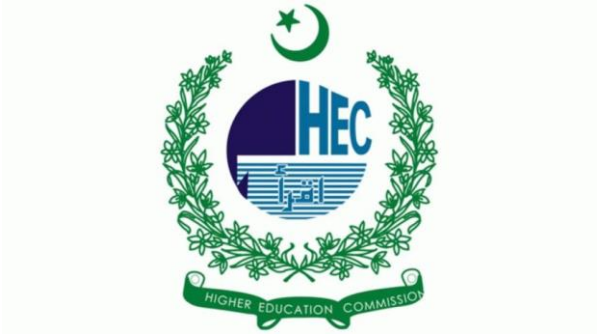
Curriculum

for

Bachelor of Civil Engineering Technology Degree

(2023)



Higher Education Commission
Islamabad
Curriculum Division

Acronyms, Abbreviations & Definitions

Acronym/ Abbreviation	Definition
NTC	National Technology Council
NCRC	National Curriculum Review Committee
IEA	International Engineering Alliance
HEC	Higher Education Commission
HEI	Higher Education Institution
RCC	Reinforced Cement Concrete
CAD	Civil Engineering
CET	Civil Engineering Technology
CLOs	Course Learning Outcomes
PLOs	Program Learning Outcomes
SA	Sydney Accord
UTM	Universal Testing Machine
SIT	Supervised Industrial Training
BIM	Building Information Modeling
BBS	Bar Bending Schedule
Th	Theory
Lab	Laboratory
Cr. Hrs.	Credit Hours

Contents

1. Introduction

Curriculum is the total learning experience of a student that occurs in the educational process. The term refers specifically to a planned sequence of instruction, and to the student's experiences in terms of the educator's or institutions instructional goals. Curriculum is a systematic and intended packaging of competencies (i.e., knowledge, skills, and attitudes, underpinned by values) that learners should acquire through organized learning experiences.

Curriculum forges in learners' life-long learning competencies, as well as social attitudes and skills, such as tolerance and respect, constructive handling of diversity, peaceful conflict management, promotion and respect of Human Rights, gender equality, justice, and inclusiveness. At the same time, curriculum must be singularly aligned to national development goals, and produce human resources that become an effective factor of production in the economy.

Curriculum is thus the foundation on which rests the edifice of academic programs designed for focused outcomes that equip graduates with desired skill sets. Engineering technology curriculum aims to produce proficient engineering technology graduates who meet demands of both national and international job markets. The curriculum conforms substantially to the Sydney Accord – the international accreditation body regulating local accrediting institutions of partnering countries -- and is in consonance with the essence of Graduates Attributes and Professional Competence defined by International Engineering Alliance (IEA). [See Appendix A through C]

Curriculum is developed and reviewed by HEC's National Curriculum and Review Committee (NCRC).

2. Curriculum Development Methodology

2.1 Benchmarking

Curriculum for Civil Engineering Technology is benchmarked to HEC' s Undergraduate Policy and in accordance with NTC Curriculum Framework. It conforms substantially to the standards laid out by the Sydney Accord and the International Engineering Alliance pertaining to engineering technology programs [See Appendix A through C].

The course of studies clearly defines and differentiates the program from Bachelor of Civil Engineering by contact hours spent in classrooms, laboratories, and industry.

Ideally, an engineering program is designed with classroom to practical training contact hours in the ratio 70:30, to emphasize design aspects. Whereas for engineering technology programs, the ratio of contact hours is reversed to 30:70, providing more opportunity for hands-on and psychomotor training.

Course learning outcomes (CLOs), and their mapping with program learning outcomes (PLOs) mentioned in this document is a guideline for HEI's.

2.2 Curriculum Development Cycle

Curriculum development is a rigorous process and entails the following steps:

- Nominations are requested from academic circles and relevant industry forums to constitute a National Curriculum Review Committee (NCRC) comprising of leading national experts.
- From the nominations received, NCRC is finalized and notified by NTC(HEC).
- A preliminary Meeting of the NCRC, spanning three days, is held to establish framework and benchmarking issues, and assign different facets of curriculum development to smaller teams within the NCRC.
- NCRC Members elect a Convenor, a co-Convenor, and a Secretary amongst themselves for the proceedings of NCRC, after mutual consultations.
- A draft of program curriculum is prepared by NCRC at the end of the Preliminary Meeting and sent to relevant foreign experts for review and feedback.
- After the foreign expert's review and feedback is received, a Final NCRC Meeting, lasting up to three days, is held to finalize the NCRC Members recommendations, and prepare a final curriculum document.
- The entire cycle of curriculum development is completed in two months.

2.3 Historical Timeline of NCRC Meetings

Historical Timeline of NCRC meetings to develop Bachelor of Civil Engineering Technology are enlisted below:

- Preliminary Meeting [See Appendix D]
- Final Meeting [See Appendix E]

3. Curriculum Details

Bachelor of Civil Engineering Technology Program			
Parameter	**HEC Framework**	**Framework - A (SIT in 7th & 8th Semesters)**	**Framework - B (SIT in 8th Semester Only)**
Program Type	Semester System	Semester System	Semester System
Program Duration	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years
Semester Duration	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams
Total Number of Courses	41	38	44 (Opt.**)
Engineering Technology Domain Courses	28	25	31**
Non-Engineering Technology Domain Courses	13	13	13**
Total Credit Hours	124 – 136	136	136
Engineering Technology Domain Credit Hours	-	100	100
Percentage of Engineering Technology Domain Courses	-	73.53 %	73.53 %
Non-Engineering Technology Domain Credit Hours	39	36	36
Percentage of Non-Engineering TechnologyDomain Courses	28.68 %	26.47 %	26.47 %
No. of Credit Hours per Semester	15 – 18	15 – 18	15 – 18
** Optional Courses may be included for Framework B (SIT in Semester 8 only)			
1 credit hour: (1) For theory: 1 contact hour per week for a minimum of 16 weeks for theory. (2) For practical's: 3 contact hours per week for a minimum of 16 weeks for practical's.			

Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework							
Knowledge Area	**Name of Course**	**Credit Hours** (Th+Lab)	**Weekly Contact Hours** (Th+Lab)	**Total Credit Hours**		**Number of Courses**	
				As per Scheme of Studies	**As per NTC Framework**	**As per Scheme of Studies**	**As per NTC Framework**
Computing	Introduction to computer Programming	1+2=3	1+6=7	3			
Civil Engineering Technology (Foundation)	Materials & Methods of Construction	2+1=3	1+3=4	23			
	Surveying	1+2=3	1+6 =7				
	Concrete Technology	1+2=3	1+6=7				
	Civil Engineering Drawing & Interpretation	1+2=3	1+6=7				
	Environmental Technology	1+1=2	1+3=4				
	Fluid Mechanics	2+1=3	2+3=5				
	Mechanics of Solids	2+1=3	2+3=5				
	Soil Mechanics	1+2=3	1+6 =7				
Civil Engineering Technology (Breadth)	Electromechanical Technology	2+1=3	2+3=5	18			
	Geology	1+1=2	1+3=4				
	Maintenance & Repair	1+1=2	1+3=4				
	GIS & Remote Sensing (Elective)	2+1=3	2+3 =5				
	Design Assessment Tools (Elective)	1+1=2	1+3=4				
	Building Codes & Compliance (Elective)	3+0=3	3+0=3				
	Construction Project Administration (Elective)	2+1=3	2+3=5				
Civil Engineering Technology (Depth)	Hydrology	1+1=2	1+3=4	39			
	Reinforced and Pre-stressed Concrete	2+1=3	2+3=5				
	Computer Aided Drawing and Building Information Modelling	1+2=3	1+6=7				
	Geotechnical Investigation and Foundations	1+1=2	1+3=4				
	Irrigation Technology	3+0=3	3+0=3				

	Construction of Steel Structures	2+1=3	2+3=5	
	Quantity Surveying and Estimation	1+2=3	1+6=7	
	Project Part -I	0+3=3	0+9=9	
	Ground Improvement Techniques	2+1=3	2+3=5	
	Smart Technologies for Facilities Management	2+1=3	2+3=5	
	Drainage Technology (Elective)	3+0=3	3+0=3	
	Applied Hydraulics	2+1=3	2+3=5	
	Water Supply Systems	1+1=2	1+3=4	
	Project Part-II	0+3=3	0+9=9	
Training	Supervised Industrial Training-(Opt.)	0+16=16	0+40=40	32
	Supervised Industrial Training	0+16=16	0+40=40	
Total Credit Hours and Courses (For Engineering Technology Domain Courses)		115	240	Cr. Hrs. **115**
** Optional Courses shall be included for Framework B (SIT in Semester 8 only)				

Non-Engineering Technology Domain Courses in Recommended Schemes of Studies as per Framework								
Knowledge Area	**Sub Area**	**Name of Course**	**Credit Hours** (Th+Lab)	**Weekly Contact Hours** (Th+Lab)	**Total Credit Hours**		**Number of Courses**	
					As per Scheme of Studies	**As per NTC Framework**	**As per Scheme of Studies**	**As per NTC Framework**
Art & Humanities	English (Expository Writing)	Communication Skills	2+1=3	2+3=5	6			
		Functional English	3+0=3	3+0=3				
	Culture	Islamic Studies	3+0=3	3+0=0	6			
		Pakistan Studies	3+0=3	3+0=3				
	Social Sciences Electives	Professional Ethics	2+0=2	2+0=2	7			
		Human Skills	2+0=2	2+0=2				
		Technical & Scientific writing	3+0=3	3+0=3				
Management Sciences	Management Sciences	Technopreneurship	2+0=2	2+0=2	2			
Natural Sciences	Math	Applied Mathematics-I	3+0=3	3+0=3	15			
	Physics	Applied Physics	2+1=3	2+3=5				
	Math	Applied Mathematics-II	3+0=3	3+0=3				
	Chemistry	Applied Chemistry	2+1=3	2+3=5				
	Economics	Fundamentals of Applied Economics	3+0=3	3+0=3				
Total Credit Hours and Courses ** Optional Courses shall be included for Framework B (SIT in 8th Semester only)					Cr. Hrs. **36**			

<table>
<tr><th colspan="2">List of Elective Subjects</th></tr>
<tr><th>Social Sciences</th><th>Management Sciences</th></tr>
<tr><td>➢ Evaluation of Architecture & Engineering</td><td>➢ Technopreneurship</td></tr>
<tr><th>Natural Sciences*</th><th rowspan="2">Depth Electives*</th></tr>
<tr><td>➢ Applied Mathematics-I
➢ Applied Physics
➢ Applied Mathematics-II
➢ Applied Chemistry
➢ Fundamentals of Applied Economics</td></tr>
<tr><th>Breadth Electives*</th><td rowspan="2">➢ Hydrology
➢ Reinforced and Pre-stressed Concrete
➢ Computer Aided Drawing and Building Information Modelling
➢ Geotechnical Investigation and Foundations
➢ Irrigation Technology
➢ Construction of Steel Structures
➢ Quantity Surveying and Estimation
➢ Project-I
➢ Ground Improvement Techniques
➢ Smart Technologies for Facilities Management
➢ Drainage Technology (Elective)
➢ Applied Hydraulics
➢ Water Supply Systems</td></tr>
<tr><td>➢ GIS & Remote Sensing (Elective)
➢ Design Assessment Tools (Elective
➢ Building Codes & Compliance (Elective)
➢ Construction Project Administration (Elective)</td></tr>
<tr><td colspan="2">Any related course can be included with approval of the HEI’s Statutory Bodies (maximum: 3 courses per elective knowledge area)</td></tr>
</table>

4. Admission Criteria

Criteria for admission in Bachelor of Civil Engineering Technology program is defined in NTC's Program Accreditation Policy and Procedures Manual for Engineering & Other Technologies, Clause 3.2.4.1. The salient feature for eligibility for admission are:

(1) Minimum 50% marks in DAE/FSc (Pre-engineering)

or other equivalent qualifications such as A-level/ICS/B.Sc. (sports and Hafiz-e-Quran marks are not included), and

(2) Entrance Test

(3) weightage:

- 70% for academics (DAE/FSc etc.)
- 30% for Entrance Test

5. Semester-wise Scheme of Studies

Semester-wise scheme of studies for the Bachelor of Civil Engineering Technology program spanning 4 years, spread over 8 semesters, and totaling 136 credit hours is presented below, along with weekly contact hours for each course.

SEMESTER-I				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
HUM-111	Islamic Studies	Art & Humanities	3+0	3+0
NSC-111	Applied Mathematics I	Natural Sciences	3+0	3+0
CET-111	Materials and Methods of Construction	Civil Engineering Technology Foundation	2+1	2+3
NSC-112	Applied Physics	Natural Sciences	2+1	2+3
HUM-112	Functional English	Art & Humanities	3+0	3+0
CET-112	Surveying	Civil Engineering Technology Foundation	1+2	3+6
Subtotal			14+4 **=18**	16+12 **=28**
SEMESTER-II				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-121	Concrete Technology	Civil Engineering Technology Foundation	1+2	1+6
HUM-121	Communication Skills	Art & Humanities	2+1	2+3
CET-122	Civil Engineering drawing, Drafting and Interpretation	Civil Engineering Technology Foundation	1+2	1+6
COM-121	Introduction to Computer Programing	Computing	1+2	1+6
NSC-121	Applied Mathematics II	Natural Sciences	3+0	3+0
NSC-122	Applied Chemistry	Natural Science	2+1	2+3
Subtotal			10+8 =**18**	10+24 =**34**
SEMESTER-III				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-211	Evolution of Architecture and Engineering	Civil Engineering Technology Foundation	2+0	2+0
HUM-211	Pakistan Studies	Art & Humanities	3+0	3+0
HUM-212	Professional Ethics	Art & Humanities	2+0	2+0
CET-212	Environmental Technology	Civil Engineering Technology Foundation	1+1	1+3
CET-213	Fluid Mechanics	Civil Engineering Technology Foundation	2+1	2+3
CET-214	Mechanics of Solids	Civil Engineering Technology Foundation	2+1	2+3

Subtotal			12+3 **=15**	12+09 **=21**
SEMESTER-IV				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-221	Transportation and Highway Technology	Civil Engineering Technology Breadth	2+2	2+6
HUM-221	Human Skills	Art & Humanities	2+0	2+0
CET-222	Soil Mechanics	Civil Engineering Technology Foundation	1+2	1+6
CET-223	Structural Principles	Civil Engineering Technology Breadth	2+0	2+0
HUM-222	Technical & Scientific Writing	Art & Humanities	3+0	3+0
NSC-221	Fundamentals of Applied Economics	Natural Sciences	3+0	3+0
Subtotal			13+4 = **17**	13+12 = **25**
SEMESTER-V				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-311	Hydrology	Civil Engineering Technology Depth	1+1	1+3
CET-312	Reinforced and Prestressed Concrete	Civil Engineering Technology Depth	2+1	2+3
CET-313	Construction Equipment and Jobsite Practices	Civil Engineering Technology Breadth	2+1	2+3
CET-314	Computer Aided Drawing and Building Information Modelling	Civil Engineering Technology Depth	1+2	1+6
CET-315	Geotechnical Investigation and Foundations	Civil Engineering Technology Depth	1+1	1+3
CET-316	Electro-Mechanical Technology	Civil Engineering Technology Breadth	2+0	2+0
CET-317	Project Part -I	Civil Engineering Technology Depth	0+3	0+9
Subtotal			9+9 = **18**	9+27 = **36**
SEMESTER-VI				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-321	Geology	Civil Engineering Technology Breadth	1+1	1+3
CET-322	Irrigation Technology	Civil Engineering Technology Depth	3+0	3+0
CET-323	Construction of Steel Structures	Civil Engineering Technology Depth	2+1	2+3
CET-324	Quantity Surveying and Estimation	Civil Engineering Technology Depth	1+2	1+6

CET-325	Maintenance and Repair of Civil Works	Civil Engineering Technology Breadth	1+1	1+3
MGM-321	Technopreneurship	Management Science	2+0	2+0
CET-326	Project Part-II	Civil Engineering Technology Depth	0+3	0+9
Subtotal			10+8 **=18**	10+24 **=34**
SEMESTER-VII **Supervised Industrial Training (Optional)/List of Elective Courses**				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-412	GIS and remote Sensing	Civil Engineering Technology Breadth	2+1	2+3
CET-413	Ground Improvement Techniques	Civil Engineering Technology Depth	2+1	2+3
CET-414	Design Assessment Tools	Civil Engineering Technology Breadth	1+1	1+3
CET-415	Building Codes and Compliance	Civil Engineering Technology Breadth	3+0	3+0
CET-416	Smart Technologies for Facilities Management	Civil Engineering Technology Depth	2+1	2+3
CET-417	Construction Project Administration	Civil Engineering Technology Breadth	2+1	2+3
CET-418	Drainage Technology	Civil Engineering Technology Breadth	3+0	3+0
CET-419	Applied Hydraulics	Civil Engineering Technology Depth	2+1	2+3
CET-4120	Water Supply Systems	Civil Engineering Technology Depth	1+1	1+3
Note: Students can take 5 to 6 courses from the list according to the per week credit hours.				
Total Credits Hours and Contact Hours in 7th Semester(* Suggested)			9+9=**16**	9+27 **= 36***
OR				
CET-411	**Supervised Industrial Training (Compulsory)**	Civil Engineering Technology Domain Industrial Training	**16**	**40**
SEMESTER-VIII				**Weekly Contact Hrs. (Th+Lb)**
Course Codes	**Course Title**	**Knowledge Area/Domain**	**Credit Hrs. (Th+Lb)**	
CET-421	**Supervised Industrial Training (Compulsory)**	Civil Engineering Technology Domain Industrial Training	**16**	**40**
Total Credits Hours and Contact Hours in 8th Semester			0+16**= 16**	0+40**= 40**
Total Credit Hours & Contact Hours in Four Years (When Optional Courses will be conducted instead of SIT in 7th semester)			77+59 = **136**	77+169 = **246**

Theory VS Practical with respect to Contact Hours	Theory Practical	76 **(31.30%)** 172 **(68.70%)**
Total Credit Hours & Contact Hours in Four Years (When SIT will be conducted in both 7th and 8th Semester)	68+68 = **136**	68+188 **= 256**
Theory VS Practical with respect to Contact Hours	Theory Practical	67 **(26.56%)** 228 **(73.43%)**

6. Course Codes

Course Codes are defined below:

- Program spans over 4 years, with 2 semesters per year, Spring and Fall (with a possible Summer Semester)
- Each course has a unique three letter prefix, followed by a three-digit code
- Letters are acronyms for course description, and numbers define the chronological position in the academic year, and sequence number in the program.

Digits in course-code are defined in table below:

1st Digit	**2nd Digit**	**3rd Digit**
Denotes Year (1,2,3,4)	Denotes Semester (1,2,3…)	Denotes Sequence in Program (1, 2, 3…)

Letters in course-code prefix are defined below:

- First two letters pertain to the program (e.g., CET for Civil Engineering)
- Third letter pertains to specifics of the course (e.g., T for technology, E for expository writing etc.)

Course Code Examples		
Sr#	**Course Code Prefix**	**Description**
1	CE**T**	Civil Engineering Technology Foundation/ Breadth/ Depth
2	HU**M**	Art & Humanities
3	NS**C**	Natural Science
4	CO**M**	Computing
5	MG**S**	Management Sciences

7. Elective Courses

The lists of elective courses – grouped across depth and breadth categories – are presentedbelow, showing credit hours and weekly contact hours.

Elective Breadth Courses				Weekly Contact Hrs.
Course Code	**Title**	**Knowledge Area**	**Credit Hrs.**	
CET-412	GIS and remote Sensing	Civil Engineering Technology Breadth	2+1	2+3
CET-414	Design Assessment Tools	Civil Engineering Technology Breadth	1+1	1+3
CET-415	Building Codes and Compliance	Civil Engineering Technology Breadth	3+0	3+0
CET-417	Construction Project Administration	Civil Engineering Technology Breadth	2+1	2+3
CET-418	Drainage Technology	Civil Engineering Technology Breadth	3+0	3+0

Elective Depth Courses				Weekly Contact Hrs.
Course Code	**Title**	**Knowledge Area**	**Credit Hrs.**	
CET-413	Ground Improvement Techniques	Civil Engineering Technology Depth	2+1	2+3
CET-416	Smart Technologies for Facilities Management	Civil Engineering Technology Depth	2+1	2+3
CET-419	Applied Hydraulics	Civil Engineering Technology Depth	2+1	2+3
CET-4120	Water Supply Systems	Civil Engineering Technology Depth	1+1	1+3

8. Course Contents

The primary goal of this curriculum is to be substantially in compliance with international standards set by relevant agencies such as the International Engineering Alliance (IEA) and the Sydney Accord (SA).

Program Learning Outcomes (PLO's), Course Learning Outcomes (CLO's) and Bloom's Taxonomy Levels are expected learning outcomes and are aligned with standards set by SA and IEA.

Course Content

8.1 Islamic Studies/Social Ethics

CODE & TITLE (HUM-111) Islamic Studies/Social Ethics		CREDIT & CONTACT HOURS (3+0) 48 Theory + 0 Lab	KNOWLEDGE AREA/ DOMAIN Art & Humanities
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Recite** Holy Quran with correct pronunciation.	C-2	PLO-8
CLO-2	**Apply** understanding of basic concepts of teaching of Islam (faith, pillars, Dawit, preaching and Seerat).	C-4	PLO-8
CLO-3	**Produce** Compilation of the Holy Quran and Basic Concepts of Hadith.	C-2	PLO-8

Course Outline for Theory

Basic teachings of Islam

- Emaniyat in the light of Quran and Hadees
- Ebadaat of Islam in the light of Quran and Hadees
- Muaamlaat in the light of Quran and Hadees
- Akhlaqiaat in the light of Quran and Hadees

Seerat of Holy Prophet (S.A.W)

- Life of Muhammad bin Abdullah (Before Prophet Hood)
- Life of Holy Prophet (S.A.W) in Makkah
- Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W)

- Life of Holy Prophet (S.A.W) in Madina
- Important Events of Life Holy Prophet in Madina
- Important Lessons Derived from the life of Holy Prophet in Madina

Islamic Culture & Civilization

- Basic Concepts of Islamic Culture & Civilization
- Historical Development of Islamic Culture & Civilization
- Characteristics of Islamic Culture & Civilization
- Islamic Culture & Civilization and Contemporary Issues

Islam & Science

- Basic Concepts of Islam & Science
- Contribution of Muslims in the Development of Science
- Quran & Science

Islamic History

- Period of Khilaft-e-Rashida
- Period of Ummayyads
- Period of Abbasids

Islamic systems

- Family system of Islam
- Economic system of Islam
- Political system of Islam
- Societal system of Islam

Recommended Books
1. Introduction to Islamic economics, theory and applications, by Hossein Askari, Zamir Iqbal, Abbas Mirakhor, Wiley 2. Islamic political system in the modern age, Theory and practice, by Manzoor udDin Ahmad 3. Social system in Islam by sheikh Taqiuddin an Nabhani Family System in Islam by Zinat Kauther

Course Content

8.2 Communication Skills

CODE & TITLE (HUM-121) **Communication Skills**		CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Art & Humanities**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Write** various formal writing genres.	C-6	PLO-10
CLO-2	**Use** integrated skills to read, verbally communicate and participate effectively in professional settings and beyond.	C-4	PLO-9

Course Outline for Theory

1. **Introduction to communication:** Explanation, concept, kinds, process and of communications. Effective communication, SEF model and characteristics of communications, barriers to communications.
2. **Principles of Communication**: Introduction to seven C's, role of seven C's, use of seven C's in daily and business communication.
3. **Writing Skills**: Introduction to effective writing, purpose of writing, stages of writing, reader's analysis, organization/gathering of writing material, writing techniques, approaches to written communication, writing formats (paragraphs, headings, subheadings, numbering etc.).
4. **Report Writing**: Introduction and significance of report writing, internal office communication, effective business letter writing, organizing business messages, managing, and organizing long business reports, feasibility report and incident report, writing a business proposal, business requests, writing job application, resume/CV writing.
5. **Handling Business Meetings:** Agenda writing, minutes of the meeting, recording and presenting minutes of the meeting, successful written and oral presentation: presentation techniques including collecting and managing material, making and using audio visual aids, handling questions and audiences, attention getting techniques, personal management in presentation, persuasive communication.
6. **Presentation Skills:** Formal Presentation Skills (3 P'S of Presentation) Public Speaking (Do's and Don'ts, Target audience, Required message, selection of medium and topic)
7. **Critical Reading:** Critically read a text to interpret and infer meanings factually, contextually, and socially**.**

Recommended Books

1. Cosmo F. Ferrara, "Writing on the Job", latest edition.
2. Murphy, "Effective Communication", latest edition

Course Content

8.3 Applied Mathematics-I

CODE & TITLE (NSC-111) **Applied Mathematics-I**		**CREDIT & CONTACT HOURS** (3+0) **45 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Natural Science**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Learn** and perform derivatives and anti-derivatives with and without applications.	C-3	PLO-1
CLO-2	**Learn** and perform with numerical techniques in solving equations and interpolation.	C-3	PLO-2

Course Outline for Theory

Derivative
Techniques, The chain rules, Implicit differentiation,
Application of Derivatives
Increasing and decreasing, Relative extrema and optimisation, Mean value theorem derivatives, Inverse function
Integration
Anti-derivatives and integrals, the substitution rules, Techniques of Integration
Application of Integration
Solution of Linear and nonlinear equations Interpolations

Recommended Books

1. Calculus, James Stewart, Daniel K. Clegg, Saleem Watson, 9th Edition
2. Advanced engineering mathematics, E. Kreyszig, 9th edition, Wiley, 2006.\
3.Numerical methods, A. Greenbaum & T. P. Chartier, Princeton University Press, 2012

Course Content

8.4 Materials and Methods of Construction

CODE & TITLE (CET-111) **Materials and Methods of Construction**		CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** various properties of construction material.		C-2	PLO-1
CLO-2	**Carryout** suitable selection of materials according to various requirements.		C-3	PLO-2

Course Outline for Theory

Materials of Construction: Constituents, types, properties of cement; preparation, setting, hardening and application of lime, comparison of lime and cement based on characteristics and cost. Properties, preparation and application of mortars. Components, properties, types, manufacturing of concrete; properties of water used for concrete mix. Physical mechanical properties and application of steel, physical, mechanical properties of aluminum. Manufacturing, standard tests for brick/blocks, ceramic stones properties, qualities, use in building construction, extraction and processing of stones. Aggregates (coarse and fine) properties, standard tests (abrasion tests, crushing strength, gradation, weathering etc.). Types, uses, seasoning and preservation of wood or timber for construction. Types, composition, preparation, and application of paints, varnishes, fillers in construction; 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.

Course Content

8.5 Materials and Methods of Construction Lab

CODE & TITLE (CET-111L) **Materials and Methods of Construction Lab**		CREDIT & CONTACT HOURS (0+1) **0 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** experiments and carry out calculations to determine setting times of cement, gradation curves, strength and specific gravities of various materials.	P-2	PLO-1
CLO-2	**Contribute** effectively as an individual or in group for performing different laboratory experiment.	A-2	PLO-9
CLO-3	**Estimate** the physical constraints using experimental results.	C-3	PLO-2

Lab Outline

Practical's

1. Standard consistency test of cement.
2. Fineness of Cement.
3. Standard sizes of brick and blocks.
4. Determination of water absorption of bricks and stone.
5. Determination of efflorescence of brick.
6. Determination of compressive strength of brick/block.
7. Determination of moisture content of wood.
8. Determination of specific gravity of wood.
9. Fineness modulus of various sands.
10. Abrasion test of coarse aggregate.
11. Crushing strength of coarse aggregates.
12. Field visit to observe formwork, scaffolding and reinforcement erection of a building construction project.
13. Field visit/video observation to observe concreting of a building.

Recommended Books

1. Construction Technology, Prentice Hall; 4th edition (December 30, 2005) or latest edition.
2. Fundamentals of Building Construction: Materials and Methods 6th Edition Wiley; 6th edition (October 14, 2013) or latest edition.
3. Construction Methods and Management by Stephens W. Nunnally, 8th Edition Pearson (2011) or latest edition
4. Materials of. Construction by R. C. Smith and C. K. Andres, ISBN: . 0070585040, McGraw Hill. January 1987 (Latest Edition).

Course Content

8.6 Applied Physics

CODE & TITLE (NSC-112) Applied Physics	CREDIT & CONTACT HOURS (2+1) 32 Theory + 48 Lab	KNOWLEDGE AREA/ DOMAIN Natural Sciences	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Comprehend** the fundamental laws of physics relevant to the engineering science.	C-2	PLO-1
CLO-2	**Apply** knowledge of basic physical laws to solve various problems of applied nature.	C-3	PLO-2

Course Outline for Theory

Units, Physical Quantities, and Vectors: Standards and Units, Unit Consistency and Conversions, Uncertainty and Significant Figures, Vectors and Vector Addition, Products of Vector.

Motion, Force and its effects: Laws of motion and equation. Freely Falling Bodies, Angular motion, Relationship between angular and linear motion, Tension, Momentum, Composition and resolution of force, Law of sine, Law of parallelogram, moment and couple.

Equilibrium: Equilibrium, its types and conditions. Center of gravity, center of mass and centroid, Moment, Moment of Inertia of the body, radius of gyration and analysis of simple geometry to check the stability of the object.

Work power and energy: Work and its units, examples of zero work, positive work and negative work, Friction and its modern concept, types, laws of limiting friction and its Engineering Applications. Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications. Energy and its types and transformation of energy. Power and its units, Power and its numerical problems.

Properties of materials: Stress and strain, modulus of elasticity, Hooke' s law and its applications, stress-strain diagram, pressure, surface tension, viscosity, elasticity, plasticity, brittle and ductile materials.

Course Content

8.7 Applied Physics (Lab)

CODE & TITLE (NSC-112L) Applied Physics (Lab)	CREDIT & CONTACT HOURS (0+1) 0 Theory + 48 Lab	KNOWLEDGE AREA/ DOMAIN Natural Sciences	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** experiments related force systems and Equilibrium.	P-2	PLO-9
CLO-2	**Interpret** results using experimental data.	C-2	PLO-2
CLO-3	**Justify** the applications of experiments related to force systems and Equilibrium.	A-3	PLO-10

Lab Outline

1. Find the radius, area and volume of different geometrical shape using Vernier calliper and screw gauge and tape.
2. Determine the value of acceleration due to gravity through simple pendulum.
3. Verify the parallelogram law of forces.
4. Verify the law of conservation of moment through set of balls at on frictionless surface.
5. Find the moment of inertia of objects using flywheel about its axis of rotation.
6. Find the work done at the plane surface and inclined wedge.
7. Determine the effect of force at 0, 30, 45, 60 and 90 degrees with the help of rod or rope.
8. Find the center of gravity of regular and irregular objects
9. Determine the viscosity of the different materials.
10. Find the force constant of spring using hooks law.
11. Verify the stress and strain relation of elastics materials.
12. To determine the density of different materials.

Recommended Books

1. Fundamentals of Physics, Extended - With WileyPLUS by David Halliday, Robert Resnick and Jearl Walker Hardback. ISBN13: 978-1118730232.
2. Physics for Scientists and Engineers 7th or 9th Edition by Raymond A. Serway & John W. Jewett. ISBN-13: 978-1133947271.
3. University Physics with Modern Physics by R. A. Freedman, H. D. Young, and A. L. Ford (Sears and Zeemansky). Addison-Wesley-Longman, 13th International ed. 2010.

Course Content

8.8 Functional English

CODE & TITLE (HUM-112) **Functional English**	CREDIT & CONTACT HOURS (3+0) **48 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Art & Humanities**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** correct use of varied contents including official letters, e-mails, and applications and summarize the texts using appropriate grammatical mechanisms and appropriate lexical choices.	C-3	PLO-10
CLO-2	**Apply** skimming, scanning and detailed reading and listening strategies to understand gist of the text/conversation and doing lexical item search.	C-3	PLO-2
CLO-3	**Articulating** one's point of view and arguments in real life situations.	C-4	PLO-12

Course Outline for Theory

1. Reading: Interactive Reading, Apply the skills of surveying, skimming, scanning and detailed reading and identify topic sentence.
2. Writing: Audience related writing, composition of sentences, paragraphs, short descriptive writing, précis and letter and application, identify contextual clues with the help of cohesive devices.
3. Listening: Collect gist and important points from listening text or any other oral source viz. lecture, speech or conversation.
4. Speaking: Taking part in different real-life situations, answering questions, argue and explain one's point of view, ask for information, turn taking techniques and presentation skills.
5. Presentation Skills: Formal Presentation Skills (3 P'S of Presentation) Public Speaking (Do's and Don'ts, Target audience, Required message, selection of medium and topic)
6. Grammar: Mechanics of English language, punctuation, conservation words, tenses and sentence structure.
7. Vocabulary: Matching vocabulary items with their corresponding definitions, identification odds items out of a list of vocabulary items, classification of vocabulary items in lexical sets.

Recommended Books

1. Thomson A. J. and Mrtenet A. V. "A Practical English Grammar", 3rdEdn., OUP, latest edition.
2. Sarwar Zakia, "English Study Skills", A Spelt Publication Karachi 1991.
3. S. Jannifer, "Grammar in Practice 1 and 2", OUP, latest edition.
4. S. Michael, "Basic English Usage", OUP, latest edition.
5. S. Michael, "Practical English Usage", OUP, latest edition.

Course Content

8.9 Surveying

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-112) **Surveying**	(1+2) **32 Theory + 96 Lab**	**Civil Engineering Technology Foundation**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Explain** different survey techniques for measurements for horizontal and vertical plane.	C-2	PLO-1
CLO-2	**Solve** problems using surveying techniques.	C-3	PLO-2

Course Outline for Theory

Introduction

Introduction to Surveying and types, Classification of surveys, Surveying Techniques, Measurements, and their Units.

Computation of Areas and Volume

Computation of areas by using mid-ordinate rule, average ordinate rule, trapezoidal and Simpson rule, Computation of areas by means of planimeter, Computation of areas by co-ordinates.

Theodolite Traversing

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

Tachometric Surveying

System of tachometry, Principles and field procedures of tachometry, Use of tachometry for traversing.

Trigonometric Levelling

Determination of Reduced levels of elevated objects when the base is accessible and inaccessible.

Highway Curves

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

Hydrographic Surveying

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

Course Content

8.10 Surveying (Lab)

CODE & TITLE (CET-112L) **Surveying (Lab)**	CREDIT & CONTACT HOURS (0+2) **0 Theory + 96 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Operate** various surveying equipment for measurements with required accuracy.	P-3	PLO-5
CLO-2	**Participate willingly** in group activities during the field work of survey experiments.	A-2	PLO-9
CLO-3	**Describe** surveying techniques related to Civil Engineering technology.	C-2	PLO-1

Lab Outline

Practical's:

1. To range out a survey line using ranging rods (Direct & Indirect ranging)
2. To measure the horizontal distance between two terminal stations by different methods. (Pacing, Measuring Tape and Chain).
3. To determine the horizontal distance between the two terminal stations on a sloping ground by (i). Stepping Method. (ii). Using Abney Level
4. To set out baseline and perpendicular line/offsets in the field using optical square and 3-4-5 method.
5. Layout of rooms of a house by offset method using Pythagoras Theorem.
6. To measure the magnetic bearing of a line with the help of Prismatic Compass.
7. Introduction to Auto level and its temporary adjustment and determine staff reading on natural ground by using Auto Level.
8. To draw profile (L-section) and cross-sectional levelling of an existing road by obtaining data using Auto level. (In two Sessions)
9. Introduction to Digital Theodolite, its temporary adjustment and determine horizontal angle, vertical angle and bearing.
10. To determine latitude and departure of lines and calculate the area of closed traversed by coordinates method.
11. To determine the Horizontal distances and Vertical distances by Tachometric Surveying.
12. To determine the independent coordinates of an existing building by Theodolite Traversing and plot its coordinates by using AutoCAD Software. (In two Sessions)
13. To measure the Heights of buildings and determine R.L at top of elevated object by Trigonometric Levelling.
14. To perform Contouring activity using Total Station
15. To perform Stake-out activity using Total Station

Recommended Books
1. Advance Civil Engineering Surveying by Muhammad Asif Shaikh, Latest Edition 2. Surveying & Leveling CT-114 by Ali Aftab, Latest Edition 3. Plane Surveying, Dr A M Chandra, Latest Edition 4. Surveying Vol: (I + II), B.C Punmia, Latest Edition 5. Surveying & Leveling by NN Basak, Latest Edition 6. Surveying Practice, Jerry. A. Nothanson and Philip Kissam, Latest Edition

Course Content

8.11 Concrete Technology

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-121) **Concrete Technology**	(1+2) **16 Theory + 96 Lab**	**Civil Engineering Technology Foundation**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Discuss** materials, activities and problems related to concrete.	C-2	PLO-1
CLO-2	**Implement** concrete mix designs considering various parameters using standard guidelines.	C-3	PLO-3

Course Outline for Theory

Characteristics of Concrete, its Components and Use

Properties of cement, sand, and aggregate. Behavior of concrete matrix. Type of cement and their uses.

Characteristics of Fresh Concrete

Properties of fresh concrete. 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.

Characteristics of Hardened Concrete

Properties of hardened concrete, strength, elastic behavior, shrinkage and creep and durability to chemical and physical attacks. Methods of testing concrete cylinders and cubes in compression.

Mix Design

Requirements of cube and 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).

Non-Destructive Testing (NDT)

Laboratory and site testing for assessing the quality, performance, and strength of a design mix. Schmidt/rebound hammer test, Ultrasonic pulse velocity testing, Penetration resistance or Windsor probe test, covermeter testing etc.

Course Content

8.12 Concrete Technology (Lab)

CODE & TITLE (CET-121L) **Concrete Technology (Lab)**	CREDIT & CONTACT HOURS (0+2) **0 Theory + 96 lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Conduct** various experiments for quality evaluation of existing structures and hardened concrete in group.	P-4	PLO-9
CLO-2	**Interpret** physical parameters using experimental data.	A-3	PLO-1
CLO-3	**Solve** various parameters using standard guidelines.	C-3	PLO-2
CLO-3	**Conduct** various experiments for quality evaluation of existing structures and hardened concrete in group.	P-4	PLO-9

Lab Outline

Practical's

1. Aggregate (course and fine) gradations and its impact of strength of concrete.
2. Determination of specific gravity and bulk densities of aggregates.
3. Casting specimens for varying w/c ratio and bulk densities, slump test and casting standard cubes and cylinders.
4. Effect of w/c ratio on strength of concrete (compressive strength test on cubes and cylinders.
5. Preparing test specimens from hand mixed, machine mixed and hand compacted concrete and comparison of compression tests on specimens.
6. Determination of initial and final setting time for Portland cement.
7. Comparison of cube and cylinder strength.
8. Casting of reinforced concrete beam specimens and testing specimens for observation of flexural and shear cracks.
9. Slump for different workability concrete.
10. Modulus of rupture test on beam specimens.
11. Schmidt/rebound hammer test, to evaluate the surface hardness of concrete.
12. Ultrasonic pulse velocity test for checking the quality and uniformity of concrete
13. Covermeter test to measure the distance of steel reinforcing bars beneath the surface of the concrete and to measure the diameter of the reinforcing bars.

Recommended Books

1. Properties of Concrete by A. M. Neville; Wiley John & Sons. (Latest Edition).
2. Concrete Technology - Theory and Practice - M. S. Shetty.
3. Concrete Design by Zahid Ahmad Siddiqi, Help Civil Engineering Publishers, Lahore, 2009.

Course Content

8.13 Civil Engineering Drawing, Drafting and Interpretation

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-122) **Civil Engineering Drawing, Drafting and Interpretation**	(1+2) **16 Theory + 96 Lab**	**Civil Engineering Technology Foundation**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Recognize** basic principles of drafting in the fields of architectural, construction, civil, and transportation engineering.	C-1	PLO-1
CLO-2	**Illustrate** different civil engineering drawings.	C-3	PLO-2

Course Outline for Theory

Drawing Basics: Elements of architectural planning and design, conceptual, schematic and working drawings and details of residential, commercial, religious, recreational, industrial, clinical, hospital, and educational buildings; Details of doors, windows, staircases etc. Elements of structural drawing and detailing, preparation of foundation plan, structural framing, slab details, staircase details, water tanks, beam and column elevations and sections mostly pertaining to reinforced concrete structures. Plumbing and electrical detailing pertaining to residential units

Drawings Interpretation: General understanding and reading of following drawings: architectural and structural detail drawings of bridges (Concrete, Steel etc.), architectural and structural detail drawings of Culverts, architectural and structural detail drawings of Dams (Concrete, Earthen etc.), architectural and structural detail drawings of Retaining Walls (Gravity, Cantilever, Counterfort etc.), architectural and structural detail drawings of Airport Building, architectural and structural detail drawings of Jetties, Quay Walls, architectural and structural detail drawings of Industrial Building, details of steel roof truss, connection details and fabrication drawings.

Course Content

8.14 Civil Engineering Drawing, Drafting and Interpretation (Lab)

CODE & TITLE (CET-122L) **Civil Engineering Drawing, Drafting and Interpretation (Lab)**	CREDIT & CONTACT HOURS (0+2) **0 Theory + 96 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Perform** basic drafting techniques including line work, lettering, dimensioning, sketching, and drawings assembly.	P-4	PLO-9
CLO-2	**Justify** awareness for drawings of simple objects/structures.	A-3	PLO-10
CLO-3	**Describe** various terms related to Civil Engineering Drawing.	C-2	PLO-1

Lab Outline

Practical's:

1. Draw a Plan and section of isolated and combine footing showing reinforcement also draw the Schedule of Footing.
2. Draw a four storied Building Column's elevation and cut section at each floor reducing reinforcement and cross-section of column.
3. 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.
4. Draw single span Beam Elevation and its Section showing reinforcement using bent up bar.
5. Draw a three span RCC Beam elevation and its section showing reinforcement also develop Schedule of Beam.
6. Draw a Plan (13 X 17) and its X-section of single span RCC Slab, showing reinforcement. Short way #3@6"c/c , long way #3@9"c/c, Slab thickness 6"
7. Draw Plan and X-section of one-way slab of three spans showing reinforcement.
8. Draw Plan and X-section of Septic Tank.
9. Draw a Plan of 120 sq. yard residential bungalow.
10. Draw elevation and section of bridges showing the components of bridge like Pile, Pile cap, Abutment, Transom, Diaphragm.
11. Draw elevation and section of girder (R.C.C & Prestress) showing pre-stress & non prestress reinforcement.
12. Draw elevation, section, and reinforcement drawing of Culvert.
13. Draw elevation, section and reinforcement drawings of Cantilever Retaining Walls.
14. Draw Elevation, section and reinforcement drawing of Counterfort Retaining Walls
15. Draw general layout of an Airport showing typical x-section of runway.
16. Draw elevation and section of Jetties and Quay Walls.

Recommended Books

1. Engineering Drawing by N.D. Bhatt.
2. Drawing for Engineering By Paul Smith
3. Basics Of Engineering Drawing By Zahid Ahmad Siddique.

4. Technical Drawing By David L. Goetsch, Wikkuan S.Chalk, John A.Nelson, Rymond L.Richman (Fifth Edition)
5. Drawing for Civil Engineering By Jan A. Van Der Westhuizen
6. Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production by Warren Jacob Luzadder, Jon M.Duff
7. E. Kreyszig, Advanced Engineering Mathematics, 9th edition, Wiley, 2006.
8. A. Greenbaum & T. P. Chartier, Numerical Methods, Princeton University Press, 2012.
9. D. P. O'Leary, Scientific Computing with Case Studies, SIAM, 2008.

Course Content

8.15 Introduction to Computer Programing

CODE & TITLE		CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN	
(COM-121) **Introduction to Computer Programing**		(1+2) **16 Theory + 96 Lab**	**Computing**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** spreadsheet programmer and its basic and selected advanced features to civil engineering technology domain.		C-3	PLO-5
CLO-2	**Discuss** structured programming for developing technical solutions to civil engineering technology domain problems.		C-2	PLO-1

Course Outline for Theory

- Introduction to spread sheet program and MS-Excel
- Introduction to data types, work sheets/workbooks
- Basic Mathematical Operations and Preparing charts/ graphs in MS Excel
- Overview of key Advanced Features of MS-Excel such as using formulae, macros, solver, etc.
- Example Application of MS-Excel for Civil Technologists (e.g., calculation of reactions, calculation of quantities, rate analysis, work scheduling, etc.)
- Developing Algorithms and Flow Charts
- Structured Programming in a Programming Language (such as C++, Python, etc.)
- Overview of Databases and MS Access

Course Content

8.16 Introduction to Computer Programing (Lab)

CODE & TITLE (COM-121L) **Introduction to Computer Programing (Lab)**		CREDIT & CONTACT HOURS (0+2) **0 Theory + 96 Lab**	KNOWLEDGE AREA/ DOMAIN **Computing**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Practice** word processing, spread sheet, presentation software's, and different programming languages.		P2	PLO-5
CLO-2	**Demonstrate** various terms related to different computer software tools.		A2	PLO-1
CLO-3	**Use** databases, process of creation of databases and querying data from databases.		C-3	PLO-5

Lab Outline??????

Practical's:

- Introduction to Microsoft Excel for Basic Features
- Mathematical Operations
- Application of Microsoft Excel for Advance Features:
- Graphical Representation
- Weight of hollow steel pipes
- Volume of staircase
- Application of Microsoft Excel for Advance Features:
- Formulae
- Macros
- Solver
- Application of Microsoft Excel for Civil Technologists:
- Moment of Inertia and Radius of Gyration
- SF and BM Values

PSEUDOCODE AND FLOWCHART

- Introduction to Pseudocode and Drawing Flowcharts on 3 example problems in various domains of civil technology

C++/ PYTHON PROGRAMMING

- Finding reactive forces for beam having UDL throughout its length
- Calculating Reactive forces having Point load for all three beams:
- Simply supported beam
- Cantilever beams
- Over Hanging beam
- Refer to Labs 7 and 8 and convert C++/ Python programming
- Programming Using Conditional statement
- Programming Using for Loop and While loop

MS ACCESS

- Overview of MS Access with its Key Functions
- How to Create a Database
- Developing a Sample database and querying results

Recommended Books
1. Access 2019 Bible – Michael Alexandar and Richard Kusleika, Wiley, Latest Edition 2. Excel 2019 Bible – Michael Alexandar and Richard Kusleika, Wiley, Latest Edition 3. Learning Python, Mark Lutz, O'Reilly, Latest Edition 4. The C++ Programming Language, Bjarne Stroustrup, Latest Edition

Course Content

8.17 Applied Mathematics-II

CODE & TITLE (NSC-121) **Applied Mathematics-II**		CREDIT & CONTACT HOURS (3+0) **48 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Natural Sciences**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Learn** and perform system of linear equations, statistical & probability analysis of data related to civil engineering technology projects.		C-3	PLO-2

Course Outline for Theory

System of Linear Equations

Representation in matrix form. Matrices. Operations on matrices. Echelon and reduced echelon form. Inverse of a matrix (by elementary row operations). Solution of linear system. Gauss-Jordan method. Gaussian elimination.

Numerical data and calculate descriptive statistics

Classification, tabulation, classes, graphical representation, histograms, frequency polygons, frequency curves and their types

Means: Arithmetic Mean (A.M), Geometric Mean (GM), Harmonic Mean (HM), and their properties, Weighted mean, median, quartiles, mode and their relations, Merits and demerits of Averages

Measures of Dispersion

Range, moments, skewness, quartile deviation, Mean deviation, Standard deviation, Variance and its coefficients, kurtosis

Curve Fitting and Simple Regression

Goodness of fit, Fitting a straight line, parabola, circle, Scatter diagram, Linear regression and correlation

Probability and Random Variable

Definitions, sample space, events, Laws of probability, conditional probability, Introduction to distribution function, discrete random variable and its probability distribution, Dependent and independent events

Mathematical expectation of a random variable

Recommended Books

1. Introduction To Mathematical Statistics, Paul G Hoel, Wiley, Latest Edition
2. Probability And Statistics for Engineering and the Sciences, Jay L Devore, Latest Edition
3. Statistics Theory and Methods, Afzal Beg and Miraj Din Mirza, Latest Edition

Course Content

8.18 Applied Chemistry

CODE & TITLE (NSC-122) **Applied Chemistry**		CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/DOMAIN **Natural Sciences**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**To apply** knowledge of chemistry in various industrial process for civil engineering materials.		C-1	PLO-1
CLO-2	**To introduce** students with thermodynamics and physico-chemical properties of water to analyze water quality.		C-2	PLO-2

Course Outline for Theory

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

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. Theories of Dry (chemical) corrosion - Pilling Bedworth rule and Wet corrosion in acidic atmosphere by hydrogen evolution mechanism. 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 Thermochemistry: 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.

Course Content

8.19 Applied Chemistry (Lab)

CODE & TITLE (NSC-122L) **Applied Chemistry (Lab)**	CREDIT & CONTACT HOURS (0+1) **0 Theory + 48 Lab**	KNOWLEDGE AREA/DOMAIN **Natural Sciences**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** experiments and carry out calculations to determine conductivity, boiling point, PH, concentration, etc.	P-1	PLO-1
CLO-2	**Contribute** Actively during lab work.	A-2	PLO-9
CLO-3	**Estimate** the physical constraints using experimental results.	C-3	PLO-2

Lab Outline

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 (Fourth 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.

Course Content

8.20 Evolution of Architecture and Engineering

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-211) **Evolution of Architecture and Engineering**	(2+0) **32 Theory + 0 Lab**	**Social Science**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Explain** architecture evolution within historic, social, and cultural contexts.	C-2	PLO-6
CLO-2	**Illustrate** the modern architectural trends in building and requirements.	C-3	PLO-1

Course Outline for Theory

- **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.

Course Content

8.21 Pakistan Studies

CODE & TITLE (HUM-211) **Pakistan Studies**	CREDIT & CONTACT HOURS (3+0) **48 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Art & Humanities**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Define** the ideology and historical perspective of nation. Trace out the determinants of Pakistan's foreign Policy.	C-2	PLO-6
CLO-2	**Discuss** Political and constitutional history of Pakistan and Examine Pakistani Society, geography and Culture.	C-2	PLO-6
CLO-3	**Analyze** current socio-economic and environmental issues of Pakistan, their causes and solutions.	C-4	PLO-7

Course Outline for Theory

Historical Perspective

Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah. Factors leading to Muslim separatism People and Land Indus Civilization Muslim Advent Location and Geo-Physical features.

Government and Politics in Pakistan

Political and constitutional phases: 1947-58 1958-71 1971-77 1977-88 1988-99 1999-2008 2008-2013 2013 - onward.

Contemporary Pakistan

- Economic institutions and issues
- Society and social structure
- Ethnicity
- Foreign policy of Pakistan and
- challenges Futuristic outlook of Pakistan

Socio-Economic International Relations

Suggested Teaching Methods

- Lecturing
- Written Assignments
- Guest Speaker
- Field Visits

Suggested Assessment Methods

- One hour test(s)/Mid-term
- Quiz tests, Assignments, Project
- Reports/Term Paper/Presentations
- Final Exam

Recommended Books
1. Burki Shahid Javed. State & Society in Pakistan, The Macmillan Press Ltd 1980. 2. Akbar, S. Zaidi. Issue in Pakistan's Economy. Karachi: Oxford University Press, 2000. 3. Mehmood, Safdar. Pakistan Kayyun Toota, Lahore: Idara-e-Saqafate-Islamia, Club Road, Lahore. 4. Sayed, Khalid Bin. The Political System of Pakistan. Boston: Houghton Mifflin, 1967. 5. Haq, Noor ul. Making of Pakistan: The Military Perspective. Islamabad: National Commission on Historical and Cultural Research, 1993. 6. Pakistan Studies by Muhammad Raza Kazmi 2007 Oxford University Press

Course Content

8.22 Professional Ethics

CODE & TITLE (HUM-212) **Professional Ethics**		CREDIT & CONTACT HOURS (2+0) **32 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Art & Humanities**
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** professional ethics and its compliance with reference to construction industry and the role of civil technologist.	C-2	PLO-8
CLO-2	**Identify** ethical dilemmas/ unethical situations in the various phases of construction project life cycle.	C-2	PLO-8
CLO-3	**Analyze** unethical situations/ ethical dilemmas and perform ethical decision making throughout their technology careers in various positions.	C-4	PLO-12

Course Outline for Theory

Fundamentals of Ethics in Profession: Understanding Ethics and its significance, how values and behavior drive ethical decision making, Being professional and ethical, 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

Professional Ethics in the Context of Construction Industry: Professional Ethics in various phases of Project Life Cycle – from feasibility to planning to design to procurement to construction to 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; 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

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

Course Content

8.23 Environmental Technology

CODE & TITLE (CET-212) **Environmental Technology**	**CREDIT & CONTACT HOURS** (1+1) **16 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**State** the laws, acts and standards being followed to protect the environment.	C-1	PLO-7
CLO-2	**Describe** the fundamental components of sewer, sewerage treatment, air, and noise pollution systems.	C-2	PLO-7
CLO-3	**Solve** the fundamental components of sewer and various types of pollution factors.	C-3	PLO-2

Course Outline for Theory

1. **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).
2. **Environmental Pollution:** Pollution and its Types; Sources, Sampling, Monitoring, Mitigation, and Effects; Atmosphere and Atmospheric Layers. Global Warming and its Causes; Green House Gases.
3. **Solid Waste Management:** Introduction to Solid Waste (SW) and its Management; Types and Sources of SW generation; Collection & Transportation of SW; Methods to Treat SW; Environmental Problems Caused by SW.
4. **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.
5. **Sewers**: Classification of Sewage and Sewer Systems; Combined and Separate Sewer Systems; Sewer Appurtenances and Sewer Testing.

Course Content

8.24 Environmental Technology (Lab)

CODE & TITLE (CET-212L) **Environmental Technology (Lab)**	**CREDIT & CONTACT HOURS** (0+1) **0 Theory + 48 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** the effect of the parameters for the water quality.	P-3	PLO-2
CLO-2	**Respond** actively during lab work.	A-2	PLO-9
CLO-3	**Interpret** physical parameters using experimental data.	C-3	PLO-2

Lab Outline

Practical's

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, CO, CO2, and H2S 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.

Course Content

8.25 Fluid Mechanics

CODE & TITLE (CET-213) Fluid Mechanics		CREDIT & CONTACT HOURS (2+1) 32 Theory + 48 Lab	KNOWLEDGE AREA/ DOMAIN Civil Engineering Technology Foundation	
After completion of this course, students will be able to:			Bloom's Taxonomy Level	PLO
CLO-1	**Explain** the basic concept of fluid static, kinematics, and dynamics.		C-2	PLO-1
CLO-2	**Solve** various problems related to fluid at rest and motion.		C-3	PLO-2

Course Outline for Theory

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: pressure 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. Pathline, 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, Color 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.

Course Content

8.26 Fluid Mechanics (Lab)

CODE & TITLE (CET-213L) **Fluid Mechanics (Lab)**		CREDIT & CONTACT HOURS (0+1) **0 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Conduct** a different experiment to verify the theoretical principles of fluid mechanics.		P-4	PLO-4
CLO-2	**Interpret** the experimental results, graphs, and initiate comments/discussion.		C-2	PLO-2
CLO-3	**Contribute** actively to the lab work of basic fluid mechanics.		A-2	PLO-9

Lab Outline

1. Introduction to Practical contents, Equipment, and HSE (Health, Safety and Environment) measures.
2. Demonstration of Hydraulics Bench.
3. To perform experiment for determination of the viscosity of a given fluid (oil/water) by using falling sphere type viscometer.
4. To check accuracy of Bourden Gauge through its calibration by means of dead weight apparatus.
5. To conduct experiment for the magnitude of Hydrostatic force on partially submerged surface and locate centre of the pressure.
6. To conduct experiment for the magnitude of Hydrostatic force on fully submerged surface and locate centre of the pressure.
7. To conduct experiment for the metacentric height and locate the positions of various important points of a floating body.
8. To conduct experiment for measurement of the pressure using Manometer.
9. To perform experiment for Study of Laminar, Transitional and Turbulent Flow using Reynold's concept equipment.
10. To conduct experiment for coefficient of discharge of a rectangular and triangular Notch.
11. To conduct experiment for the hydraulic coefficients of an orifice.
12. To verify Bernoulli's theorem for steady flow of water.
13. To measure the flow of incompressible fluid in pipes by Flow Meters.

Recommended Books

1. Fluid Mechanics for Civil Engineers by N. B. Webber, Chapman & Hall, (Latest Edition).
2. Fluid Mechanics with Engineering Applications by Dougherty, Franzine 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).

Course Content

8.27 Mechanics of solid

CODE & TITLE (CET-214) Mechanics of solid		CREDIT & CONTACT HOURS (2+1) 32 Theory + 48 Lab	KNOWLEDGE AREA/ DOMAIN Civil Engineering Technology Foundation	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Discuss** materials and their utilization in structures considering engineering properties.		C-2	PLO-1
CLO-2	**Apply** fundamental concepts to analyse structural members subjected to various loadings.		C-4	PLO-2

Course Outline for Theory

Simple stress and strain
Types of stresses and strains, statically determinate and indeterminate compatibility problems, Compound bars, Temperature stresses.

Analysis of Beams
Advanced cases of shearing forces and bending moment diagrams for determinate beams, Relationship between loads, shear force and bending moment, Theory of simple bending, Distribution of shear stresses in beams of symmetrical sections. Principle of superposition, Deflection of beams using double integration, moment area and conjugate beam methods.

Column and Struts
Columns, Types, and different formulae for critical load like Euler's formula, and Empirical formula like Rankine Gordon Formula, initially imperfect columns, slenderness ratio. Strain Energy: Strain energy due to direct load, shear bending and torsion, Impact loads.

Course Content

8.28 Mechanics of solid (Lab)

CODE & TITLE (CET-214L) **Mechanics of solid (Lab)**	CREDIT & CONTACT HOURS (0+1) **0 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** experiments related to the mechanical properties of materials.	P-2	PLO-9
CLO-2	**Interpret** results using experimental data.	C-2	PLO-2
CLO-3	**Justify** the applications of experiments related to stress strain and deflection of materials.	A-3	PLO-10

Lab Outline

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 determine the shear center of different structural shapes.
9. To study the biaxial bending behavior of various structural and non-structural shapes.
10. 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
2. Beer, F. P., E. R. Johnston, J. T. DeWolf, and D. F. Mazurek (2011) Mechanics of Materials, 6th Edition, McGraw Hill.
3. Hibbeler, R. C. (2011) Mechanics of Materials, 8th Edition, Prentice Hall.
4. Gere, J. M., and B. J. Goodno (2012) Mechanics of Materials, Brief edition, Cenage learning.
5. Case, J., L. Chilver, and C. T. F. Ross (1999) Strength of Materials and Structures, 4th Edition, Edward Arnold.

Course Content

8.29 Transportation and Highway Technology

CODE & TITLE (CET-221) **Transportation and Highway Technology**		CREDIT & CONTACT HOURS (2+2) **32 Theory + 96 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Breadth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** concepts of transportation systems and its planning.		C-2	PLO-1
CLO-2	**Use** fundamental concepts of Highway geometry, traffic operations and Highway Design for effective traffic system implementation.		C-3	PLO-1

Course Outline for Theory

- **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.

Course Content

8.30 Transportation and Highway Technology (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-221L) **Transportation and Highway Technology (Lab)**	(0+2) **0 Theory + 96 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** traffic survey for operational data collection in the field and investigate the properties of aggregate, bitumen, and Hot Mix Asphalt.	P-4	PLO-4
CLO-2	**Respond** actively during lab work.	A-2	PLO-9
CLO-3	**Describe** basic tools and commands of transportation.	C-1	PLO-1

Lab Outline

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 signalised 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

Course Content

8.31 Human Skills

CODE & TITLE (HUM-221) **Human Skills**		CREDIT & CONTACT HOURS (2+0) **32 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Art & Humanities**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** skills of career foresightedness and relationship building.		C-3	PLO-10
CLO-2	**Demonstrate** productivity improvement, and empowerment skills.		C-3	PLO-8
CLO-3	**Demonstrate** teamwork, mobility and engagement.		C-3	PLO-9

Course Outline for Theory

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

Course Content

8.32 Soil Mechanics

CODE & TITLE (CET-222) **Soil Mechanics**		CREDIT & CONTACT HOURS (1+2) **16 Theory + 32 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Foundation**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Discuss** fundamentals of soil properties, behavior, and classification systems.		C-2	PLO-1
CLO-2	**Solve** various problems related to soil permeability, consolidation and shear strength.		C-3	PLO-2

Course Outline for Theory

1. **Introduction:** Importance of mechanics of soils in Civil Engineering Technologists.
2. **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.
3. **Soil Classification:** Particle size classification systems, AASHTO classification system, Unified soil classification system, Identification and classification of expansive soils, Collapsible and dispersion soils.
4. **Permeability of Soil:** Permeability, Darcy's law, Factors affecting permeability, Permeability of stratified soils, Laboratory and field determination of permeability.
5. **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.
6. **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.

Course Content

8.33 Soil Mechanics (Lab)

CODE & TITLE (CET-222L) Soil Mechanics (Lab)	CREDIT & CONTACT HOURS (0+2) 0 Theory + 96 Lab	KNOWLEDGE AREA/ DOMAIN Civil Engineering Technology Foundation	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** various experiments of soil mechanics related to index properties, permeability and shear strength of soil.	P-5	PLO-9
CLO-2	**Solve** results using experimental data.	C-3	PLO-2
CLO-3	**Respond** actively to experimental work.	A-2	PLO-1

Lab Outline

Practical's

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

Course Content

8.34 Structural Principles

CODE & TITLE (CET-223) **Structural Principles**		**CREDIT & CONTACT HOURS** (2+0) **32 Theory + 0 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Civil Engineering Technology Breadth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** the basic concepts of equilibrium and explain their application in civil technology.		C-2	PLO-1
CLO-2	**Apply** fundamental structural principles of statics & kinematics for analyzing forces in statically determinate structures.		C-3	PLO-2

Course Outline for Theory

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.

Introduction to cables and suspension bridges-Deflection
Deflection diagrams and elastic curves, Energy methods to compute deflections, Castiglioni's theorem for trusses, beams and frames, Principle of virtual work for trusses, beams, and frames.

Friction
Coulomb's theory of friction. Problems involving friction on flat and curved surfaces.

Application of Principles of Dynamics
Rectilinear and curvilinear motion. Newton's equation of motion, dynamic equilibrium. Introduction to practical use of the above principles and properties. Simple harmonic motion and free vibration.

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).

Course Content

8.35 Technical and Scientific Writing

CODE & TITLE (HUM-222) Technical and Scientific Writing		CREDIT & CONTACT HOURS (3+0) 48 Theory + 0 Lab	KNOWLEDGE AREA/ DOMAIN Art & Humanities
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the content and structure of various technical reports and academic documents to understand the writing process and formats.	C-4	PLO-10
CLO-2	**Create** various writing genres such as: report writing, internship reports and project reports writing.	C-6	PLO-10

Course Outline for Theory

1. **Basics of Technical Writing:** Introduction to Technical writing and communication, Rationale/Characteristics/Features of Technical Writing compared to other forms of writing. Types of technical documents.
2. **Introduction to Writing Process:** Technical Writing Process: Pre-writing, Writing & Revising (Demonstration & Illustration), Context & technical writing, Implicit vs Explicit features of writing/ Text, Legal & Ethical communication in technical writing.
3. **Writing a Technical Document:** Researching, organizing, and composing the content, Revising, proofreading, and evaluating, Elements of a technical document.
4. **Academic Writing:** Academic & Scientific Language: Word to Sentence & Sentences to Paragraph, Report writing format, citation & referencing, Annotation, paraphrasing, quotation, and Summarization.
5. **Organizational Technical Correspondence:** Formal Technical Report Writing, Internship report, Project report writing.

Recommended Books

1. Perelman, L. C., J. Paradis, and E. Barrett. Mayfield Handbook of Technical and Scientific Writing, Mountain View, Mayfield, 1997
2. Sharma, S. D. A Textbook of Scientific and Technical Communication Writing for Engineers and Professionals. Sarup & Sons, 2007.
3. Glasman, Hilary. Science research writing: For non-native speakers of English. Imperial College Press: London, UK, 2010.
4. Alred, Gerald J., Charles T. Brusaw, and Walter E. Oliu. Handbook of technical writing. Macmillan, 2009.
5. H. Kalsi, "Electronic Instrumentation", 2nd Ed., Tata McGraw-Hill, 2004Theodore Wildi "Electrical Machines, Drives, and Power Systems (or Latest edition)

Course Content

8.36 Fundamentals of Applied Economics

CODE & TITLE (NSC-221) **Fundamentals of Applied Economics**	CREDIT & CONTACT HOURS (3+0) **48 Theory + 0 Lab**	KNOWLEDGE AREA/ DOMAIN **Natural Sciences**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** economics, its key sub-domains and its relationship with micro and macro indicators.	C-2	PLO-6
CLO-2	**Understand** the relationship of economics with the civil and construction industry.	C-2	PLO-6
CLO-3	**Analyze** cost benefit of technology solutions related to civil engineering and construction industry.	C-4	PLO-6

Course Outline for Theory

- 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 Policies
- Price-supply-demand-relationship
- Efficiency vs Equality
- Firm Behaviour 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
- Cost benefit analysis of technology solutions in civil engineering and construction industry domains
- Construction project supply chains

Recommended Books

1. Principles of Economics. N. Gregory Mankiw. Sixth Edition. Southwestern Cenage Learning.
2. The Economics of the Construction Industry. Gerald Finkel. Routlege.

Course Content

8.37 Hydrology

CODE & TITLE (CET-311) **Hydrology**		CREDIT & CONTACT HOURS (1+1) **16 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Depth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** the occurrence, movement, and distribution of water in the atmosphere and at the ground surface.		C-4	PLO-4
CLO-2	**Apply** the principles of groundwater movement for lifting of sub-surface water.		C-3	PLO-3

Course Outline for Theory

- **Introduction**
  Hydrology, The world's freshwater resources, Hydrologic cycle, Hydrologic equation, Importance and Scope of hydrology.
- **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**
  Size of floods, Estimation of peak flood, Flood frequency studies, Introduction to Reservoir routing and Channel routing, Methods of flood control, Flood forecasting and warning.
- **Groundwater 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, Comparison of Tube well irrigation and Canal irrigation.

Course Content

8.38 Hydrology (Lab)

CODE & TITLE (CET-311L) **Hydrology (Lab)**	CREDIT & CONTACT HOURS (0+1) **0 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Demonstrate** experimental investigations related to various hydrological parameters.	P-3	PLO-9
CLO-2	**Solve** the measured hydrological parameters.	C-3	PLO-2
CLO-3	**Contribute** actively to experimental work.	A-2	PLO-1

Lab Outline

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. To perform an Open-ended lab.

Recommended Books

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

Course Content

8.39 Reinforced and Pre-stressed Concrete

CODE & TITLE (CET-312) **Reinforced and Pre-stressed Concrete**	CREDIT & CONTACT HOURS (2+1) **32 Theory + 48 Lab**	KNOWLEDGE AREA/ DOMAIN **Civil Engineering Technology Depth**	
After completion of this course, students will be able to:		**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** basic knowledge on design of concrete structures.	C-2	PLO-1
CLO-2	**Apply** reinforced ultimate strength design method for design of reinforced concrete members using different international codes.	C-4	PLO-3
CLO-3	**Design** assessment of pre-stressed concrete members for flexure and other relevant factors.	C-3	PLO-2

Course Outline for Theory

Mechanics of Reinforced Concrete:
Fundamental behavior of reinforced concrete structural systems and their members; basis for design and code constraints and associated assumptions, Behavior of reinforced concrete members in flexure, Strength, and deformation of concrete under various states of stress; failure criteria; concrete plasticity; and fracture mechanics concepts. High-performance concrete materials and their use in innovative design solutions

Serviceability:
Introduction Limit state design, Importance of Deflections, Control of Deflections, Calculation of Deflections, Effective Moments of Inertia, Long-Term Deflections, Simple-Beam Deflections, Types of Cracks, Control of Flexural Cracks, ACI Code Provisions Concerning Cracks.

Shear Strength in beams and design of shear reinforcement:
Shear Stresses in Concrete Beams, Shear Strength of Concrete, Shear Cracking of Reinforced Concrete Beams, Web Reinforcement, Behavior of Beams with Web Reinforcement, Design for Shear, ACI Code Requirements, Cutting Off or Bending Bars.

Bond in concrete and development length:
Introduction to bond, 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.

Detailing: Preparation of working drawings of structural elements. Details of bar bending and preparation of schedules.

Field execution and its challenges: Congested reinforcement and its placement techniques, shear links in various structural members and requirement of standard 135° hooks in the high seismic zone, provision of construction joint in flexural members and compression members, shapes of construction joints.

Prestressing - Theory and Behavior
Basic concepts, Advantages and disadvantages, Materials required, Systems and end anchorages, Methods of prestressing, Load balancing concept, Effect of loading on the tensile stresses in tendons, sources of prestress force, Effect of tendon profile on deflections, Factors influencing deflections, short term and long-term deflections, Losses of prestress, Estimation of crack width, Type of concrete for prestress construction, Merits and demerits of Pre-stressing, Basic idea of prestressing steel.

Precast Units: 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.

Introduction of Formwork
Formwork and shuttering requirements, sizes, and types, shoring and scaffolding, advantages and disadvantages, design of formwork for RC members.

Course Content

8.40 Reinforced and Pre-stressed Concrete (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-312L) **Reinforced and Pre-stressed Concrete (Lab)**	(0+1) **0 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Conduct** various experiments for reinforced concrete in group.	P-4	PLO-9
CLO-2	**Solve** physical parameters using experimental data.	C2	02
CLO-3	**Justify** the applications of experiments related to properties of concrete.	A3	10

Lab Outline

1. To study the compressive strength of concrete using cube and cylinder
2. To study effect of aggregate/cement ratio of workability and compressive strength of concrete.
3. To determine the strength of concrete using core extraction and to discuss the results from control cylindrical samples
4. To study the permeability of concrete samples with various mixed ratios.
5. Making form work for precast concrete members and grills and casting of the specimens.
6. Study of equipment and machinery for pre-stressed concrete industry
7. Casting and testing specimens of pre-stressed concrete units.
8. Casting and testing of specimens of precast RC concrete units.
9. Test for evaluation of structures (visual inspection and rebound hammer)

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).

Course Content

8.41 Constructions Equipment and Job Site Practices

CODE & TITLE		CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN	
(CET-313) **Constructions Equipment and Job Site Practices**		(2+1) **32 Theory + 48 Lab**	**Civil Engineering Technology Breadth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Analyze** Heavy construction equipment productivities.		C-4	PLO-2
CLO-2	**Apply** Project Control Plans for effective site management.		C-3	PLO-11
CLO-3	**Perform** on-site (or video assisted) productivity studies, layout planning, material management and inspections.		P-3	PLO-4

Course Outline for Theory

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 concrete 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.

Course Content

8.42 Constructions Equipment and Job site Practices (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-313L) **Constructions Equipment and Job site Practices (Lab)**	(0+1) **0 Theory + 48 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Conduct** various experiments for calculations, estimation, and onsite inspection.	P-4	PLO-9
CLO-2	**Solve** physical parameters using collected data.	C2	02
CLO-3	**Justify** the applications of experiments related to job site practices/equipment.	A3	10

Lab Outline

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.

Course Content

8.43 Computer aided Drawing and BIM

CODE & TITLE (CRT-314) **Computer aided Drawing and BIM**		**CREDIT & CONTACT HOURS** (1+2) **16 Theory + 96 Lab**	**KNOWLEDGE AREA/ DOMAIN** **Civil Engineering Technology Depth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** development of computer aided 3D drawings of basic nature including architectural and structural.		C-2	PLO-5
CLO-2	**Apply** BIM Models up to 5D of basic nature including architectural and structural.		C-3	PLO-5
Course Outline for Theory				
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, **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, Discussion on BIM Benefits. 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.				

Course Content

8.44 Computer aided Drawing and BIM (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CRT-314L) **Computer aided Drawing and BIM (Lab)**	(0+2) **0 Theory + 96 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Describe** different commands and tools in CAD.	C-1	PLO-1
CLO-2	**Practice** CAD software to develop building and structural drawings.	P-3	PLO-5
CLO-3	**Justify** drawing sense and awareness in CAD.	A-3	PLO-10

Lab Outline

1. Orientation to Revit Environment (Architectural Perspective), Starting a Project and Modelling Basics
2. 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:
3. Links: Imports and Groups, Sketch Based Modelling Components Stairs and Complex Walls
4. Visibility and Graphics Controls
5. Rooms, Schedules and Tags, Annotation and Details
6. The Basics of Families Sheets, Plotting and Publishing
7. 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
8. Estimating Quantities of 3D Model including Architectural and Structural of single unit (80-120 Sq-Yd)
9. Development of Schedule and Cost of 80 Sq-Yd House on MS Excel/ MS Project/ Primavera
10. Integration of Schedule with Architectural Model of 80 Sq-Yd House on Navisworks
11. Developing 5D Model of 80 Sq-Yd House
12. 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.
13. Open Ended Problem

Recommended Books

1. Autodesk manual

Course Content

8.45 Geotechnical site Investigation and Foundations

CODE & TITLE	CREDIT & HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-315) **Geotechnical site Investigation and Foundations**	(1+1) **16 Theory + 48 Lab**	**Civil Engineering Technology Depth**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Investigate** the construction site for geotechnical information.	C-4	PLO-4
CLO-2	**Interpret** various problems related to soil compaction and foundation.	C-2	PLO-1
CLO-3	**Perform** various experiments to determine the geotechnical properties of soil.	P-3	PLO-1

Course Outline for Theory

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, Types of bearing capacities of foundation, Gross and net pressures on footing, Plate load test, Pile load test.

Lab Outlines

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

Course Content

8.46 Electro-mechanical Technology

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-316) **Electro-mechanical Technology**	(2+0) **32 Theory + 0 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Understand** construction and working principles of capacitors, batteries, diodes, and transistors.	C-2	PLO-1
CLO-2	**Apply** various energy conversion systems used in thermodynamics equipment.	C-3	PLO-2

Course Outline for Theory

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
2. Electrical technology, H.U Ghes, 17th edition Knson Education Asian
3. Basic Electrical Engineering Science, Mc Kenzie Smith, ELBS edition
4. Applied thermodynamics, Ryner Joel, Mc Graw Hill Company

Course Content

8.47 Geology

CODE & TITLE		CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN	
(CET-321) **Geology**		(1+1) **16 Theory + 48 Lab**	**Civil Engineering Technology Breadth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Describe** basic concepts of geology, formation of rocks and structural features of strata.		C-1	PLO-1
CLO-2	**Apply** knowledge of geology in civil engineering.		C-3	PLO-1

Course Outline for Theory

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.

Course Content

8.48 Geology (Lab)

CODE & TITLE		CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN	
(CET-321L) **Geology (Lab)**		(0+1) **0 Theory + 48 Lab**	**Civil Engineering Technology Breadth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Perform** various experiments of geology related to rocks identification and strength.		P-3	PLO-9
CLO-2	**Illustrate** the experimental results, graphs, and initiate comments/discussion.		C-3	PLO-1
CLO-3	**Contribute** actively to the lab work.		A-2	PLO-9

Lab Outline

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

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

Course Content

8.49 Irrigation Technology

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-322) **Irrigation Technology**	**(3+0)** **48 Theory + 0 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Examine** the various irrigation concepts and soil-water-crop relationships.	C-3	PLO-1
CLO-2	**Analyze** problems related to irrigation canals and other hydraulic structures.	C-4	PLO-2

Course Outline for Theory

1. **Introduction**
   Definition, Necessity, Scope, Benefits, and ill effects of irrigation engineering.
2. **Methods of Irrigation**
   Irrigation methods, Factors affecting choice of irrigation methods, Pressurized and non-pressurized methods, Uniformity coefficient.
3. **Soil-Water-Crop Relationship**
   Soil and its physical and chemical properties, Root zone soil water, Crops of Pakistan and crop rotation.
4. **Water Requirement of Crops**
   Functions of irrigation water, Standards for irrigation water, Definition of some common terms, Relationship between duty and delta, 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.
5. **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.
6. **Lined Channels:**
   Canal Lining and its types, permissible velocities in lined channels, Design interpretation of lined irrigation channels.
7. **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.
8. **Canal Outlets**
   Definition, Types, Essential requirements and characteristics of outlets, Tail cluster and tail escape.
9. **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

Course Content

8.50 Construction of Steel Structures

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-323) **Construction of Steel Structures**	(2+1) **32 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** specifications and design philosophy of structural steel members.	C-2	PLO-1
CLO-2	**Analyze** structural steel members under various loading conditions.	C-4	PLO-2
CLO-3	**Design** components of steel roof truss and develop shop drawing according to the latest LRFD code.	P-6	PLO-3

Course Outline for Theory

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

Tubular Structures: Permissible stresses, tube columns and compression members, tube tension members, tubular roof trusses, joints in tubular trusses, tubular beams and purlins

Steel Bridges: Introduction to suspension bridges, cantilever bridges, cable-stayed bridges. Standard specifications for railway bridges, Railway bridge code. General arrangement of single-track broad-gauge railway bridge with open floor

Course Content

8.51 Construction of Steel Structures (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-323L) **Construction of Steel Structures (Lab)**	(0+1) **0 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Perform** various experiments of structural steel.	P-3	PLO-9
CLO-2	**Illustrate** the experimental results, graphs, and initiate comments and discussion.	C-3	PLO-1
CLO-3	**Contribute** actively to the lab work.	A-2	PLO-9

Lab Outline

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 a 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

Course Content

8.52 Quantity Surveying and Estimation

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-324) **Quantity Surveying and Estimation**	(1+2) **16 Theory + 96 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Apply** concept and skills for quantity take-off for different civil Engineering works.	C-3	PLO-2
CLO-2	**Describe** various terms related to Quantity Surveying and Estimation	C-3	PLO-2
CLO-3	**Organize** programmed spreadsheet-based cost estimates and bills.	P-4	PLO-5

Course Outline for Theory

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, 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.

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.

Course Content

8.53 Quantity Surveying and Estimation (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-324L) **Quantity Surveying and Estimation (Lab)**	(0+2) **0 Theory + 96 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Organize** programmed spreadsheet-based cost estimates and bills.	P-4	PLO-5
CLO-2	**Have** rate analysis, productivity, and pricing.	C-3	PLO-2
CLO-3	**Respond** to assigned tasks actively.	A-2	PLO-9

Lab Outline

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. Work out 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 1500ft long bituminous road.
17. Estimate the cost of construction of a concrete road 24'-6" wide and one mile long for a given section. The concrete will have a proportion of 1:3:6 and 0.5 % reinforcement are to be used.
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. Fundamentals of Industrial Drives by B.N. Sarkar (Latest edition)
2. Electric Motors and Drives by Austin Hughes and Bill Drury (Latest edition)
3. PLC Manuals for Siemens and Mitsubishi. (Latest edition)

Course Content

8.54 Repair and Maintenance of Civil Work

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-325) **Repair and Maintenance of Civil Work**	(1+1) **16 Theory + 48 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Recognize** various defects in civil structures with respect to the design guidelines	C2	PLO-4
CLO-2	**Examine** the advance materials and their utilization for the repairing of the structures.	C4	PLO-2

Course Outline for Theory

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 used tests.

Buildings:

Types of Building Repair and Maintenance Services

1. Day to Day Repairs.
2. Special Repairs.
3. Additions and Alterations.
4. Preventive Maintenance.

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

1. Guniting.
2. Shotcreting.
3. Concrete Stitching.
4. Resin Injections.
5. Dry packing.
6. Polymer impregnation.
7. 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:
Symptoms of distress for hydraulic structure are: Active and 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:

1. Patching techniques
2. Substitution of members
3. Strengthening of existing members by Shotcreting
4. Wrapping / bonding techniques
5. Encasement with concrete / free flow micro concrete
6. Chloride extraction / passivating technique
7. Electro – chemical remedies
8. Pressure grouting
9. Providing waterproof barriers
10. Surface protection

Materials for Repair, maintenance, and protection
Compatibility aspects of repair materials, State application of following materials in repairs.

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.).

Course Content

8.55 Technopreneurship

CODE & TITLE		CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN	
(MGM-321) **Technopreneurship**		(2+0) **32 Theory + 0 Lab**	**Management Science**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** concept of Technopreneurship and characteristics of successful entrepreneur.		C2	PLO-6
CLO-2	**Analyze** Technopreneurship ideas by developing Technopreneurship potential by carrying out work individually and in teams.		C4	PLO-9
CLO-3	**Organize** and practice innovative ideas suitable for commercialization.		A4	PLO-12

Course Outline for Theory

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 plans 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

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

Course Content

8.56 GIS and Remote Sensing

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/ DOMAIN
(CET-412) **GIS and Remote Sensing**	(2+1) **32 Theory + 48 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Explain** the basics of geographic information systems (GIS) for acquiring data to be used in different fields.	C2	PLO-1
CLO-2	**Discuss** Remote Sensing as modern tool to acquire data.	C2	PLO-11
CLO-3	**Practice** use of Conventional and Advanced Surveying tools for acquiring data.	P4	PLO-11

Course Outline for Theory

- Introduction to geographic information systems (GIS) and related areas such as geodesy and remote sensing
- Use of GIS to accumulate primary and secondary spatial data for generating required maps
- Manage and analyse digital data in raster and vector formats
- Data storage, editing and retrieval techniques used in a GIS
- Cartographic principles of scale, resolution, projection, and data management to a problem of a geographic nature
- History, Scope and Concept of Remote Sensing
- Electromagnetic radiation its characteristics and different parts of spectrum
- Evaluate the applications of Remote Sensing in various disciplines

Lab Outlines

1. To practice GIS and Image Processing Software (e.g., ERDAS Imagine, ENVI, Orfeo Toolbox, ArcGIS) using collected data
2. To plot a geographic grid of graph paper from collected data (manual).
3. To survey a geographic area by using Handheld GPS device.
4. Practice creating shape files and spatial database files from available data.
5. Use of layer stacking and image mosaicking in remote sensing software.
6. Image classification (Supervised & Un supervised) supports vector machine and neutral network.
7. Indices Development: NDVI, NDWI, NDSI, Leaf Area Index in ERDAS Imagine, ENVI, MATLAB, etc.

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 ress.
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.

Course Content

8.57 Ground Improvement Techniques

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-413) **Ground Improvement Techniques**	(2+ 1) **32 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** various soil improvement techniques, their applications.	C2	PLO-1
CLO-2	**Perform** various lab experiments e.g., shear strength, proctor and CBR on stabilized soil.	P3	PLO-4
CLO-3	**Observe** various ground improvement processes in the field.	P1	PLO-12

Course Outline

Surface Compaction; Deep Compaction; Vibro-Flotation; Preloading; Perforated Vertical Drains; Vacuum Drainage; Mechanically Stabilized Earth (Reinforced Earth), Granular Piles; Micro-Piles; Lime Stabilization; Cement Stabilization; Chemical Stabilization; Grouting; Geotextiles; Geosynthetics; Geo-reinforcement.

Lab Outlines

Related Field Visits include the following.

- soil compaction,
- stabilization by lime/cement/chemical,
- use and manufacturing of geotextiles/reinforcement
- 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)

Course Content

8.58 Design Assessment Tools

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-414) **Design Assessment Tools**	(1+1) **16 Theory + 48 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Explain** different approaches for the design assessment.	C2	PLO-1
CLO-2	**Develop** engineering structures using digital assessment tool, considering safe design limits.	P4	PLO-3

Outline for Theory

Introduction

Requirements of low-cost, energy-efficient building design and construction methods that utilize more renewable resources. Building information models (BIM), digital prototypes of buildings, Sustainability performance of buildings through analyses before construction. Early-stage design revise decisions at the conceptual design level.

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 advanced software such as BIM.

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

Outline for Laboratory Experiments

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

Course Content

8.59 Building Codes and Compliance

CODE & TITLE		CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN	
(CET-415) **Building Codes and Compliance**		(3+0) **48 Theory + 0 Lab**	**Civil Engineering Technology Breadth**	
After completion of this course, students will be able to:			**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Justify** selection of design code for various functions.		C2	PLO-1
CLO-2	**Discuss** different structures of various natures and importance in compliance with the standard codes of practices.		C2	PLO-3

Outline for Theory

Specifications codes and Practice:

a) ACI-318-14
b) ASCE-07
c) Pakistan Building Codes (PBC)
d) IBC
e) 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

1. Design of structures by R.H Nilson
2. ACI-318-14
3. ASCE-07
4. Building Code of Pakistan – Seismic Provisions – 2007
   a. S.R.O. for "Application for Building Code of Pakistan" dated September 10, 2008
5. Building Code of Pakistan- Energy Provisions – 2011
   a. S. R. O. 249 (I) for Building Code of Pakistan- Energy Provisions – 2011
6. Pakistan Electric – Telecommunication Safety Code (PETSAC) – 2014
   a. S. R. O. 716 (I) for Pakistan Electric & Telecommunication Safety Code (PETSAC) 2014
   b. S. R. O. 717 (I) for Pakistan Electric & Telecommunication Safety Code (PETSAC) 2014
7. Building Code of Pakistan- Fire Safety Provisions – 2016
   a. S.R.O. 1073 (1) for Fire Safety Provisions – 2016

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

Course Content

8.60 Smart Technologies for Facilities Management

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-417) **Smart Technologies for Facilities Management**	(2+1) **32 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	**Bloom's Taxonomy Level**	**PLO**
CLO-1	**Understand** facility management and role of facility manager.	C2	PLO-1
CLO-2	**Demonstrate** facility management application using information modeling software for facility management.	C3	PLO-5

Outline for Theory

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.

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, Life-Cycle Cost Analysis, Carbon/Greenhouse Gas Calculations, Energy Analysis Tools and Applications, 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.

Outline for Laboratory Experiments

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

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

Course Contents

8.61 Construction Project Administration

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-418) **Construction Project Administration**	(2+1) **32 Theory + 48 Lab**	**Civil Engineering Technology Breadth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Interpret** and communicate various construction documents on site.	C3	PLO-10
CLO-2	**Apply** scheduling techniques like CPM.	C3	PLO-2
CLO-3	**Analyze** various aspects of Site Administration and Organization.	C4	PLO-11

Outline for Theory

Documentation and Record Keeping at Jobsite: Overview of Project Team Responsibilities with 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 Protections; 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.

Outline for Laboratory Experiments

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)
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

Course Content

8.62 Drainage Technology

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-419) **Drainage Technology**	(3+0) **48 Theory + 0 Lab**	**Civil Engineering Technology Breadth**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Categorize** the situations that necessitate drainage of agricultural lands.	C4	PLO-4
CLO-2	**Apply** principles of drainage to operate and maintain the surface and sub-surface drainage systems for sustainable agriculture and society.	C3	PLO-7

Outline for Theory

1. **Introduction**
   Causes of waterlogging, Need for drainage, Objectives of land drainage, Reclamation of waterlogged soils.
2. **Observation wells and Piezometers**
   Difference between shallow monitoring wells and piezometers, Construction, location and installation of observation wells and piezometers, Reading water levels.
3. **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.
4. **Surface drainage**
   Land forming- Bedding, Land grading and land planning, Field drains- Design of surface drains and construction of surface drains.
5. **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. Drainage Manual, Bureau of Reclamation, US Department of Interior, Latest Edition.
2. Irrigation and Drainage Practices for Agriculture, Muhammad Rafiq Choudhry, University of Agriculture Faisalabad, Pakistan, Latest Edition.
3. Modern Land Drainage, Lambert K. Smedema and Willem F. Voltman, Latest Edition.

Course Content

8.63 Applied Hydraulics

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-419) **Applied Hydraulics**	(2+1) **32 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Discuss** open channel flow, dimensional analysis, similitude, and basic principles of hydraulics.	C2	PLO-1
CLO-2	**Analyze** various hydraulic structures in open channel flow.	C4	PLO-2
CLO-3	**Complete** with confidence the fundamental experiments of open channel flow, flow types and its measurements including pipe flows and investigate processes using hydraulic machines (pumps, turbines, flow channels, etc).	P4	PLO-4
CLO-4	**Apply** the experimental results, graphs to real circumstances and initiate comments/discussion.	C3	PLO-4
CLO-5	**Argue** actively in the lab work of applied hydraulics.	A3	PLO-9

Outline for Theory

1. **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.
2. **Gradually Varied flow**
   Introduction, Analysis of gradually varied flow equation, Classifications of Gradually Varied Flow, Computation of Water Surface Profiles.
3. **Similitude**
   Similitude in hydraulic models, similitude requirements, geometric, kinematics and dynamics similarities, dimensionless numbers, and their significance.
4. **Hydraulic Structures**
   Elementary concept about canals, Types of head works and their layout, Weirs, barrages with their components and functions, Canal falls, Outlets, Cross drainage works, its types and functions.
5. **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.
6. **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.

Course Content

8.64 Applied Hydraulics (Lab)

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-419L) **Applied Hydraulics (Lab)**	(0+1) **0 Theory + 48 Lab**	**Civil Engineering Technology Depth**

	After completion of this course, students will be able to:	Bloom's Taxonomy Level	PLO
CLO-1	**Complete** with confidence the fundamental experiments of open channel flow, flow types and its measurements including pipe flows and investigate processes using hydraulic machines (pumps, turbines, flow channels, etc).	P4	PLO-4
CLO-2	**Apply** the experimental results, graphs to real circumstances and initiate comments/discussion.	C3	PLO-4
CLO-3	**Argue** actively in the lab work of applied hydraulics.	A3	PLO-9

Lab Outline

1. Measurement of water level and speed along the channel.
2. To perform experiment on Pelton and Francis wheel to plot its characteristics curves.
3. To perform experiments on centrifugal and reciprocating pumps to plot its characteristics curves.
4. To perform test on Centrifugal Pump in parallel and in series
5. To measure head losses both major and minor in pipe flow under different scenarios.
6. Flow rate measurement through changes in the channel section.
7. To analyse 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 channels.
10. Perform experiment on flume to plot E~y diagram 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 sediments transport and settling mechanisms.

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 (Latest Edition).
- Open-Channel Flow by M. Hanif Chaudhry (Latest Edition).

Course Content

8.65 Water Supply Systems

CODE & TITLE	CREDIT & CONTACT HOURS	KNOWLEDGE AREA/DOMAIN
(CET-4120) **Water Supply Systems**	(1+1) **16 Theory + 48 Lab**	**Civil Engineering Technology Depth**

After completion of this course, students will be able to:		Bloom's Taxonomy Level	PLO
CLO-1	**Introduce** basic concepts relating to the provisions of water supply.	C2	PLO-1
CLO-2	**Estimate** water demand for various needs.	C4	PLO-2

Outline for Theory

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 standards, WHO standards.
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 consumption maximum daily consumption and peak hourly consumption. Design period factors affecting design period. Commonly used design period and local criteria. Population forecasting; mathematical and graphical methods of forecasting population. Population density.

4. **Distribution and Contamination 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. Types & Sources of Water Contaminants. Removal Method of Water Contaminants.

5. **Water Distribution Pipes:** Types of pipes and their use in water distribution. Pipe joints, service connection. Valves and fire hydrants. Construction of water distribution systems. Disinfections of old and new pipes. Water waste surveys and tracing of leakages. Pipes losses: major & minor losses.

Outline for Laboratory Experiments

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.

9. Supervised Industrial Training

9.1 Background

Supervised Industrial Training (SIT) refers to students supervised hands-on experience in an environment where engineering technology is practiced, familiarizing them with professional engineering work prior to graduation. The training curriculum consists of minimum 16 weeks of continuous industrial training, comprised of 8 hours per day, 5 working days per week. A Bachelor of Engineering Technology student shall undergo mandatory SIT during the 8th semester (16 weeks), or 7th and 8th semesters (16 weeks mandatory and 16 weeks in 7th semester optional), after he/ she has passed all subjects up to the 6th semester.

SIT covers a range of activities, such as design implementation, production processes, laboratory experiments, on-site field works and maintenance. It also serves as a mechanism to integrate engineering practices and the curriculum to achieve Program Learning Outcomes that cover Engineering Technologists Graduate Attributes in line with the Sydney Accord. While SIT provides practical exposure to engineering processes and helps developing professional skills required for an Engineering Technologist, it also offers an opportunity to the prospective employers to assess potential skills of a future employee.

9.2 Objectives

Through the SIT, students will:

a. Learn to apply engineering technology knowledge learned in classroom environment in real industrial situations.
b. Be provided exposure to professional practices in the industries.
c. Understand the role and responsibilities and code of ethics that Engineering Technologists should uphold.
d. Develop awareness about general workplace behavior and build interpersonal skills.
e. Maintain professional work records and reports.
f. Learn to write reports and network with probable future employers to increase employability.

9.3 Responsibility of HEI: Placement in SIT Program

During 7th (Optional) and 8th semester, Bachelor of Civil Engineering Technology students will be undergoing continuous SIT of 16 (or 32) weeks. This training shall be arranged by HEIs in leading industry, and preferably should sign an MoU for the SIT. A designated Administrator/Coordinator of HEI shall complete all necessary documentation, preferably 12 weeks prior to the commencement of the training, and issue Training Schedule for 16 (or 32) weeks so that all stakeholders and the students are aware and assured of undergoing SIT training in 7th (optional) and 8th semester according to a scheduled timeline.

9.4 Responsibilities of Students

a. Bachelor of Civil Engineering Technology students shall get enrolled for SIT during the 6th semester and before commencement of 7th semester.
b. Students shall have to undergo continuous training of 16 (or 32) credit hours. One week's training of 8 hours daily for 5 days (40 contact hours) will be counted as 1 credit hour. Accordingly, 16 weeks (One semester) will help earn students 16 credit hours.
c. Total contact hours per semester are: 16 weeks per semester x 5 working days per week x 8 hours per day = 640. If an HEI opts SIT in 2 semesters (7th and 8th), these credit hours and contact hours will be doubled.
d. Students will maintain a daily Logbook, signed by the SIT supervisor at site, Training Administrator appointed by HEI and the student.
e. Students must observe safety & security rules of the Organization where they receive Training.
f. Students must wear specified working dress during training.
g. Students must obey all rules and regulations of the organization.

h. Students must observe working timings of the training Organization. Students may be allowed 10 days leave during the Training period of 16 (or 32) for genuine reasons. The leave shall only be used to cater for emergencies, with prior sanction from the training Administrator/Coordinator.
i. Leave will be deducted from training hours and required to be made up later.
j. Unsanctioned leaves shall be treated as "absent", and liable to disciplinary action.
k. Public holidays and leave should not be counted as working hours.

9.5 Training Progress Assessment and Review by HEI

Every HEI should appoint a focal person as SIT Administrator/Coordinator for each program who will monitor progress randomly through site visits, phone calls or emails to the industrial organization's counterpart focal person. Progress reports will be maintained after coordination with training supervisor(s) as well as the students.

The purpose of monitoring of SIT by Training Administrator/Coordinator are:

a. To ensure the training organization is providing suitable and appropriate training to students.
b. To obtain feedback on students' performance and training progress through discussion with training supervisor(s).
c. To make courtesy visits and establish industrial relations between the HEI and the industries where students will receive their SIT.
d. To discuss the possibility of students' job placement with the training organization.
e. To survey new industries as potential training placement locations in the future.

9.6 Changing Student Placement During SIT

a. Students are discouraged to change placement during the training period from one organization to another.
b. However, written permission may be granted by the training Administrator/Coordinator, if a new placement of the student is available and confirmed in another organization, provided the student does not suffer loss of training hours due to this changeover.
c. After getting written permission from the Training Administrator/Coordinator, a fresh approval should be applied for the new placement.

9.7 Daily Training Logbook

All training activities must be recorded on a daily basis in the Training Logbook [See Appendix F]. Students must get it signed, on a daily basis, by on-the-job Trainer.

The Training logbook must reflect:

a. The student's learning experience during the industrial training.
b. Training records and evidence of supervised training, with evidence of participation of student, on- the-job Trainer and HEI's training Administrator/Coordinator.
c. Part of professional practice in engineering profession where incidence and evidence are properly documented.
d. Information that becomes a source of reference in preparing the Industrial Training Report [See Section 8.8].
e. The Logbook must be submitted along with the Industrial Training Report.

9.8 Industrial Training Report

An Industrial Training Report will be submitted upon completion of SIT. The Report must describe a student's learning and development in technical knowledge, engineering practices and professional skills acquired through practical experience. The Industrial Training Report should also reflect a student's ability in communication skills and understanding of engineering practices. Students should seek advice from their on-the-job Trainer on site, to ensure that no confidential materials are included in the report. The report shall be submitted to the Training Administrator. The student may present a copy of the report to the prospective employer. Any references made in preparation of

the report should be recognized using standard referencing formats. Students should refer to the Industrial Training Report Template as provided [See Appendix G] and guidelines given below in preparing the Report. The Daily Training Logbook should be submitted together with the Report.

9.9 Guideline for Preparation of Industrial Training Report

Under the guidance of supervisors, students need to properly document their experience and learning during the SIT in the form of an Industrial Training Report. A properly prepared Report can portray their practical experience precisely in an orderly manner. The Report must be prepared according to the format and the guidelines below:

9.9.1 Contents of Industrial Training Report

(a) Table of Content

This section of the report should consist of:

i. Headings
ii. Sub-headings
iii. Page numbers

Every appendix requires a title, and each page needs to be numbered accordingly.

(b) Background & Profile of the Training Organization

Brief and concise description of the organization in which the student is undertaking the SIT. The main items are:

i. Backgrounds/profile of the organization
ii. Vision and Mission
iii. Organogram.
iv. Title and position of the supervisor in charge
v. Other necessary information only (not more than three pages)

(c) Schedule of duties performed as Trainee

This section briefly describes the time, duration and types of duties performed during the training. The description must follow the schedule of the training, i.e., in chronological order (for 16/32 weeks). The days when the student was not on duty must be properly recorded with cogent reasons.

(d) Experience During SIT

In this section, the student must fully describe the industrial training experience gained. Some suggested areas include:

i. Project (s) carried out, if any.
ii. Supervisory works
iii. Problems encountered
iv. Problems solving process or approach
v. Hands on skill acquired.
vi. How productivity can be further enhanced.
vii. Quality Management system in place.
viii. Safety at work.

(e) Conclusion

Students provide an overall assessment in this section and arrive at a conclusion with regards to the SIT undergone. Content may include:

i. Types of major work performed during SIT
ii. Different modules of SIT
iii. Comments whether SIT met the training objectives
iv. Suggestions and recommendations for improvement of the SIT

(f) References

A complete list of the references used in the report must be included according to standard referencing format.

(g) Appendix

Appendixes are additional information appended to support the main text of the Report. A copy of the letter of permission from the Training Organization must be attached as an appendix. Other suggested appendixes are:

i. Investigation and project report during SIT
ii. Technical drawings, so far these are not secret documents or proprietary etc.
iii. Any other document that adds to the Report

(h) Figures and Tables

All figures, tables and similar content must be captioned, labeled, and mentioned in the main text of the Report.

(i) Notations, Symbols & Acronyms

If the report contains notations, symbols, and acronyms, these must be defined before they first appear in the main text. It is good practice to put a list of notations, symbols, and acronyms on a separate page, appropriately titled, and placed after 'Tables of Contents' page.

Every appendix must have a title and be mentioned in the main text of the Report. All page numbers for appendixes must be in continuation of page numbers of the main Report.

Do not include irrelevant materials, e.g., brochures from the organizations, or any publicity materials in the report.

9.9.2 Format of the Report

Note on Good Practice

Students are advised to start writing the industrial training report as soon as possible, after beginning of the training period, to ensure timely completion and submission of the report.

(a) General

i. Students are advised to start writing the SIT Report as soon as training commences to ensure timely completion and submission.
ii. Do not include irrelevant materials, e.g., brochures from the organizations, or any publicity materials in the report.
iii. The Report must be typewritten on plain white A4 size paper, with 12-point Times New Roman font type and line spacing of 1.5.

(b) Abstract or Preface

The Report should start with an abstract of maximum 2 pages, and should briefly describe:

i. Description of Organization providing SIT
ii. Summary of the Report
iii. Acknowledgement

9.10 SIT Assessment

Assessment of the SIT should be based on the following parameter:

i.	On-the-Job Trainer Report	(20% marks)
ii.	HEI'S Training/ Advisor Report through visits or survey	(10% marks)
iii.	Industrial Training Report	(50% marks)
iv.	Viva voce	(20% marks)

It is also be noted that:

i. Minimum of 50% marks are required to pass the SIT.
ii. Students are advised to be diligent in writing their Report.

iii. The Report must be of good quality and portray in full the industrial experience and knowledge gained.
iv. The Report should not be in the form of short notes and figurative form.
v. If the Report is not satisfactory, students shall rewrite the Report until it is deemed satisfactory.

9.11 Completion of Industrial Training

i. Upon completion of a 16- or 32-week continuous SIT, a Confirmation Letter to this effect must be obtained from the training organization and/or probable employer.
ii. The Confirmation Letter must be submitted to the Industrial Training Administrator/Coordinator, together with the (1) On-the-Job Trainer's Report, (2) Student Feedback Form, and (3) Industrial Training Report for grading.

APPENDIX A: Sydney Accord Knowledge and AttitudeProfile

(Retrieved from www.ieagreements.org)

A Sydney Accord program provides:
SK1: A systematic, theory-based understanding of the natural sciences applicable to the sub-discipline and awareness of relevant social sciences.
SK2: Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed consideration and use of models applicable to the sub-discipline.
SK3: A systematic, theory-based formulation of engineering fundamentals required in an accepted sub-discipline.
SK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for an accepted sub-discipline.
SK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations using the technologies of a practice area.
SK6: Knowledge of engineering technologies applicable in the sub-discipline.
SK7: Knowledge of the role of technology in society and identified issues in applying engineering technology, such as public safety and sustainable development (represented by the 17 UN-SDGs).
SK8: Engagement with the current technological literature of the discipline and awareness of the power of critical thinking.
SK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

APPENDIX B: Engineering Technologist GraduateAttribute Profile

(Retrieved from www.ieagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to have the following attributes:
Engineering Technology Knowledge: **SA1:** An ability to apply knowledge of mathematics, natural science, Engineering Technology fundamentals and Engineering Technology specialization to defined and applied Engineering Technology procedures, processes, systems, or methodologies.
Problem Analysis **SA2:** An ability to Identify, formulate, research literature and analyze broadly-defined Engineering Technology problems reaching substantiated conclusions using analytical tools appropriate to the discipline or area of specialization.
Design/Development of Solutions **SA3:** An ability to design solutions for broadly- defined Engineering Technology problems and contribute to the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
Investigation **SA4:** An ability to conduct investigations of broadly defined problems; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions.
Modern Tool Usage **SA5:** An ability to Select and apply appropriate techniques, resources, and modern technology and IT tools, including prediction and modelling, to broadly-defined Engineering Technology problems, with an understanding of the limitations.
The Engineering Technologist and Society **SA6:** An ability to demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Engineering Technology practice and solutions to broadly defined Engineering Technology problems.
Environment and Sustainability **SA7:** An ability to understand and evaluate the sustainability and impact of Engineering Technology work in the solution of broadly defined Engineering Technology problems in societal and environmental contexts.

Ethics: **SA8:** Understand and commit to professional ethics and responsibilities and norms of Engineering Technology practice.
Individual and Teamwork **SA9:** An ability to Function effectively as an individual, and as a member or leader in diverse teams.
Communication **SA10:** An ability to communicate effectively on broadly defined Engineering Technology activities with the Engineering Technologist community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
Project Management **SA11:** An ability to demonstrate knowledge and understanding of Engineering Technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.
Lifelong Learning: **SA12:** An ability to recognize the need for and have the ability to engage in independent and life-long learning in specialist Engineering Technologies.

APPENDIX C: Engineering Technologist ProfessionalCompetence Profile

(Retrieved from www.ieagreements.org)

As per Sydney Accord, Engineering Technologist Graduate is expected to demonstrate the following competencies:
Comprehend and apply universal knowledge: **TC1:** Comprehend and apply the knowledge embodied in widely accepted and applied procedures, processes, systems, or methodologies.
Comprehend and apply local knowledge: **TC2:** Comprehend and apply the knowledge embodied procedures, processes, systems, ormethodologies that is specific to the jurisdiction of practice.
Problem analysis: **TC3:** Identify, clarify, and analyze broadly defined problems using the support of computing andinformation technologies where applicable.
Design and development of solutions: **TC4:** Design or develop solutions to broadly defined problems considering a variety of perspectives.
Evaluation: **TC5:** Evaluate the outcomes and impacts of broadly defined activities.
Protection of society: **TC6:** Recognize the foreseeable economic, social, and environmental effects of broadly defined activities and seek to achieve sustainable outcomes (represented by the 17 UN-SDGs).
Legal, regulatory, and cultural: **TC7:** Meet all legal, regulatory, and cultural requirements and protect public health and safety during all activities.
Ethics: **TC8:** Conduct activities ethically
Manage engineering activities: **TC9:** Manage part or all of one or more broadly defined activities.
Communication and Collaboration: **TC10:** Communicate and collaborate using multiple media clearly and inclusively with a broadrange of stakeholders during all activities.

Continuing Professional Development (CPD) and Lifelong learning: **TC11:** Undertake CPD activities to maintain and extend competences and enhance the ability toadapt to emerging technologies and the ever-changing nature of work.
Judgement: **TC12:** Choose appropriate technologies to deal with broadly defined problems. Exercise soundjudgement in the course of all broadly defined activities.
Responsibility for decisions: **TC13:** Be responsible for making decisions on part or all of one or more broadly defined activities.

APPENDIX D: Minutes of Preliminary Meeting of NCRC

1. The preliminary meeting of National Curriculum Review Committee (NCRC) was held on 29-10-2021 to 31-10-2021 at the NED University, Karachi.

2. On the first day, the meeting started with the recitation of Holy Quran. On behalf of worthy vice chancellor NED University, Prof. Dr. Muhammad Tufail, the Pro Vice Chancellor of the University welcomed all participants. Chairman NTC, Mr. Imtiaz H. Gilani joined the meeting online.

3. After the introduction of all participants, Chairman NTC stated the purpose of the meeting and gave some suggestions regarding the curriculum design of the Civil Engineering Technology. Prof. Rizwan Farooqui, Chair Department of Civil Engineering, NED University then welcomed the participants on behalf of the Department and provided some guidelines as to the process of curriculum development.

4. Prof. Dr. Asad Ur Rehman Khan, Dean CPL, NED University attended the orientation session as a member but then regretted his further presence owing to other pre- occupations.

   Following is the list of participants.

Sr#	NCRC Members	Role
1.	Engr. Prof. Dr. Rizwan Ul Haque Farooqui, Chairperson, Department of Civil Engineering, NED University Karachi	Convener
2.	Engr. Prof. Dr. Naeem Aziz Memon Professor, Department of Civil Engineering, MUTE Jamshoro.	Co-Convener
3.	Engr. Dr. Asim Ali Abro Chairperson, Department of civil engineering, The BBSUTSD Khairpur Mirs	Secretary
4.	Engr. Dr. Saeed Ullah Jan Mandokhail, Chairperson, Department of Civil Engineering BUITEMS, Quetta	Member
5.	Engr. Dr. Rashid Farooq Meo Chairperson, Department of Civil Engineering, International Islamic University, Islamabad	Member
6.	Engr. Prof. Dr. Anil Kumar, Dean, Department of Civil Engineering MUTE Jamshoro.	Member
7.	Engr. Prof. Dr. Ashraf Tanoli, Chairperson, Department of Civil Engineering GiKi, Topi Swabi	Member
8.	Engr. Prof. Dr. Anwar Khitab, Dean, Department of Civil Engineering MUST, AJK	Member

9.	Engr. Prof. Dr. Qaiser uz Zaman Khan Chairperson, Department of Civil Engineering, UET, Taxila	Member
10.	Engr. Prof. Dr. Ashfaque Ahmed Memon, Department of Civil Engineering MUTE Jamshoro	Member
11.	Engr. Dr. Farrukh Arif Department of Civil Engineering, NED University, Karachi	Member
12.	Engr. Prof. Dr. Mansoor A. Baluch, Registrar, UET, Taxila	Member
13.	Mr. Muhammad Fahd Amin, Deputy Director / Acting Registrar, NTC, Pakistan	NTC Representative
14.	Mr. Hafiz Ghulam Muhammad, Deputy Director, NTC Pakistan	NTC Representative

5. After taking charge of the nominated committee, convener, Engr. Prof. Dr. Rizwan ul Farooqui chaired the meeting and emphasized reflection of Sydney Accord in the curriculum and course titles. He also advised that the curriculum must provide a uniform framework and nomenclature for Bachelor of Information Security Engineering Technology degrees.

6. In continuation of above guidelines, Engr. Prof. Naeem Aziz Memon, Co-Convener, Engr. Dr. Asim Ali Abro, Secretary highlighted the objectives of curriculum development.

7. Agreed upon objectives were categorized and assigned to Subcommittees, where honorable members reviewed, discussed, and submitted the following resolutions:

   - Develop an undergraduate curriculum of Civil engineering technology which is at par with international standards and in substantial conformity with the Sydney Accord.
   - Clearly define program education objectives (PEOs), course learning outcomes (CLOs) with taxonomy levels, and course contents aligned with program learning outcomes (PLOs).
   - Incorporate latest relevant reading materials/ references.
   - Ensure that course content that is uniform across other disciplines (HEC's Gen Ed requirements) is not duplicated.
   - Curriculum must be futuristic, and answer needs of society.

8. In second session, the house openly discussed the nomenclature of the discipline, preface, objectives of the programs, PLOs, methods of instruction and learning environment, assessment, and operational framework.

9. After long deliberation, the Committee proposed the curriculum framework, the duration of the program, number of semesters, number of weeks per semester, total number of credit hours, weightage of technology domain and non-technology domain courses and weightage of theory and practical of undergraduate 4-years program in civil engineering technology.

10. Furthermore, list of courses (core and elective) and semester wise breakup of courses werealso discussed thoroughly and finalized.

11. Admission/intake criteria were discussed and adopted same as defined in NTC AccreditationManual.

12. Supervised industrial training (SIT) was discussed in detail. There was a consensus that SIT will be mandatory for 8th Semester.

13. Those HEI's that can provide only one semester of SIT (in 8th), shall offer optional courses instead of SIT in the 7th semester to cover credit hours and other requirements.

14. HEI's that are geared to provide SIT in two semesters can do this in 7th and 8th Semesters.

15. In line with the experience and expertise of NCRC members, list of courses in various domains were distributed among the Sub-Committees.

16. These Committees were assigned responsibility for reviewing course objectives, adding course learning outcomes, appropriate mapping with taxonomy and PLOs, updating list of contents, adding teaching-learning methods and assessment, and updating bibliography/ references/ suggested books.

17. The following Core Committee's, along with four Sub-Committees, were constituted with separate Conveners and Secretaries:

Civil Engineering Technology Core Committee		
Sr#	**Name**	**Role**
1	Engr. Prof. Dr. Rizwan Ul Haque Farooqui	Convener
2	Engr. Prof. Naeem Aziz Memon	Co-convener
3	Engr. Dr. Asim Ali Abro	Secretary
1. Sub-Committee: Computing, Humanities and Social Sciences Courses		
Sr#	**Name**	**Role**
1	Engr. Prof. Dr. Qaiser uz Zaman Khan	Convener
2	Engr. Prof. Dr. Ashfaque Ahmed Memon	Member
3	Engr. Prof. Dr. Naeem Aziz Memon	Member
4	Engr. Dr. Farrukh Arif	Secretary
2. Sub-Committee: Civil Engineering Technology Foundation Courses		

Sr#	Name	Role
1	Engr. Prof. Dr. Aneel Kumar	Convener
2	Engr. Dr. Rashid Farooq Meo	Member
3	Engr. Dr. Saeed Ullah Jan	Member/Secretary
3. Sub-Committee: Civil Engineering Technology Core (Breadth) Courses		
1	Engr. Dr. Prof. Rizwan Ul Haque	Convener
2	Engr. Dr. Mansoor A. Baluch	Member
3	Engr. Dr. Anwar Khitab	Member
4	Engr. Dr. Asim Ali Abro	Member / Secretary
4. Sub-Committee: Civil Engineering Technology Core (Depth) Courses		
Sr#	**Name**	**Role**
1	Engr. Dr. Ashraf Tanoli	Convener
2	Engr. Prof. Dr. Naeem Aziz Memon	Member
3	Engr. Dr. Rashid Farooq Meo	Member
4	Engr. Dr. Farrukh Arif	Member/ Secretary

18. After conclusion of the Preliminary Meeting, the Sub-Committees submitted the proposedcourse contents for theory and practical's, along with CLOs, list of recommended books, list of experiments and relevant information of each course.

19. The first draft was compiled by Engr. Dr. Asim Ali Abro, Secretary NCRC,and distributed to Members for review.

20. Preliminary curriculum draft was submitted to NTC and sent to international reviewers.

APPENDIX E: Minutes of the Final Meeting of NCRC

1. The final meeting of the NCRC was held on 20-01-2022 to 22-01-2022 for 03 days at Indus University Karachi.

2. The inauguration session started with recitation of Holy Quran, and chaired by Honorable Chancellor Mr. Khalid Amin of Indus University Karachi.

3. Engr. Imtiaz Hussain Gilani, Chairman NTC, joined the meeting online. He appreciated the efforts by Members and highlighted their valuable contribution for the national cause in setting standards for quality-education in civil engineering technology.

4. The Chair also extended his gratitude to the entire team and briefed the objectives and arrangements for the final NCRC.

5. The following members attended the meeting:

Sr.	NCRC Members	Role
1.	Engr. Prof. Dr. Rizwan Ul Haque Farooqui, Chairperson, Department of Civil Engineering, NED University Karachi	Convener
2.	Engr. Prof. Dr. Naeem Aziz Memon Professor, Department of Civil Engineering, MUTE Jamshoro.	Co-Convener
3.	Engr. Dr. Asim Ali Abro Chairperson, Department of civil engineering, The BBSUTSD Khairpur Mirs	Secretary
4.	Engr. Dr. Rashid Farooq Meo Chairperson, Department of Civil Engineering, International Islamic University, Islamabad	Member
5.	Engr. Dr. Saeed Ullah Jan Mandokhail, Chairperson, Department of Civil Engineering BUITEMS, Quetta	Member
6.	Engr. Prof. Dr. Anil Kumar, Dean, Department of Civil Engineering MUTE Jamshoro.	Member
7.	Engr. Prof. Dr. Ashraf Tanoli, Chairperson, Department of Civil Engineering GiKi, Topi Swabi	Member
8.	Engr. Prof. Dr. Anwar Khitab, Dean, Department of Civil Engineering MUST, AJK	Member

9.	Engr. Prof. Dr. Qaiser uz Zaman Khan Chairperson, Department of Civil Engineering, UET, Taxila	Member
10.	Engr. Prof. Dr. Ashfaque Ahmed Memon, Department of Civil Engineering MUTE Jamshoro	Member
11.	Engr. Dr. Farrukh Arif Department of Civil Engineering, NED University, Karachi	Member
12.	Engr. Prof. Dr. Mansoor A. Baluch, Registrar, UET, Taxila	Member
13.	Mr. Muhammad Fahd Amin, Deputy Director / Acting Registrar, NTC, Pakistan	NTC Representative
14.	Mr. Hafiz Ghulam Muhammad, Deputy Director, NTC Pakistan	NTC Representative

6. The task of developing the curriculum for Civil Engineering Technology was assigned to the respective committees selected for different areas.

   - After receiving feedback from the concerned committees, national and international experts and long deliberations among the members, curriculum was finalized at par with international standards and in substantial conformity with the Sydney Accord.

   - This was also made sure that the course contents similar to other disciplines (HEC's Gen. Ed. requirements) are not duplicated.

   - The main committee also finalized program education objectives (PEOs), course learning outcomes (CLOs) with taxonomy levels, and course contents aligned with program learning outcomes (PLOs).
   - The mapping of CLOs with concerned PLO's was also finalized to meet the requirements of the Civil Engineering Technology Program as per Sydney Accord.

7. The final draft was compiled by Engr. Rashid Farooq Meo, Engr. Dr. Asim Ali Abro and Engr. Prof. Dr. Naeem Aziz Memon.
8. After review by Members and with the approval of Convener, it was submitted to HEC.

APPENDIX F: Supervised Industrial Training Logbook Sample Format

Personal Details:
Name:
Roll Number:
Address:
Email:

Course of Study:
Year/Semester of Study:

Training Start Date:
Training End Date:

Training Organization Details:
Name:
Address:

Contact Person:
Contact Number:

Daily Training Log

Please specify training information by descriptive statements, tables, sketches, figures, photographs, and so forth. Feel free to incorporate attachments wherever necessary.

Training Week: _____

Date	Time	Training Log

Declaration:

I, _____ Roll Number_____, do hereby declare that all information provided above is true and correct to the best of my knowledge.

_____
Student signature with date

_____ _____
Organization Supervisor signature with date HEI Coordinator signature & date

APPENDIX G: Supervised Industrial Training Report Sample Format

Sample table of content for supervised industrial training report is provided so that students can develop an understanding of what is expected of them when making the submission. Students areencouraged to expand upon the content presented below. A declaration page validating the originality of work duly signed by the student and the trainee is also to be attached at the beginning of the submitted report.