Sustainability performance of buildings through analyses before construction. Early-stage design revise decisions at the conceptual design level, Value Engineering Analysis during design

Digital tool for construction safety design

Construction Hazard Assessment with Spatial and Temporal Exposure, Construction job safety analysis and evaluation of operational risk levels using advanced software such as BIM, Computer image generation for job simulation for job safety analysis using Virtual Reality.

Decision Support System (DSS)

Assisting the monitoring and control of operations using advanced software such as GIS, Safety Analysis of Building in Construction for assessing the Structural analysis and safety using Sensors and IoT based solutions, Structural Health Monitoring tools and analysis methods.

Applications of remote sensing in civil engineering, Introduction to Image sensing, cracking analysis using image sensing, Infrastructure management, Critical infrastructure protection, detailed geographic information, Landslide prediction and analysis, construction requirements, Data handling

RACTICAL WORK TO BE CARRIED OUT:

Practical will be based on design class using suitable digital design assessment tool like BIM etc.

Recommended Books

1. The Impact of Building Information Modelling by Ray Crotty
2. BIM and Construction Management: Proven Tools, Methods, and Workflows by Brad Hardin, Dave McCool, Willey Online
3. Essential Principles of Image Sensors by- O'Reilly Media, 1st Edition

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Title of Course:	**:**	**Building Code and Compliance (3 + 0)**			
Course Code	**:**	CET404			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 10 Marks Assignments/Projects/Presentations: 10 Marks Mid Semester Exam: 30 Marks Final Semester Exam: 50 Marks		N.A	
Credit Hours/week	**:**	**Th**	3	**Pr**	0
Minimum Contact Hours	**:**	**Th**	48	**Pr**	0
Marks	**:**	**Th**	100	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**JUSTIFY** selection of design code for various functions.	C2	1
2	Theory	**DEMONSTRATE** different structures of various natures and importance in compliance with the standard codes of practices.	C3	3

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:	√	9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

Objectives:
To understand different structures of various natures and importance in compliance with the standard codes of practices

COURSE CONTENTS:

Specifications codes and Practices:

- ACI-318-14
- ASCE-07
- Pakistan Building Codes (PBC)
- IBC
- AASHTO

Choice and forms of Structures for various conditions. Drawing office Practice for preparation of detailed working drawing. Analysis design and preparation of working drawings of steel and concrete structures.

Code Compliance Policies and Procedures: Policy description, Prioritizing Code Cases, Problem Oriented Policing Program, Performance Measures, Records Organization and Electronic File Naming, Initial Steps, Investigation, and Informal Efforts to Obtain Voluntary Compliance and Correction of Violations, Scope of Inspection and Expectation of Privacy, Consent, Documentation, Inspection Warrants, Officer Safety - Basic Officer Safety Rule, Expectations, Avoiding Conflict, and Reporting.

Recommended Books

- Design of structures by R.H Nilson
- ACI-318-14
- ASCE-07
- Building Code of Pakistan – Seismic Provisions (Latest Edition)
- S.R.O. for "Application for Building Code of Pakistan" (Latest Edition)
- Building Code of Pakistan- Energy Provisions – (Latest Edition)
- S. R. O. 249 (I) for Building Code of Pakistan- Energy Provisions – (Latest Edition)
- Pakistan Electric – Telecommunication Safety Code (PETSAC) – (Latest Edition)
- S. R. O. 716 (I) for Pakistan Electric & Telecommunication Safety Code (PETSAC) (Latest Edition)
- S. R. O. 717 (I) for Pakistan Electric & Telecommunication Safety Code (PETSAC) (Latest Edition)
- Building Code of Pakistan- Fire Safety Provisions – (Latest Edition)
- S.R.O. 1073 (1) for Fire Safety Provisions – (Latest Edition)

Note: Each specialty related structural design based on codes and standard will be taught by respective specialist, like building, highway, water retaining structures and foundation design.

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Title of Course:	**:**	**Smart Technologies for Facilities Management (2 + 1)**			
Course Code	**:**	CET405			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations : 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**UNDERSTAND** facility management and role of facility manager	C2	1
2	Theory	**DEMONSTRATE** facility management application using information modeling software for facility management	C3	5

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:	√	11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:
To understand facility management application using information modeling software for

facility management

COURSE CONTENTS:

Introduction to Facilities Management: Objectives of FM, Key terminologies and concepts in the domain of FM, importance of good facilities management, Trends in Facility Management.

Role of Facility Manager: Responsibilities of the facility manager, Core traits and skills of a successful facilities manager.

Overview of Computer-Aided Facility Management (CAFM): Current Facility Management Technology and Technology of the (Near) Future, Trends in Technology.

Building Information Modeling for Facilities Management: Overview of Application of BIM for FM, Standards and Data Exchange, Challenges of BIM for FM, FM BIM in Practice, HVAC based modeling

Role of Geographic Information Systems in Facility Management: Enhancing FM Capabilities with GIS, GIS Data, Location, Vector Data, Raster Data, Attribute Data, Mapping for FM, Location Mapping, Thematic Mapping, Mapping Density, Mapping Change, Spatial Analysis for FM, Attribute Selection, Nearest Selection, Inside Selection, Buffering Selection, Geocoding, Access to GIS through the Internet, GIS Analysis within the Building, Mobile Technologies.

Sustainability and FM: Sustainability for Buildings, Certification for Sustainability, ENERGY STAR Building Certification, Assessment and Planning, Software for Sustainable Facilities Management, The Importance of Visualization, L~~ife Cycle Cost Analysis,~~ Carbon/Greenhouse Gas Calculations, Energy Analysis Tools and Applications, Energy management system software that monitors and controls energy consumption in buildings by analyzing data from sensors and building systems, Building Performance and Monitoring, Case Study.

Technology Management: Building Management and Automation Systems, Access and Security Management Systems, Emerging Technologies, Smart Infrastructures, IoT, Cloud Computing.

RACTICAL WORK TO BE CARRIED OUT:

1. To develop small-scale CAFM Models
2. To develop small-scale BIM Model for Facility Management of sample residential/ building construction
3. To develop small-scale GIS Model for Facility Management of sample residential/ building construction
4. To develop model on one software for Sustainable Facilities Management
5. To perform Energy Analysis of developed models
6. To calculate Life-Cycle Cost Analysis of developed models
7. To calculate emissions of Carbon/Greenhouse Gases
8. To simulate Building Performance Analysis on sample building
9. To integrate Mobile Technology(ies) with Facilities Management on previously developed models
10. Open ended lab

Recommended Books

1. Technology for Facility Managers - The Impact of Cutting-Edge Technology on Facility Management by Eric Teicholz (John Wiley & Sons, Inc.)
2. The Facility Management Handbook by David G. Cotts, Michael Lee, Published by AMACOM

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Title of Course:	**:**	**Construction Project Administration (2 + 1)**			
Course Code	**:**	CET406			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations : 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**INTERPRET** and communicate various construction documents on site	C3	10
2	Theory	**ANALYZE** various aspects of Site Administration and Organization	C4	11
3	Practical	**APPLY** scheduling techniques like CPM	P3	2

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	√
5	Modern Tool Usage:		11	Project Management:	√
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- The student should be able to understand various aspects of Site Administration and communicate various construction documents on site.

COURSE CONTENTS:

Documentation and Record Keeping at Jobsite: Overview of Project Team Responsibilities with particular reference to Site, Record Types and Content, Event and Conversation Documentation, Periodic Reports, Diaries, Logs, Accident Reports, Progress Photographs, Video Recordings, Time-lapse Photography, Progress Schedules and Schedule Updates, Cost Documentation, Labor, Material, Equipment, Correspondence, RFIs, Change Order Logs, etc., Contractual Requirement for Documentation.

Submittals, Samples and Execution Drawings:
Types; Requirements; and Review of Submittals, Execution Drawings and Samples, Procurement Schedule, Subcontractor Submittals. **Jobsite Layout and Organizing:** Material and Equipment Handling, Labor Productivity, Equipment Constraints, Site Constraints, Elements of the Jobsite Layout Plan, Material Storage, Temporary Facilities, Jobsite Offices, Jobsite Security, Perimeter Fencing, Access Roads, Signs and Barricades, Organizing Jobsite Layout.

Planning for Construction: Construction Schedules; Scheduling Methods; Bar Charts; S-Curve Scheduling; Network Diagrams; Selection of Scheduling Software.

Site Administration: Various Project Meetings, Maintaining Good Relations with Project Stakeholders, Conduct at the Project Site, Coordinating Construction Activities, Sequencing the Work on Site, Jobsite Quality Control, Testing and Inspection; Coping with Defective and Nonconforming Work; Cleaning and Construction Waste Management; Noise Control, Dust and Mud Control; Environmental Protection s; Protecting Installed Construction.

Jobsite Safety: Construction Safety & Health Programme, Plans and Policies; Jobsite Safety Plan; Safe Work Procedures; Safety Audit and Inspections, Accident Prevention; Personal Protective Equipment, Jobsite Hazard Analysis, Safety Communications; Accident Reporting and Investigation; Training; Emergency Response

Project Closeout: The Closeout Process, Settling Punch Lists, Substantial and Final Completion, Financial Closure, As-Built Drawings.

RACTICAL WORK TO BE CARRIED OUT:

Site visits to be conducted to achieve the following outcomes:

1. Development of sample Submittals
2. Development of Daily Reports and various Site Logs
3. Development of a sample Incident/ Accident Report
4. Collect and analyse Progress Photographs, Video Recordings and Time-lapse Photography
5. Development of Site Layout for Site Management
6. Development of QC documents
7. Development of Safety Documents

Computer software to be used to achieve the following:

8. Develop Project Schedules
9. Load Resources and Cost on Project Schedule
10. Using Excel to develop Sample Project Administration templates

Explore Web-Enabled Project Administration Application(s)

11. Open ended lab.`

Recommended Books

1. Construction Project Administration 10th Edition By Edward R. Fisk & Wayne D. Reynolds
2. Construction Jobsite Management 4th Edition By William R. Mincks, Hal Johnston

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Title of Course:	**:**	**Drainage Technology (3 + 0)**			
Course Code	**:**	CET407			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 10 Marks Assignments/Projects/Presentations: 10 Marks Mid Semester Exam: 30 Marks Final Semester Exam: 50 Marks		-	
Credit Hours/week	**:**	**Th**	3	**Pr**	0
Minimum Contact Hours	**:**	**Th**	48	**Pr**	0
Marks	**:**	**Th**	100	**Pr**	0

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**CATEGORIZE** the situations that necessitate drainage of agricultural lands.	C4	4
2	Theory	**APPLY** principles of drainage to operate and maintain the surface and sub-surface drainage systems for sustainable agriculture and society.	C3	7

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:		7	Environment and Sustainability:	√
2	Problem Analysis:		8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To understand principles of drainage to operate and maintain the surface and sub-surface drainage systems for sustainable agriculture and society.

COURSE CONTENTS:

- **Introduction:** Causes of waterlogging, Need for drainage, Objectives of land drainage, Reclamation of waterlogged soils. **Observation wells and Piezometers:** Difference between shallow monitoring wells and piezometers, Construction, location and installation of observation wells and piezometers, Reading water levels.

- **Drainage systems:** Drainage as part of an agricultural development project, Field drainage systems, Surface and subsurface drainage systems, Combined drainage systems, Components of a drainage system, Layout of field drainage systems, Outlet of a field drainage system, discharge calculations for a drain, Slopes of field drains.

- **Surface drainage:** Land forming- Bedding, Land grading and land planning, Field drains- Design of surface drains and construction of surface drains.

- **Subsurface drainage:** Types of subsurface drainage systems, principles of subsurface drainage systems, Depth and spacing of field drains, Drainage coefficient, Pipes, Envelopes, Construction of pipe drainage systems, Construction methods, Alignment and levels, Machinery, Supervision and inspection, Interceptor drains.

Recommended Books

1. Irrigation and Drainage Practices for Agriculture, Muhammad Rafiq Choudhry, University of Agriculture Faisalabad, Pakistan, Latest Edition.
2. Modern Land Drainage, Lambert K. Smedema and Willem F. Voltman, Latest Edition.
3. Drainage Manual, Bureau of Reclamation, US Department of Interior, Latest Edition.

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Title of Course:	**:**	**Applied Hydraulics (2 + 1)**			
Course Code	**:**	CET408			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project: 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	2	**Pr**	1
Minimum Contact Hours	**:**	**Th**	32	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**DISCUSS** open channel flow, dimensional analysis, similitude, and basic principles of hydraulics.	C2	1
2	Theory	**ANALYZE** various hydraulic structures in open channel flow.	C4	2
3	Practical	**CONDUCT** proficiently essential experiments related to the fundamental of open channel flow, flow types and its measurements including pipe flows and investigate processes using hydraulic machines (pumps, turbines, flow channels, etc.)	P4	4
4	Practical	**CONTRIBUTE** actively in the lab work of applied hydraulics.	A2	9

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	√
4	Investigation:	√	10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

To analyze various hydraulic structures in open channel flow.

COURSE CONTENTS:

- **Steady Flow in Open Channels:** Introduction, velocity distribution in open channel flow, energy principles in open channel flow, uniform open channel flow, overview of open channel design, critical flow, specific energy, hydraulic jump.

- **Gradually Varied flow:** Introduction, Analysis of gradually varied flow equation, Classifications of Gradually Varied Flow, Computation of Water Surface Profiles.

- **Similitude:** Similitude in hydraulic models, similitude requirements, geometric, kinematic and dynamic similarities, dimensionless numbers and their significance.

- **Hydraulic Structures:** Elementary concept about canals, Types of head works and their layout, Weirs and barrages with their components and functions, Canal falls, Outlets, Cross drainage works, its types and functions.
- **Dams and Hydro Power Technology:** Selection of hydropower sites, Components and layout of hydropower schemes, Types of storage dams, Reservoir engineering, operation and regulation of storage reservoirs, Water hammer phenomenon, Sedimentation Problems in Reservoirs.

- **Pumps and Turbines:** Pumps: Introduction; Classification; characteristics; head delivered; specific speed; and selection. Turbine: Introduction; Types; Construction features; Operation; Efficiencies; Specific speed, and Characteristic curves.

RACTICAL WORK TO BE CARRIED OUT:

1. Measurement of water level and velocity along the channel.
2. To perform experiment on Pelton and Francis wheel to plot its characteristic curves.
3. To perform experiment on centrifugal and reciprocating pumps to plot its characteristic curves.
4. To perform test on Centrifugal Pump in parallel and in series
5. To measure major and minor head losses in pipe flow under different scenarios.
6. Flow rate measurement through changes in the channel section.

7. To analyze water hammer phenomena through water hammer apparatus.
8. To observe the hydraulic jump downstream of the regulator.
9. Measurement of the subcritical and supercritical flows in open channel.
10. Perform experiment on flume to plot Specific energy curve for uniform flow.
11. Demonstration of Flow through Sluice Gate in Open Flow Channel.
12. Relationship between backwater level and discharge level.
13. Study of the sediment transport and settling mechanisms.
14. Open ended lab.

Recommended Books

- Fundamentals of Hydraulic Engineering Systems by Robert J. Houghtalen, A. Osman Akan, Ned H. C. Hwang (Latest Edition)
- Irrigation and Hydraulic Structures: Theory, Design and Practice by Dr. Iqbal Ali and Dr. Bagh Ali, Institute of Environmental Engineering & Research, NED University of Engineering & Technology, Karachi (Latest Edition).
- Irrigation Canals by Iqtidar H. Siddiqi, Oxford University Press (Latest Edition).
- Open-Channel Flow by M. Hanif Chaudhry, Springer (Latest Edition).

Approval:	Industrial Advisory Board	Res No. 9.5	Dated: 09/05/2024
	Board of Studies	Res. No.2.4	Dated: 29/05/2024
	Board of Faculty	Res. No. 3.1	Dated: 19/08/2024
	Academic Council	Res. No.108.4(i)	Dated: 31-10-2024

Title of Course:	**:**	**Water Supply System (1 + 1)**			
Course Code	**:**	CET409			
Semester	**:**	7th			
Technology	**:**	Civil Engineering Technology			
Effective	**:**	22 – Batch and onwards			
Pre-requisite	**:**	Nil			
Co-requisite	**:**	Nil			
Assessment	**:**	**Theory**		**Practical**	
	:	Quizzes/Test (s): 05 Marks Assignments/Projects/Presentations: 05 Marks Mid Semester Exam: 15 Marks Final Semester Exam: 25 Marks		Lab Rubrics: 30 % Open Ended Lab/Mini Project : 20 % Final Exam; Objective Test*: 30 % Final Exam; Conduct of Practical/Viva Voce*: 20 % *Appearance in Final Exams is mandatory	
Credit Hours/week	**:**	**Th**	1	**Pr**	1
Minimum Contact Hours	**:**	**Th**	16	**Pr**	48
Marks	**:**	**Th**	50	**Pr**	50

After Completing the Course, each student will be able to:

Sr. No.	Theory/ Practical	CLO	Taxonomy Level	PLO
1	Theory	**INTRODUCE** basic concepts relating to the provisions of water supply.	C2	1
2	Theory	**ESTIMATE** water demand for various needs.	C4	2
3	Practical	**PERFORM** practical related to water quality.	P3	2

Relevant Program Learning Outcomes (PLOs):
The course is designed so that students will achieve the following PLOs:

1	Engineering Technology Knowledge:	√	7	Environment and Sustainability:	
2	Problem Analysis:	√	8	Ethics:	
3	Design/Development of Solutions:		9	Individual and Team Work:	
4	Investigation:		10	Communication:	
5	Modern Tool Usage:		11	Project Management:	
6	The Engineering Technologist & Society:		12	Lifelong Learning:	

OBJECTIVES:

- To understand the methods of determining the quantity and quality of drinking water.
- To understand the importance of water conservation and efficient use of water resources.

COURSE CONTENTS:

1. **Introduction;** Water supply systems and their importance with respect to human health. Water borne diseases. Types of impurities and their effects on human health, WHO standards for drinking wtaer.

2. **Sources of Water:** Ground and surface sources. Selection of water sources with respect to quality and quantity considerations.

3. **Estimation of Water Demand:** Water consumption. Components of water consumption. Factors affecting consumption. Fire demand. Variations in demand; average daily, maximum daily and peak hourly consumption. Design period, factors affecting design period. Population forecasting; mathematical and graphical methods of forecasting population. Population density.

4. **Distribution of Water Supply;** Intake structures; Methods of water distribution. Components and layout of water distribution system. Storage capacity of overhead reservoirs. Use of Hazen William formula for the design of water distributions systems.

5. **Contamination in Water:** Types & Sources of Water Contaminants. Removal Methods of Water Contaminants.

5. **Pipes for Water Distribution:** Types of pipes and their use in water distribution. joints, service connection, valves and fire hydrants. Layout of water distribution systems. Disinfections of old and new pipes. Waterwaste surveys and tracing of leakages. Major & minor losses in pipes.

RACTICAL WORK TO BE CARRIED OUT:

1. Determination of pH in Water.
2. Determination of Turbidity of Water.
3. Determination of Suspended Solids in Water.
4. Calculation of dosage of Chlorine in water.
5. Calculation of dosage of coagulants (i.e. Alum and etc.)
6. Detailed Study of Various Types of Valves.
7. Detailed Study of Pipe Materials in Water Supply.
8. Detailed Study of Layout of Water Distribution Systems.
9. Detailed Study of Water Supply Drawings of Any Town/City.

Recommended Books

1. Water Supply and Sewerage by E. W. Steel and L. J. McGhee. McGraw Hill, New York. (Latest Edition).
2. Water and Wastewater Technology by M. J. Hammer, John Wiley & Sons. New York, (Latest Edition).
3. Water Supply And Sanitary Engineering by S. C. Rangwala (Latest Edition).

4. Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, Fifth Edition, Nathanson. Pearson.

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