COMSATS University Islamabad
Registrar Office, Academic Unit (PS)

No: CUI-Reg/Notif- 790 /25/ 807. March 17, 2025

NOTIFICATION

Academic Council in its 41st meeting held on December 31, 2024, on the recommendation of the 35th meeting of Board of Faculty of Engineering held on October 10, 2024, approved the revised Scheme of Studies of Bachelor of Science in civil Engineering (BSCEE), effective from Fall 2024:

1. Name of Degree: Bachelor of Science in Civil Engineering (BSCEE)

Minimum Duration:	04 Years	Minimum Semesters:	08	Minimum Credit Hours required:	135

2. Framework of Courses and Credit Hours for Degree Program

Sr. No	Course Work	(Min No. of Courses)	(Min No. of Credit Hours)
a)	General Education Courses	16	41
b)	Major Engineering Discipline Courses		
	1. Computer and Information Sciences	02	06
	2. Engineering Foundation Courses	15	24
	3. Core Breadth Courses	13	22
	4. Core Depth Courses	13	22
	5. Multi-Disciplinary Engineering Courses	5	07
c)	Flexible Engineering/Non-Engineering Courses	03-04	07
d)	Field Experience/Internship	01	0
e)	Capstone Project	02	06
f)	Community Services	01	0
g)	Survey Camp	01	0
Minimum No. of Courses/Credit hours required:		**72-73**	**135**

Dr. Muhammad Hanif (Ph.D)
Deputy Registrar

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A. General Education Courses

i. Arts and Humanities (any one course from the following list)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	HUM107	21st Century Communication Skills	2(2, 0)	
2.	HUM122	Fundamentals of Psychology	2(2, 0)	
3.	HUM123	Fundamentals of Philosophy	2(2, 0)	
4.	HUM131	Anthropology	2(2, 0)	

ii. Natural Sciences (Mandatory Courses)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	PHY124	Applied Physics	3(2, 1)	
2.	MTH115	Quantitative Reasoning-I	3(3, 0)	
3.	MTH116	Quantitative Reasoning-II	3(3, 0)	MTH115
4.	MTH106	Advanced Calculus	3(3, 0)	
5.	MTH212	Applied Mathematics	3(3, 0)	MTH106
6.	MTH375	Numerical Computations	3(2, 1)	

iii. Social Sciences (any one course from the following list)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	ECO300	Engineering Economics	2(2, 0)	
2.	HUM130	Fundamentals of Sociology	2(2, 0)	
3.	HUM209	Fundamentals of Political Science	2(2, 0)	
4.	HUM222	Fundamentals of International Relations	2(2, 0)	
5.	MGT201	Introduction to Human Resource Management	2(2, 0)	
6.	MGT202	Introduction to Organizational Behavior	2(2, 0)	
7.	MGT203	Introduction to Engineering Management	2(2, 0)	
8.	MGT204	Introduction to Financial Management	2(2, 0)	
9.	MGT205	Introduction to Marketing Management	2(2, 0)	
10.	MGT206	Leadership and Personal Grooming	2(2, 0)	
11.	MGT207	Introduction to Project Management	2(2, 0)	

iv. Functional English (Mandatory Course)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	HUM104	Functional English	3(3, 0)	

v. Expository Writing (Mandatory Course)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	HUM120	Expository Writing	3(3, 0)	

vi. **Islamic Studies** will be a mandatory course; however, non-Muslim students will have the option to substitute Islamic Studies with HUM116 Ethics)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	HUM112	Islamic Studies	2(2, 0)	
2.	HUM116	Ethics	2(2, 0)	

vii. **Ideology and Constitution of Pakistan (Mandatory Course)**

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	HUM113	Ideology and Constitution of Pakistan	2(2, 0)	

viii. **Applications of Information and Communication Technologies (Mandatory Course)**

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	CSC101	Applications of Information and Communication Technologies	3(2, 1)	

ix. **Entrepreneurship (Mandatory Courses)**

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	MGT250	Introduction to Entrepreneurship	2(2, 0)	
2.	MGT462	Project Planning and Management	2(2, 0)	

x. **Civics and Community Engagement (Mandatory Course)**

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	HUM208	Civics and Community Engagement	2(2, 0)	

B. Major Engineering Discipline Courses

Knowledge Area	Course Code	Course Title	Credit Hours[1]	Prerequisite (s)[†]
Computer and Information Sciences	CSC142	Introduction to Computer Programming	3(2, 1)	
	CEE310	Civil Engineering Construction and Graphics	1(1, 0)	CEE102
	CEE317	Civil Engineering Construction and Graphics Lab	2(0, 2)	CEE102
Engineering Foundation Courses	CEE101	Engineering Mechanics	2(2, 0)	
	CEE102	Civil Engineering Drawing	1(1, 0)	
	CEE104	Civil Engineering Materials	2(2, 0)	
	CEE106	Engineering Mechanics Lab	1(0, 1)	
	CEE107	Civil Engineering Drawing Lab	2(0, 2)	
	CEE108	Civil Engineering Materials Lab	1(0, 1)	
	CEE201	Engineering Surveying	2(2, 0)	
	CEE202	Mechanics of Solids I	2(2, 0)	
	CEE203	Elementary Fluid Mechanics	2(2, 0)	
	CEE204	Soil Mechanics	2(2, 0)	
	CEE207	Structural Analysis-I	3(3, 0)	CEE101
	CEE212	Engineering Surveying Lab	1(0, 1)	
	CEE213	Mechanics of Solids I Lab	1(0, 1)	
	CEE214	Elementary Fluid Mechanics Lab	1(0, 1)	
	CEE215	Soil Mechanics Lab	1(0, 1)	
Core Breadth Courses	CEE208	Advanced Fluid Mechanics	2(2, 0)	CEE203
	CEE211	Advanced Surveying	2(2, 0)	CEE201
	CEE217	Advanced Fluid Mechanics Lab	1(0, 1)	CEE203
	CEE219	Advanced Surveying Lab	1(0, 1)	CEE201
	CEE302	Structural Analysis-II	3(3, 0)	CEE207
	CEE304	Quantity Surveying and Cost Estimation	2(2, 0)	
	CEE306	Engineering Hydrology	2(2, 0)	
	CEE307	Environmental Engineering	2(2, 0)	
	CEE308	Reinforced Concrete Design I	3(3, 0)	CEE206
	CEE314	Engineering Hydrology Lab	1(0, 1)	
	CEE315	Environmental Engineering Lab	1(0, 1)	
	CEE316	Reinforced Concrete Design I Lab	2(0, 2)	CEE206
	CEE319	Quantity Surveying and Cost Estimation Lab	1(0, 1)	
Core Depth Courses	CEE206	Mechanics of Solids II	2(2, 0)	CEE202
	CEE209	Geotechnical Engineering	3(3, 0)	CEE204
	CEE216	Mechanics of Solids II Lab	1(0, 1)	CEE202
	CEE218	Geotechnical Engineering Lab	1(0, 1)	CEE204

	CEE404	Hydraulics Engineering	2(2, 0)	CEE208
	CEE406	Reinforced Concrete Design II	3(3, 0)	CEE308
	CEE426	Foundation Engineering	2(2, 0)	CEE204
	CEE427	Pavement Analysis & Design	2(2, 0)	
	CEE428	Irrigation Engineering	2(2, 0)	CEE208
	CEE429	Hydraulics Engineering Lab	1(0, 1)	CEE208
	CEE430	Reinforced Concrete Design II Lab	1(0, 1)	CEE308
	CEE432	Pavement Analysis & Design Lab	1(0, 1)	
	CEE433	Irrigation Engineering Lab	1(0, 1)	CEE208
Multi-Disciplinary Engineering Courses	CEE100	Occupational Health and Safety	1(1, 0)	
	CEE105	Engineering Geology	2(2, 0)	
	CEE309	Introduction to Architecture and Town Planning	2(2, 0)	
	CEE313	Modelling and Simulation in Civil Engineering	1(1, 0)	
	CEE318	Modelling and Simulation in Civil Engineering Lab	1(0, 1)	

Flexible Engineering/Non-Engineering Courses:

Construction Engineering Domain

Sr. No.	Course Code	Course Title	Credit Hours1	Prerequisite(s)†
1.	CEE312	Construction Management	3(3, 0)	
2.	CEE420	Construction Project Scheduling	3(3, 0)	MGT462
3.	CEE421	Contract Management	3(3, 0)	MGT462

Highway Engineering Domain

Sr. No.	Course Code	Course Title	Credit Hours1	Prerequisite(s)†
1.	CEE301	Highway & Traffic Engineering	2(2, 0)	
2.	CEE414	Pavement Design and Rehabilitation	3(3, 0)	CEE301
3.	CEE415	Traffic Engineering and Safety	3(3, 0)	CEE301
4.	CEE416	Road Construction, Materials and Practices	3(3, 0)	CEE301
5.	CEE417	Geometric Design of Highways and Streets	3(3, 0)	CEE301

Structural Engineering Domain

Sr. No.	Course Code	Course Title	Credit Hours1	Prerequisite(s)†
1.	CEE305	Matrix Analysis of Structures	3(3, 0)	CEE302
2.	CEE402	Steel Structures	3(3, 0)	
3.	CEE410	Design of Concrete Structures	2(2, 0)	CEE308
4.	CEE424	Elementary Structural Dynamics	3(3, 0)	CEE308
5.	CEE434	Design of Concrete Structures Lab	1(0, 1)	CEE308

Disaster Management and Geo-Informatics Domain

Sr. No.	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)[†]
1.	CEE311	Fundamentals of Disaster Management	3(3, 0)	
2.	CEE423	Environment Management and Impact Assessment	3(3, 0)	CEE307
3.	CEE425	Geo-Informatics	1(1, 0)	
4.	CEE431	Geo-Informatics Lab	1(0, 1)	

C. List of Multi-Disciplinary Engineering Courses (Mandatory Courses)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)[†]
1.	CEE105	Engineering Geology	2(2, 0)	
2.	CEE309	Introduction to Architecture and Town Planning	2(2, 0)	
3.	CEE313	Modelling and Simulation in Civil Engineering	1(1, 0)	
4.	CEE318	Modelling and Simulation in Civil Engineering Lab	1(0, 1)	
5.	CEE100	Occupational Health and Safety	1(1, 0)	

D. Internship (Mandatory Course)**

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)[†]
1.	EGG497	Internship	0(0, 0)	

E. Capstone Project (Mandatory Courses)

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)[†]
1.	EGG498	Final Year Design Project (Part I)*	3(0, 3)	
2.	EGG499	Final Year Design Project (Part II)	3(0, 3)	EGG498 Final Year Design Project (Part I)

F. Remedial Course***

#	Course Code	Course Title	Credit Hours[1]	Prerequisite(s)†
1.	CHM102	Introduction to Chemistry	3(2, 1)	

Notes:

[1] 03 credit hours of theory is equivalent to 03 hours of lectures whereas 01 credit hour of lab is equivalent to 03 hours of lab session. All the lab sessions are graded. Students have to pass both theory and lab to earn the course credits.

† Courses with prerequisites can only be allowed if all prerequisite courses have been passed.

* Students must pass at least 80 credit hours (engineering and non-engineering subjects) to register for the final year project.

** EGG497 Field Experience/Internship minimum duration 6-8 weeks, preferably conducted in summer breaks after the 4th semester, as a *Non-Credit mandatory requirement* for degree completion.

*** To be offered as a Non-Credit course to the students who have passed FSc/Equivalent with Physics, Mathematics and Computer Studies/Science (ICS) combination, i.e., FSc/Equivalent with non-Pre-Engineering background. These students may preferably pass this remedial course during the 1st year of their degree program. This course will not contribute to a student's GPA.

Additional Notes:

1. Students enrolled in the **Bachelor of Science in Civil Engineering** program have the flexibility to choose to pursue one or two additional minors or even opt for a second major as per the scenarios stated below. These minors and majors can be selected from any category of courses recognized as minors or majors by other programs offered at their respective CUI campus. This choice must adhere to the established rules and regulations of the University.

a) Scenario 1 - Single Major (135 credits):

This scenario centers on a single major, demanding a minimum of 135 credits for completion. This breakdown includes 41 credits for General Education courses, a minimum of 81 credit hours for the major Engineering Discipline Courses, 7 credit hours for Flexible Engineering/Non-Engineering Courses, and 6 for the Capstone Project.

b) Scenario 2 - Single Major with Minor (147 credits):

In this case, a single major is accompanied by a minor, requiring a minimum of 147 credits in total. The components encompass 41 credits for General Education courses, a minimum of 81 credit hours for the major Engineering Discipline Courses, 7 credit hours for Flexible Engineering/Non-Engineering Courses, and 6 for the Capstone Project. Additionally, a 12-credit hours minor complements the major, fostering broader skills.

c) Scenario 3 - Single Major with Two Minors (159 credits):

Here, a single major is augmented by two minors, totaling a minimum of 159 credits. The distribution consists of 41 credits for the General Education course, a minimum of 81 credit hours for the major Engineering Discipline Courses, 7 credit hours for Flexible Engineering/Non-Engineering Courses, 6 for the Capstone Project, and two minors with a minimum of 12 credits each.

d) Scenario 4 - Double Major (207 credits):

This scenario involves pursuing two majors, necessitating a minimum of 207 credits. The components comprise 41 credits for the General Education course, a minimum of 81 credit hours for the major Engineering Discipline Courses, a minimum of 72 credits for second major, 7 credit hours for Flexible Engineering/Non-Engineering Courses, 6 for the Capstone Project.

2. The study of the **HUM101: Understanding Quran and HUM141: Seerah of Holy Prophet S.A.W.** courses will constitute a mandatory component of the curriculum for all undergraduate degree programs. These courses will be conducted using a hybrid mode of instruction across the CUI System. Upon successful completion by more than 80% of course video watched time serves as a primary assessment criterion to measure student engagement and progress, students will receive a certificate endorsed by the Head of Department (HoD).

3. The study of the **HUM117: Pakistan Studies 2(2, 0)** non-credit course is a mandatory component of the curriculum for all undergraduate degree programs. This course will be conducted using a hybrid mode of instruction across the CUI System and all undergraduate students will have to successfully pass the course.

Framework of BS Civil Engineering Program

Duration: 4 years

Number of semesters: 8

Number of weeks per semester: 16 - 18 (16 for teaching and 2 for examinations)

Total number of credit hours: 135-136

Engineering Courses: 69.40-69.63%

Non-Engineering Courses: 30.37-30.60%

Summary				
Domain	**Knowledge Area**	**Total Courses**	**Total Credits**	**% Overall**
Non-Engineering	Humanities	7	16	30.37-30.60
	Management Sciences	2	4	
	Basic Computing	1	3	
	Natural Sciences	6	18	
	Sub Total	**16**	**41**	
Engineering	Advanced Computing	**2**	**6**	69.40-69.63
	Engineering Foundation	**15**	**24**	
	Major Based Core (Breadth)	**13**	**22**	
	Major Based Core (Depth)	**13**	**22**	
	Multi-Disciplinary Engineering Courses	**5**	**7**	
	Engineering Electives	**3-4**	**7-8**	
	Final Year Design Project	**2**	**6**	
	Internship	**1**	**0**	
	Community Service	**1**	**0**	
	Survey Camp	**1**	**0**	
	Sub Total	**56-57**	**94-95**	
	Grand Total	**72-73**	**135-136**	

General Education / Non-Engineering Domain						
Knowledge Profile (WK1-WK9)	**Knowledge Area**	**Sub Area**	**Course Title**	**Credit Hours**	**Total Credits**	**% Overall**
WK-1/ WK-5/ WK-7/ WK-9	Humanities	English	Functional English	3 (3, 0)	16	11.85-11.94
			Expository Writing	3 (3, 0)		
		Culture	Ideology and Constitution of Pakistan	2(2, 0)		
			Islamic Studies*	2(2, 0)		
			21st Century Communication Skills	2(2, 0)		
		Social Sciences	Engineering Economics	2(2, 0)		
			Civics and Community Engagement	2(2, 0)		
	Management Sciences	Professional Practice	Project Planning and Management	2(2, 0)	4	2.96-2.99
			Introduction to Entrepreneurship	2(2, 0)		
	Computer Sciences	Basic Computing	Applications of Information and Communication Technologies	3 (2, 1)	3	2.22-2.24
WK-1 WK-2	Natural sciences	Mathematics	Quantitative Reasoning-I	3 (3, 0)	15	11.11-11.19
			Quantitative Reasoning-II	3 (3, 0)		
			Advanced Calculus	3 (3, 0)		
			Applied Mathematics	3 (3, 0)		
			Numerical Computations	3(2, 1)		
		Physics	Applied Physics	3(2, 1)	3	2.22-2.24
Total (General Education / Non-Engineering Domain)					**41**	**30.37-30.60**

*Non-Muslim students can opt for HUM116 Ethics 2(2, 0) course in lieu of HUM112 Islamic Studies if they intend to.

Engineering Domain						
Knowledge Profile (WK1-WK9)	**Knowledge Area**	**Sub Area**	**Course Title**	**Credit Hours**	**Total Credits**	**% Overall**
WK-2/ WK-4/ WK-5	Advanced Computer and Information Sciences	ICT/AF Data Science/ Cyber Security	Introduction to Computer Programming	3(2, 1)	6	4.44-4.48
			Civil Engineering Construction and Graphics	1(1, 0)		
			Civil Engineering Construction and Graphics Lab	2(0, 2)		
WK-3/ WK-2	Engineering Foundation Courses		Civil Engineering Materials	2(2, 0)	24	17.78-17.91
			Civil Engineering Materials Lab	1(0, 1)		
			Civil Engineering Drawing	1(1, 0)		
			Civil Engineering Drawing Lab	2(0, 2)		
			Engineering Surveying	2(2, 0)		
			Engineering Surveying Lab	1(0, 1)		
			Mechanics of Solids I	2(2, 0)		
			Mechanics of Solids I Lab	1(0, 1)		
			Structural Analysis I	3(3, 0)		
			Soil Mechanics	2(2, 0)		
			Soil Mechanics Lab	1(0, 1)		
			Elementary Fluid Mechanics	2(2, 0)		
			Elementary Fluid Mechanics Lab	1(0, 1)		
			Engineering Mechanics	2(2, 0)		

			Engineering Mechanics Lab	1(0, 1)		
WK-4/ WK-2/WK-1	Engineering Breadth Courses		Advanced Surveying	2(2, 0)	22	16.30-16.42
			Advanced Surveying Lab	1(0, 1)		
			Advanced Fluid Mechanics	2(2, 0)		
			Advanced Fluid Mechanics Lab	1(0, 1)		
			Reinforced Concrete Design I	3(3, 0)		
			Reinforced Concrete Design I Lab	1(0, 1)		
			Environmental Engineering	2(2, 0)		
			Environmental Engineering Lab	1(0, 1)		
			Structural Analysis II	3(3, 0)		
			Quantity Surveying and Cost Estimation	2(2, 0)		
			Quantity Surveying and Cost Estimation Lab	1(0, 1)		
			Engineering Hydrology Lab	2(2, 0)		
			Engineering Hydrology	1(0, 1)		
WK-5/ WK-6	Major Based Courses		Reinforced Concrete Design II	3(3, 0)	22	16.30-16.42
			Reinforced Concrete Design II Lab	1(0, 1)		
			Mechanics of Solids II	2(2, 0)		
			Mechanics of Solids II Lab	1(0, 1)		
			Geotechnical Engineering	3(3, 0)		

			Geotechnical Engineering Lab	1(0, 1)		
			Foundation Engineering	2(2, 0)		
			Pavement Analysis & Design	2(2, 0)		
			Pavement Analysis & Design Lab	1(0, 1)		
			Hydraulics Engineering	2(2, 0)		
			Hydraulics Engineering Lab	1(0, 1)		
			Irrigation Engineering Lab	2(2, 0)		
			Irrigation Engineering	1(0, 1)		
WK-1/ WK-2/ WK-3/ WK-4/ WK-7/ WK-9	Multi-Disciplinary Engineering/ Speciality Courses		Engineering Geology	2(2, 0)	7	5.19-5.22
			Introduction to Architecture and Town Planning	2(2, 0)		
			Modelling and Simulation in Civil Engineering	1(1, 0)		
			Modelling and Simulation in Civil Engineering Lab	1(0, 1)		
			Occupational Health and Safety	1(1, 0)		
			Community Service*	-		
			Survey Camp*	-		
	Flexible Engineering/Non-Engineering Courses		Engineering Elective I	2(2, 0)/ 2(1, 1)/ 3(3, 0)/ 3(2, 1)/	7-8	5.11-5.88
			Engineering Elective II			
			Engineering Elective III			
WK-4/ WK-5/ WK-6/ WK-7/ WK-8/ WK-9	Final Year Design Project (FYDP)		FYDP-Part I	3(0, 3)	6	4.38-4.41
			FYDP-Part II	3(0, 3)		
WK-6/ WK-7/ WK-9	Industrial Training	6-8 weeks Industrial Training (Qualifying & Mandatory) *		-		

Total (Engineering Domain)	**94-95**	69.40-69.63
Total (Credit Hrs.)	**135-136**	

*Non-Credit Courses

Bachelor of Science in Civil Engineering

Tentative Plan of Studies

The course offered in each semester as given below is not fixed. It may vary depending on the faculty availability and student needs.

Semester 1

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CEE104	Civil Engineering Materials	2	0	2	
2	CEE108	Civil Engineering Materials Lab	0	1	1	
3	HUM104	Functional English	3	0	3	
4	HUM112	Islamic Studies*	2	0	2	
5	MTH115	Quantitative Reasoning-I	3	0	3	
6	CEE102	Civil Engineering Drawing	1	0	2	
7	CEE102	Civil Engineering Drawing Lab	0	2	1	
8	HUM	Arts & Humanities Elective (21st Century Communication Skills)	2	0	2	
		Total	**13**	**3**	**16**	

Semester 2

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CSC101	Applications of Information and Communication Technologies	2	1	3	
2	CEE101	Engineering Mechanics	2	0	2	
3	CEE106	Engineering Mechanics Lab	0	1	1	
4	PHY124	Applied Physics	2	1	3	
5	CEE105	Engineering Geology	2	0	2	
6	HUM113	Ideology and Constitution of Pakistan	2	0	2	
7	MTH116	Quantitative Reasoning-II	3	0	3	MTH115
8	HUM208	Civics and Community Engagement	2	0	2	
		Total	**15**	**3**	**18**	

Semester 3

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CEE201	Engineering Surveying	2	0	2	
2	CEE212	Engineering Surveying Lab	0	1	1	
3	CEE202	Mechanics of Solids I	2	0	2	
4	CEE213	Mechanics of Solids I Lab	0	1	1	
5	CEE203	Elementary Fluid Mechanics	2	0	2	
6	CEE214	Elementary Fluid Mechanics Lab	0	1	1	
7	CEE204	Soil Mechanics	2	0	2	
8	CEE215	Soil Mechanics Lab	0	1	1	

9	CEE207	Structural Analysis-I	3	0	3	CEE101
10	MTH106	Advanced Calculus	3	0	3	
		Total	**14**	**4**	**18**	

Semester 4

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CSC142	Introduction to Computer Programming	2	1	3	
2	CEE206	Mechanics of Solids II	2	0	2	CEE202
3	CEE216	Mechanics of Solids II Lab	0	1	1	CEE202
4	CEE208	Advanced Fluid Mechanics	2	0	2	CEE203
5	CEE217	Advanced Fluid Mechanics Lab	0	1	1	CEE203
6	CEE211	Advanced Surveying	2	0	2	CEE201
7	CEE219	Advanced Surveying Lab	0	1	1	CEE201
8	MGT462	Project Planning and Management	2	0	2	
9	CEE302	Structural Analysis-II	3	0	3	CEE207
		Total	**13**	**4**	**17**	

Semester 5

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CEE307	Environmental Engineering	2	0	2	
2	CEE315	Environmental Engineering Lab	0	1	1	
3	CEE301	Major Elective I (Highway & Traffic Engineering)	2	0	2	
4	CEE308	Reinforced Concrete Design I	3	0	3	CEE206
5	CEE316	Reinforced Concrete Design I Lab	0	1	1	CEE206
6	CEE304	Quantity Surveying and Cost Estimation	2	0	2	
7	CEE319	Quantity Surveying and Cost Estimation Lab	0	1	1	
8	HUM120	Expository Writing	3	0	3	
9	MTH212	Applied Mathematics	3	0	3	MTH106
		Total	**15**	**3**	**18**	

Semester 6

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CEE406	Reinforced Concrete Design II	3	0	3	CEE308
2	CEE430	Reinforced Concrete Design II Lab	0	1	1	CEE308
3	CEE425	Major Elective II (Geo Informatics)	1	0	1	
4	CEE431	Geo Informatics Lab	0	1	1	

5	CEE306	Engineering Hydrology	2	0	2	
6	CEE314	Engineering Hydrology Lab	0	1	1	
7	CEE209	Geotechnical Engineering	3	0	3	CEE204
8	CEE218	Geotechnical Engineering Lab	0	1	1	CEE204
9	CEE310	Civil Engineering Construction and Graphics	1	0	1	CEE102
10	CEE317	Civil Engineering Construction and Graphics Lab	0	2	2	CEE102
11	CEE313	Modelling and Simulation in Civil Engineering	1	0	1	
12	CEE318	Modelling and Simulation in Civil Engineering Lab	0	1	1	
		Total	**11**	**7**	**18**	

Semester 7

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	MTH375	Numerical Computations	2	1	3	CSC142, MTH212
2	CEE404	Hydraulics Engineering	2	0	2	CEE208
3	CEE404	Hydraulics Engineering Lab	0	1	1	CEE208
4	CEE426	Foundation Engineering	2	0	2	CEE204
5	ECO300	Social Science Elective (Engineering Economics)	2	0	2	
6	CEE309	Introduction to Architecture and Town Planning	2	0	2	
7	EGG498	Final Year Design Project (Part-I)	0	3	3	
		Total	**10**	**5**	**15**	

Semester 8

S. No.	Course Code	Course Title	Credit Hours		Total Cr. Hrs.	Prerequisite
			Theory	Lab		
1	CEE428	Irrigation Engineering	2	0	2	CEE208
2	CEE433	Irrigation Engineering Lab	0	1	1	CEE208
3	CEE402	Major Elective III (Steel Structures)	3	0	3	
4	MGT250	Introduction to Entrepreneurship	2	0	2	
5	CEE427	Pavement Analysis & Design	2	0	2	
6	CEE432	Pavement Analysis & Design Lab	0	1	1	
7	CEE100	Occupational Health and Safety	1	0	1	
8	EGG499	Final Year Design Project (Part-II)	0	3	3	EGG498
		Total	**10**	**5**	**15**	

		Course Title	Credit Hours		Prerequisite

S. No.	Course Code		Theory	Lab	Total Cr. Hrs.	
1	CEE300	Survey Camp	-	-	0(0, 0)	
2	CEE200	Community Service	-	-	0(0, 0)	
3	EGG497	Internship	-	-	0(0, 0)	

Course Contents

Course Code: **CEE100**
Course Title: **Occupational Health and Safety**
Credit Hours: **1(1, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

In this course students will acquire knowledge of safe work practices applicable to office, industry, and construction settings. Additionally, they will learn how to identify, prevent, and address issues related to occupational safety and health, not only within professional environments but also in domestic settings.

Course Outline:

1. **Health and Safety Foundations**
   - Nature and scope of health and safety
   - Reasons/benefits and barriers for good practices of health and safety
   - Legal framework and OHS Management System
   - Fostering a Safety Culture
   - Four principles of safety- RAMP (Recognize, Assess, Minimize, Prepare)
   - Re-thinking safety-learning from incidents
   - Safety ethics and rules
   - Roles and responsibilities towards safety
   - Building positive attitude towards safety
   - Safety cultures in academic institutions

2. **Recognizing and Communicating Hazards**
   - Hazards and Risk
   - Types of hazards: Physical (mechanical and non-mechanical), Chemical (Toxic and biological agents), electrical, fire, construction, heat and Temperature, noise and vibration, falling and lifting etc.
   - Learning the language of safety: Signs, symbols and labels
   - Finding hazard information material safety data sheets
   - Safety data sheets and the GHS (Globally Harmonized Systems)

3. **Accidents & Their Effect on Industry**
   - Costs of accidents
   - Time lost.
   - Work injuries, parts of the body injured on the job
   - Chemical burn injuries

- Construction injuries
- Fire injuries

4. **Assessing and Minimizing the Risks from Hazards**
   - Risk Concept and Terminology
   - Risk assessment procedure
   - Risk Metric's
   - Risk Estimation and Acceptability Criteria
   - Principles of risk prevention
   - Selection and implementation of appropriate Risk controls
   - Hierarchy of controls
   - Preparing for Emergency Response Procedures
   - Fire
   - Chemical Spill
   - First Aid
   - Safety Drills / Trainings:
   - Firefighting
   - Evacuation in case of emergency

5. **Stress and Safety at Work Environment**
   - Workplace stress and sources
   - Human reaction to workplace stress
   - Measurement of workplace stress
   - Shift work, stress and safety
   - Improving safety by reducing stress
   - Stress in safety managers
   - Stress and workers compensation
   - Incident Investigation
   - Importance of investigation
   - Recording and reporting
   - Techniques of investigation
   - Monitoring
   - Review
   - Auditing Health and Safety

Recommended Books:

Textbook:	1. The A-Z of Health and Safety by Jeremy Stranks, 2006.
Reference Books:	1. The Manager's Guide to Health & Safety at Work by Jeremy Stranks, 8th edition, 2006. 2. Occupational Safety and Health Law Handbook by Ogletree, Deakins, Nash, Smoak and Stewarts, second edition, 2008

Course Code: **CEE101**
Course Title: **Engineering Mechanics**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course is setup to introduce students with basic concepts of Engineering mechanics based on equilibrium, principles and application of forces, calculation of resultants, geometrical properties related to different shapes and their application in Civil Engineering. Further to this an introduction to simple dynamics is given to the students.

Course Outline:

1. **Basic Concepts**
   - Concepts of space, time, mass, velocity, acceleration and force
   - Scalar and vector quantities
   - Newton's law of motion
   - Law of gravitation

2. **System of Forces**
   - Resultant and resolution of co-planer forces using parallelogram, triangle &
   - Polygon law and funicular polygon
   - Simple cases of resultant and resolution of forces in space
   - Conditions of equilibrium of co-planar forces, analytical and graphical
   - Formulations

3. **Equilibrium of Rigid Bodies**
   - 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
   - Degree of restraint and static determinacy
   - Statically determinate problems especially of civil engineering importance,
   - Equilibrium of two-force and three-force bodies

4. **Kinematics**
   - Work, energy and power
   - Virtual work formulation of equilibrium of coplanar force
   - Potential energy, energy criterion for equilibrium, stability of equilibrium,
   - application to simple cases

5. **Rigid Bodies**
   - Geometrical properties of plane areas
   - First moment of area, centroid, second moment of area, principal axes, polar

- Second moment of area and radius of gyration

6. Friction

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

7. 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.

Recommended Books:

Textbook:	2. Engineering Mechanics – Statics and Dynamics by R.C.Hibbeler (Latest Edition).
Reference Books:	3. Engineering Mechanics – Statics and Dynamics by R.C.Hibbeler. 4. Engineering Mechanics – Statics and Dynamics by J.L.Meriam & L.G. Kraige. 5. Vector Mechanics for Engineers – Statics by Ferdinand P. Beer and E. Russell Johnston Jr.

Course Code: **CEE102**
Course Title: **Civil Engineering Drawing**
Credit Hours: **1(1, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of basic drawing concepts as well as simple architectural and civil engineering drawings. The course will provide detailed guidance on the manual drawing concepts keeping in mind the load bearing masonry structures. Emphasis will be placed on developing the drawing skills of the students.

Course Outline:

1. **Introduction to Engineering Drawing and Types of Civil Engineering Drawings**
   - Drawing, sketch, painting and map
   - Drawing instruments and their use
   - Type of drawing lines and appropriate uses
   - General rules for drawing lines
   - Gothic lettering
   - Dimensioning
   - Planning of a drawing sheet
   - Drawing types with respect to technicality (Survey plan, contour plan, geotechnical plan, infrastructures drawing, architectural drawing, structural drawing, plumbing drawing, electrical drawing)
   - Drawing types with respect to project execution (Proposals/PC-1 drawing, Submission /Tender drawing, Working /Construction drawing, Completion /As-built drawing.

2. **Conceptual Drawings and Projection system**
   - Conceptual drawing
   - Projection system and its variables
   - Classification of projections
   - Perspective and parallel projections
   - Oblique projection
   - Axonometric projection (isometric projection)
   - Orthographic projections (First-angle and third-angle projection) and their comparison
   - Importance of line types and rules
   - Glass box concept and six principal views
   - Comparison between isometric and orthographic views
   - Sections, Details behind the cutting plane, Parts not sectioned
   - Scaling

3. **Architectural Plan, Elevation and Section of a Simple Building (House)**
   - Architectural views (Plan, elevation and section) of a simple building

- General terminologies and symbols including schedule of opening
- Architectural design of a house
- Seismic requirement for architectural design
- General notes

4. Structural Details of a Simple Building (House)

- Foundation plan
- Plinth plan
- Lintel plan
- Slab plan
- Cross-sectional details of foundation, columns, vertical stiffeners, plinth band, lintel band, lintels, beams and slabs
- General notes

5. Architectural and Structural Details of Boundary Wall and Staircase (House)

- Plan, elevation and section of a boundary wall
- Structural design considerations
- Simple staircase and its components terminology
- Architectural details of a simple stair
- Types of stairs

6. Plumbing, sanitation, and Roof Drainage Plan of a Simple Building (House)

- Typical water supply system
- Water and waste water removal system
- Roof drainage slopes
- Standard Plumbing symbols
- General notes

7. Electrical Drawings of a Simple Buildings (House)

- Typical layout of electrification
- Symbols used for electrical layout
- General notes

Recommended Books:

Text Books

1. Basics of Engineering Drawing by Dr. Zahid Ahmed Siddiqi, 2016

Reference Books

1. Horchsel R. P; Engineering Drawing and Geometry, John Willy & Sons, 2nd Edition, 2002.
2. Jensen C.H and Mason F. H. S “Drafting Fundamentals”, McGraw Hill,
3. 5th Edition.
4. N. D. Bhatt; Engineering Drawing, 50th Edition (2010), Charotar Book Stall
5. Parkinson, A. C. A First Year Engineering Drawing. English language Book Society. Reprint 1964.

Course Code: **CEE104**
Course Title: **Civil Engineering Materials**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of materials commonly employed in civil engineering and construction (steel, aggregates, Portland cement, concrete, masonry, asphalt and asphalt mixtures, wood, Ceramics, and composites) including their methods of manufacture, evaluation of their physical and mechanical properties, and life-cycle impact. The course will provide detailed guidance on material preparation (e.g. material manufacture and concrete and asphalt mix design) and material testing that are commonly employed in the construction and civil engineering disciplines. Emphasis will be placed on selection criteria, design, applications and proper use of these materials.

Course Outline:

1. **Materials and their Properties**
   - Introduction of materials
   - Construction materials
   - Physical, mechanical, and chemical properties
   - Electrical and thermal properties

2. **Binding Materials (Cement and Lime)**
   - Introduction and manufacture of Ordinary Portland Cement
   - Constituents of cement
   - Types of cement and their use
   - Properties and field tests of cement
   - Special cements
   - Introduction and preparation of lime
   - Setting and hardening of lime
   - Applications of lime
   - Comparison (cost and characteristics) of lime and cement

3. **Fine & Coarse Aggregates and Stones**
   - Definition and introduction of aggregates
   - Mechanical and physical properties of aggregates
   - Importance and methods of grading of aggregates
   - Introduction, types, applications, characteristics of good building stones
   - Artificial stones

4. **Cementitious materials**
   - Introduction and methods of preparation of paste

- Properties and application of paste
- Introduction and methods of preparation of mortars
- Properties and application of mortars
- Introduction about concrete
- Components and manufacture of concrete, properties of concrete
- Types of concrete

5. Metals (Steel and Aluminum)

- Introduction to steel
- Mechanical and physical properties of steel
- Application of steel in civil engineering projects
- Introduction to aluminum
- Mechanical and physical properties of aluminum
- Application of aluminum in civil engineering projects

6. Ceramics, Bricks and Blocks

- History and evolution of ceramics
- Manufacture of ceramics
- Properties and applications of ceramics in buildings
- History and evolution of bricks
- Properties and applications of bricks
- Dimensions, manufacture and classification of bricks
- History and evolution of blocks
- Properties and applications of blocks
- Dimensions, manufacture and classification of blocks

7. Glass and Wood

- Constituents of glass and methods of manufacture.
- Types, use and significance of glass in civil engineering
- Advantages and drawbacks of glass
- Structure of tree and general characteristics
- Types, seasoning and preservation of wood
- Lamination of wood

8. Pavement Materials

- Bitumen
- Asphalt
- Road Metals

9. Miscellaneous Construction Materials

- Asbestos, Plaster of Paris, Abrasives
- Rubber, Cork, Plastics
- Paint
- Thermometry and acoustics

- Bamboo
- Natural, artificial, and steel fibers
- Modern Materials (Fiber reinforced polymer etc.)

Recommended Books:

Text Books	1. Edward Allen, Joseph Iano, (2019), Fundamental of Building Construction Materials and Methods, 7th Edition (or latest), John Wiley & Sons. NY. 2. Eva Kultermann and William P. Spence, Construction, Materials, Methods, and Techniques, Building for a sustainable future (2022), 5th Edition (or latest), Cengage Learning, Inc. 3. William F., Smith, (2009), Foundation of Materials Science & Engineering, 5th Edition (or latest), McGraw Hill.
Reference Books	1. Duggal, S. K, (2010), Building Materials, New Age International. 2. David R. H. Jones and Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design (2019), 5th Edition (or latest), Butterworth-Heinemann publishing.

Course Code: **CEE105**
Course Title: **Engineering Geology**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course introduces students to various branches of geology, including the constituents of the Earth, rock formation, rock weathering, volcanic eruptions, landslides, and earthquakes. It covers fundamental concepts of general geology and hydrogeology, illustrating their practical applications in the construction of underground tunnels, and other infrastructure projects.

Course Outline:

1. **General geology**
   - The earth as planet and process of external origin
   - Weathering and erosion
   - Transportation, and deposition, of rock material by geological agents
   - Processes of internal origin volcanism, earthquakes, intrusion and metamorphism
   - Rock cycle, diastrophism, and isostasy.

2. **Elements of structural geology**
   - Folds and faults, joints, fractures, and cleavages
   - Unconformities, primary and secondary structural features of rock
   - Expression of geological features on geological field maps
   - Construction of cross sections and geological mapping.

3. **Minerals and rocks**
   - Important minerals and rocks, and their identification
   - Igneous, sedimentary and metamorphic rocks
   - Basic principles of stratigraphy and Geologic time scale
   - Brief introduction of local geology from boring logs.

4. **Applied geology**
   - Application of geology to planning and design of various civil engineering infrastructure like dams, reservoirs, bridges, application of geology to building materials and soils

5. **Earthquakes**
   - Theory of plate-tectonics, seismic waves, seismology
   - Prediction of earthquakes and preventive measures against earthquakes
   - Ground subsidence
   - Earthquake zoning of Pakistan

6. Stability of rock slopes

- Various types of rock failures and factors affecting the stability of rock slopes
- Analysis, and calculation of factor of safety
- Types of land sliding: slump, rockslides and rock falls
- Causes of landslides and remedial measures.

7. Hydrogeology

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

8. Tunnelling

- Introduction to tunnels
- Types of tunnels
- Tunnel construction methods in rocks
- Geological survey prior to tunnelling
- Lining of tunnels and its sections.

Recommended Books:

Text Books

1. A Geology for Engineers 7th Edition by F.G.H. Blyth and M.H. de Freitas
2. A Text Book of Geology by K.M. Bangar

Reference Books

1. Banger, K. M. (1988), A Textbook of General AND Engineering Geology, Latest Edition.
2. N.T Price, N. T. & Cosgrove, I. W. (1990), Analysis of Geological Structures, Latest Edition.
3. Steven L. Kramer, (2010), Analysis of Geological Structures, Latest Edition
4. Blyth, F. G. H. (2003), A Geology for Engineers, Latest Edition, Arnold International.
5. Legget, R. F. (2010), Geology and Engineering, Latest Edition, McGraw Hill International
6. Richard and Busch (2019), Laboratory Manual in Physical Geology 9th Edition (or latest), American Geological Institute.
7. Frederick K. Lurgens (2016), Earth: An Introduction to Physical Geology, 12th Edition (or latest), Pearson Publishers.

Course Code: **CEE106**

Course Title: **Engineering Mechanics Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

This course is setup to introduce students with basic concepts of Engineering mechanics based on equilibrium, principles and application of forces, calculation of resultants, geometrical properties related to different shapes and their application in Civil Engineering. Further to this an introduction to simple dynamics is given to the students.

List of Experiments:

1. To verify the principle of moments Theorem.
2. To verify the equilibrium of coplanar forces by drawing a polygon of forces.
3. To determine the force acting in the tension member of a simple jib crane.
4. To find the tension in various parts of hanging rope loaded at One point & to compare the theoretical and experimental results.
5. To find the tension in various parts of hanging rope loaded at Two points & to compare the theoretical and experimental results.
6. To determine the reaction of a beam under One Point loading.
7. To determine the reaction of a beam under Two Point loadings.
8. To determine the reaction of a beam under Three Point loadings.
9. To verify the laws of friction between solid bodies and to find the coefficient of friction between wood and various other materials.
10. To find the center of gravity of different shapes.
11. Open ended lab.

Recommended Books:

Textbook:
1. Engineering Mechanics – Statics and Dynamics by R.C.Hibbeler (Latest Edition).

Reference Books:
1. Engineering Mechanics – Statics and Dynamics by R.C.Hibbeler.
2. Engineering Mechanics – Statics and Dynamics by J.L.Meriam & L.G. Kraige.
3. Vector Mechanics for Engineers – Statics by Ferdinand P. Beer and E. Russell Johnston Jr.

Course Code: **CEE107**

Course Title: **Civil Engineering Drawing Lab**

Credit Hours: **2(0, 2)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of basic drawing concepts as well as simple architectural and civil engineering drawings. The course will provide detailed guidance on the manual drawing concepts keeping in mind the load bearing masonry structures. Emphasis will be placed on developing the drawing skills of the students.

List of Experiments:

1. Border line / margin, title box, gothic lettering
2. Simple geometry, isometric views,
3. Orthographic views first angle of projection method and sections.
4. Orthographic views third angle of projection method and sections.
5. Plan, section and elevation of different components (doors, windows, ventilators) of building (house)
6. Architectural plan and elevation a simple building (house).
7. Cross sectional details of architectural plan a simple building (house).
8. Structural details of a simple building (house).
9. Architectural and structural details of a boundary wall.
10. Architectural and structural details of stair case in a house.
11. Plumbing, sanitation, and roof drainage plan of a simple building (house).
12. Electrical drawings of a simple building (house).
13. Open ended lab

Recommended Books:

Text Books

1. Basics of Engineering Drawing by Dr. Zahid Ahmed Siddiqi, 2016

Reference Books

1. Horchsel R. P; Engineering Drawing and Geometry, John Willy & Sons, 2nd Edition, 2002.
2. Jensen C.H and Mason F. H. S “Drafting Fundamentals”, McGraw Hill,
3. 5th Edition.
4. N. D. Bhatt; Engineering Drawing, 50th Edition (2010), Charotar Book Stall
5. Parkinson, A. C. A First Year Engineering Drawing. English language Book Society. Reprint 1964.

Course Code: **CEE108**
Course Title: **Civil Engineering Materials Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **Nil**

Course Objectives:

The practical component includes hands-on activities such as to determine the consistency, initial and final setting time of cement, sieve analysis of coarse and fine aggregates, compressive strength of mortar and bricks, and flexural strength of wood.

List of Experiments:

1. To determine the normal consistency of cement.
2. To determine the initial and final setting time of various samples of cement and then to discuss the results.
3. To determine the soundness of cement by Le-Chatelier apparatus.
4. To determine fineness modulus of coarse aggregate.
5. To carry out sieve analysis of various samples of coarse aggregates, draw gradation curves for those and to discuss its effects on the properties of concrete.
6. To determine fineness modulus of fine aggregate.
7. To carry out sieve analysis of various samples of fine aggregates, draw gradation curves for those and to discuss its effects on the properties of concrete.
8. To determine the compressive strength of mortar with various mix ratios.
9. To determine water absorption of bricks and to discuss the results.
10. To determine compressive strength of bricks and to discuss the results.
11. To determine the compressive strength of wood by compressive testing machine.
12. To determine flexural strength of provided samples of timber.
13. Open ended lab

Recommended Books:

Text Books

1. Edward Allen, Joseph Iano, (2019), Fundamental of Building Construction Materials and Methods, 7th Edition (or latest), John Wiley & Sons. NY.

2. Eva Kultermann and William P. Spence, Construction, Materials, Methods, and Techniques, Building for a sustainable future (2022), 5th Edition (or latest), Cengage Learning, Inc.
3. William F., Smith, (2009), Foundation of Materials Science & Engineering, 5th Edition (or latest), McGraw Hill.

Reference Books

1. Duggal, S. K, (2010), Building Materials, New Age International.
2. David R. H. Jones and Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design (2019), 5th Edition (or latest), Butterworth-Heinemann publishing.

Course Code: **CEE201**

Course Title: **Engineering Surveying**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

The main purpose of the course is to enable students to understand theory and practice of land surveying. This course is also aimed to enable students in reading and preparing surveying maps and to develop their skills to use modern survey instruments.

Course Outline:

1. **Introduction**
   - Introduction to land surveying, Definitions of basic surveying terms branches and their application, Instruments used

2. **Survey Techniques**
   - Distance measurement techniques, Compass survey, and Theodolite survey

3. **Traversing and triangulation**
   - Method of Running Traverses with Theodolite, Traverse computations, Transformation of Coordinates, Omitted Measurements, Triangulation, Classification of triangulation systems

4. **Leveling and Contouring**
   - Methods and types of levels, precise leveling, Tachometry and trigonometrical levelling, Methods and applications of contouring

5. **Computations and Plotting**
   - Maps and plans, plotting, contour maps, profiles, cross-sections, prismoidal formula, Computation of areas and volumes by various methods, Computations of area and volumes by graphical analysis and use of surveying software

Recommended Books:

Text Book

1. Surveying and Leveling by "T.P Kanetkar & S.V. Kulkarni" Part I and II

Reference Books

1. Surveying Theory and Practice, R.E. Davis, 7th Edition
2. Wolf P. R. & Ghilani C. D., (2004), Elementary Surveying – An introduction to Geomatics, 11th Edition, Prentice Hall, USA.
3. Thomas, M. Lillesand & Ralph W. Kiefer, (2005), Remote Sensing and Images Interpretation, 5th edition, John Wiley & Sons, Inc.
4. Kavanagh Barry, (2010), Surveying with Construction Applications, 7th Edition, Pearsons Education.

Course Code: **CEE202**
Course Title: **Mechanics of Solids I**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course equips students with fundamental knowledge of strength of materials, enhancing their skills in selecting appropriate materials for Civil Engineering applications. The theoretical component covers topics such as uniaxial stress and strain, relationships between elastic constants, material response under different loading conditions, bending theory, deflections of beams, torsion, and stress and strain transformations.

Course Outline:

1. **Stress, Strain and Mechanical Properties of Materials**
   - Uniaxial state of stress and strain
   - Relationships between elastic Constants
   - Response of materials under different sets of monotonic loading (including impact)
   - Normal and shearing stress and strains
   - Distribution of direct stresses on uniform and non-uniform members
   - Thermal stresses and strains

2. **Bending Theory**
   - Shear Force and Bending Moment Diagrams
   - Relationship between load, shear force and bending moment
   - Theory of bending
   - Moment of resistance and section modulus
   - Bending and shearing stress distribution in beams
   - Stresses in composite sections

3. **Deflections of Beams**
   - Curvature, slope and deflection of beams using integration methods

4. **Theory of Torsion**
   - Theory of torsion of solids and hollow circular shafts
   - Shearing stress distribution, angle of twist, strength and stiffness of shaft

5. **Stress and Strain Transformations**
   - Biaxial state of stresses
   - Resolution of stresses
   - Principal plane, principal stresses and strains,
   - Graphical representation of stress and strains, Mohr's circle of stresses and strains

Recommended Books:

Text Books	1. Strength of Materials by Pytel. A & F.L.Singer, Harper & Row Publishers, New York. 2. Hibbler, R. C., Mechanics of Materials, Prentice Hall, 10th Edition
Reference Books	1. Engineering Mechanics of Solids by E.P. Popov and T.A. Balan 2. Mechanics of Materials by J.M. Gere and B.J. Goodno 3. Mechanics of Solids and Strength of Materials by WarnocK and Benham.

Course Code: **CEE203**

Course Title: **Elementary Fluid Mechanics**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will enable students to learn basics of fluid mechanics for civil engineering applications including properties of fluids, fluid statics, forces on immersed bodies, fluid kinematics, hydrodynamics, flow measuring devices in pipes and open channels. An introduction will be given to the basic principles of fluid mechanics in stationary fluids and in motion.

Course Outline:

1. **Introduction**
   - Solids and fluids (liquids and gases) Units and dimensions
   - Physical properties of fluids; density, specific weight, specific volume, specific gravity, surface tension, compressibility
   - Viscosity and its measurement Newton's equation of viscosity, Hydrostatics
   - Kinematics Hydrodynamics Hydraulics

2. **Fluid Statics**
   - Pressure intensity and pressure head, Pressure and specific weight relationship, Absolute and gauge pressure Measurement of pressure
   - Piezometer, manometer, Pressure transducers
   - Differential manometer and Borden gauge

3. **Forces on Immersed Bodies**
   - Forces on submerged planes & curved surfaces and their applications
   - Buoyancy and floatation
   - Equilibrium of floating and submerged bodies

4. **Fluid Kinematics**
   - Steady and unsteady flow
   - Laminar and turbulent flow
   - Uniform and non-uniform flow
   - Path lines, streamlines and stream tubes
   - Velocity and discharge
   - Control volume
   - Equation of continuity for compressible and incompressible fluids

5. **Hydrodynamics**
   - Different forms of energy in a flowing liquid
   - Bernoulli's equation and its application

- Energy line and Hydraulic Gradient Line
- Introduction to density currents, free and forced vortex

6. Flow Measurement

- Orifices and mouthpieces, sharp-crested weirs and notches, Pitot tube and pitot static tube
- Venturimeter, orificemeter

7. Dimensional Analysis and Similitude

- Geometric, kinematic and dynamic similarities
- Different dimensionless numbers and their significance
- Method of dimensions;Buckingham Pi theorem

Recommended Books:

Textbook:	1. Fluid Mechanics with Engineering Applications by Franzini, J.B., Daugherty and Finnemore E.J., McGraw Hill. 10th Edition
Reference Books:	1. Fundamentals of Fluid Mechanics by Munson, B.R., Young, D.F. and Okiishi, T.H., John Wiley & Sons. 6th Edition 2. Fluid Mechanics by Frank M. White 7th edition

Course Code: **CEE204**
Course Title: **Soil Mechanics**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course offers a detailed insight into fundamental engineering concepts of soil behavior, emphasizing its physical and index properties. It covers basic geotechnical properties for soil classification using various systems. It also describes interaction between water and soil, and the in-situ stresses with the impact of static and flowing water. Additionally, the course analysis soil compaction mechanisms, and consolidation process. The course also provides practical methods for quantifying the related parameters.

Course Outline:

1. **Introduction**
   - Introduction to soil mechanics and geotechnical engineering
   - Significance of geotechnical engineering
   - Soil formation, transportation, sorting, and deposition
   - Types of soil deposits and their properties
   - Soil types, soil structure and clay minerals.

2. **Index and Physical Properties**
   - Basic physical and index properties of soil
   - Water content, void ratio, porosity, degree of saturation, air voids, unit weights, specific gravity etc.
   - Phase relationships, and numerical examples
   - Particle size and shapes, sieve Analysis, hydrometer Analysis.
   - Consistency and various states of fine-grained soils
   - Atterberg's limits
   - Related numerical examples

3. **Soil Classification Systems**
   - Importance of soil classification
   - Grain size distribution, gradation curves and interpretation
   - Soil classification systems: Textural classification system, AASHTO soil classification system, Unified soil classification system, and description of their subgroups.
   - Related numerical examples.

4. **Permeability and Seepage**
   - Permeability and Seepage
   - Darcy's law

- Factors affecting permeability.
- Laboratory and filed determination of permeability.
- Capillary action and its effects in soils
- Seepage force
- Introduction to flow net
- Quicksand condition and sand boiling
- Related numerical examples.

5. In-Situ Stresses

- Stress condition in soil: effective and neutral stresses, stresses in saturated soils with upward and downward seepages

6. Stress Distribution in Soils

- Geo-static stresses
- Total stress, effective stress, and pore water pressure
- Vertical stresses induced due to structural loads
- Approximate methods.
- Westergaard and Boussinesq's theories
- Pressure bulb and stress isobars
- Stress distribution diagrams on horizontal and vertical planes
- Stress at a point outside the loaded area
- Newmark's influence charts
- Related numerical problems

7. Compaction of Soils

- Compaction of soils
- Fundamentals of compaction
- Standard and modified Proctor compaction tests
- Moisture density relationship
- Compaction standards
- Factor effecting compaction.
- Field control and measurement of in situ density and field compaction.
- Numerical examples and assignments.

Recommended Books:

Textbook:

1. Baraja M. Das (2020), Principles of Geotechnical Engineering, 10th Ed, Cengage Learning, Inc. USA.

Reference Books:

1. Braja M. Das, (2020), Advanced Soil Mechanics, 5th Ed, CRC Press, 734 pp.
2. Craig, R. F. (2019). Craig's Soil Mechanics, 9th Ed., CRC Press, 654 pp
3. Doland P. Coduto (1999), Geotechnical Engineering Principles and Practices, Prentice-Hall, Upper Saddle River, NJ 07 458.

4. Bowles J. E. (1984). Physical and Geotechnical properties of soils, 2nd Ed. McGraw-Hill, New York, 578 pp.
5. Holtz and Kovac (2012), An Introduction to Geotechnical Engineering, Latest Edition, Prentice Hall.

Course Code: **CEE206**
Course Title: **Mechanics of Solids II**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **CEE202**

Course Objectives:

The theoretical framework encompasses topics related to beam bending and shear, including unsymmetrical bending, shear flow, shear center, analysis of curved beams, and beams on elastic foundations. The course further explores the theory of elasticity, covering the analysis of stresses and strains under the combined effects of axial, bending, and twisting forces/moments. Additionally, the course delves into torsion of thin tubes and open sections, addressing non-circular shafts, membrane analogy, and torsion in thin tubes and open sections. Theoretical insights into plasticity, plastic hinges, shape factor, and collapse mechanisms are covered, along with energy methods and their general applications. The course concludes with discussions on stability, exploring struts and columns, Euler, Rankine, and other formulas for buckling loads of columns, and stability analysis of columns under eccentric loading. Fatigue considerations, encompassing cyclic loading, discontinuities, stress concentration, corrosion fatigue, low cyclic fatigue are also addressed.

Course Outline:

1. **Enhanced Topics Related to Beam Bending and Shear**
   - Unsymmetrical bending
   - Shear flow, shear center
   - Analysis of curved beams
   - Beams on elastic foundations

2. **Theory of Elasticity**
   - Analysis of stresses and strains due to combined effect of axial, bending and twisting forces/moments
   - Elementary theory of elasticity
   - Equilibrium and compatibility equations
   - Stress and deformation relationships
   - Stress transformation
   - Theories of failure

3. **Torsion of Thin Tubes and Open Sections**
   - Torsion of non-circular shafts
   - Membrane analogy
   - Torsion in thin tubes and open sections

4. **Cylinders**
   - Analysis of thin and thick cylinders

5. **Theory of Plasticity**
   - Elementary theory of plasticity
   - Plastic hinges
   - Shape factor
   - Collapse mechanism

6. **Energy Methods**
   - Energy methods-General area of application and its usefulness

7. **Stability**
   - Struts and columns
   - Euler, Rankine and other formulas for buckling load of columns
   - Stability analysis of columns under eccentric loading

8. **Fatigue**
   - Fatigue due to cyclic loading
   - Discontinuities and Stress Concentration
   - Corrosion Fatigue
   - Low Cyclic Fatigue
   - ε-N relations

Recommended Books:

Text Book	1. Arthur P. Boresi. & Richard J. Schmidt, Advanced Mechanics of Materials, John Wiley; 6th Edition (2002) 2. Pytel, A. & Ferdinand L. Singer, Strength of Material, Harper and Row Harper Collins College Div; 4th Sub Edition (1987) 3. Hibbler, R. C., Mechanics of Materials, Prentice Hall, 10th Edition
Reference Books	1. James M. Gere & Barry. J. Goodno, Mechanics of Materials, 8th Edition, CL Engineering 2. James M. Gere & Stephen P. Timoshenko, Mechanics of Materials, 4th Edition, 1997, PWS Pub Co. 3. Mechanics of Materials by Zahid Ahmed Siddiqi, 2015.

Course Code: **CEE207**
Course Title: **Structural Analysis-I**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **CEE101**

Course Objectives:

The purpose of this course is to provide a comprehensive understanding of structural analysis principles and their essential role in the design process. It starts with an introduction to structural analysis, covering various types of structures, structure idealization, and loading conditions, along with key concepts like redundancy and stability. The course then moves on to the analysis of determinate pin-jointed structures and rigid jointed plane frames, emphasizing joint and section analysis as well as graphical techniques for shear and moment. The curriculum further includes the analysis of structures under moving loads, focusing on the use of influence lines for reactions and member forces. Additionally, the course explores three-hinged arches and cables. Students will also learn different methods for determining deflections and rotations of determinate beams, plane frames, and trusses. Overall, this course will equip students with the analytical skills needed to evaluate determinate structural members in both static and dynamic conditions.

Course Outline:

1. **Introduction to Structural Analysis**
   - Types of structures
   - Structure idealization and loads
   - Redundancy and stability of structures

2. **Analysis of Determinate Pin-Jointed Structures**
   - The Method of Joints
   - The Methods of Sections
   - Truss Graphical Method

3. **Analysis of Statically Determinate Rigid Jointed Plane Frames**
   - Shear and Moment Functions
   - Axial force diagram
   - Shear force diagram
   - Bending moment diagram

4. **Moving Loads**
   - Influence Lines for Reactions in Determinate Beams
   - Influence Lines for Shear Force and Bending Moment in Statically Determinate Beams and Floor Girders
   - Influence Lines for Member Forces in Pin Jointed Structures
   - Calculation of Maximum Stress Function (Reaction, Shear, Bending Moment, Axial Force) using Influence Line Diagrams

5. Arches and Cables

- Cables
- Analysis of Cables Subjected to Concentrated and Uniformly Distributed Loads
- Arches
- Analysis of Three Hinged Arches

6. Deflections and Rotations of Statically Determinate Structures using energy and geometric methods

- Principle of Virtual Work for Beams, Frames and Trusses
- Castigliano's Theorem for Beams, Frames and Trusses
- Conjugate Beam Method
- Moment Area Theorems for Beams

Recommended Books:

Textbook:

1. R. C. Hibbler, Structural Analysis, Prentice Hall, 9th Edition (2016).

Reference Books:

1. Wang, C. K., (1984), Intermediate Structural Analysis, McGraw-Hill Education - Europe.
2. K. M. LEET & Chia-Ming Uang, Fundamentals Structural Analysis Prentice Hall, 7th Edition, 2009.
3. H. H. West, Fundamentals of Structural Analysis, John Willey-New York, 2nd Edition, 2002.
4. N.J. Alexender Chajes, Structural Analysis, Prentice Hall, 3rd Edition, 1995.W. J. Spencer, Fundamental Structural Analysis, Palgrave MacMillon, 1988 New York, Inc.

Course Code: **CEE208**

Course Title: **Advanced Fluid Mechanics**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **CEE203**

Course Objectives:

This course aims to provide Civil Engineering students with a comprehensive understanding of fluid mechanics principles and their applications in engineering. The course aims to equip students with the knowledge and skills necessary to analyze and solve fluid flow problems in various contexts, including pipe flow, open-channel flow, and flow around bodies. The course will also provide detailed guidance on the hydraulic working of various types of turbines and pumps.

Course Outline:

1. **Laminar Flow Through Pipes**
   - Incompressible, steady and uniform flow through circular pipes
   - Velocity and shear stress distribution
   - Head loss in laminar flow
   - Hagen-Poiseuille equation

2. **Turbulent Flow Through Pipes**
   - Turbulent flow
   - Darcy Weisbach equation
   - Velocity distribution in fully turbulent flow
   - Pipes in rough, transition and smooth zone;
   - Shear stresses in pipes
   - Turbulent fluctuating velocity components
   - Moody chart and Colebrook-White formula

3. **Steady, Incompressible Flow in Pipelines**
   - Steady flow in pipelines,
   - Pipes in series
   - Pipes in parallel
   - Pipe Network Analysis

4. **Steady, Uniform Open-Channel Flow**
   - Natural and artificial open channel
   - Chezy and Manning equations
   - Most efficient cross-section

5. **Incompressible flow around a body**
   - Laminar and turbulent boundary layer
   - Flow around a flat thin plate

- Drag and Lift forces

6. Impact of Jets

- Impulse momentum principle
- Force of jet on stationary flat and curved plates
- Force of jet on moving flat and curved plates
- Forces on plumbing fittings

7. Hydraulic Turbines

- Pelton wheel turbine, working principal, construction and regulation
- Francis turbine, working principal, construction

8. Pumps

- Centrifugal pump, construction features and applications
- Reciprocating pump, construction features and applications;
- Cavitation in Fluid Machines

9. Introduction to related software

- Introduction to software EPANet for pipe flow analysis
- Trbnpro software application

Recommended Books:

Textbook:	1. Fluid Mechanics with Engineering Applications by Franzini, J.B., Daugherty and Finnemore E.J., McGraw Hill. 10th Edition
Reference Books:	1. Fundamentals of Fluid Mechanics by Munson, B.R., Young, D.F. and Okiishi, T.H., John Wiley & Sons. 6th Edition 2. Fluid Mechanics by Frank M. White 7th edition

Course Code: **CEE209**

Course Title: **Geotechnical Engineering**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE204**

Course Objectives:

This course aims to provide students with a thorough comprehension of soil shear strength and its determination, calculation of lateral earth pressures, consolidation and settlement analysis in soils, slope stability analysis using diverse methods, an introduction to earth and rockfill dams, and various techniques for soil improvement.

Course Outline:

1. **Shear Strength**
   - Concept and parameters of shear strength of soils
   - Mohr Coulomb's failure envelope
   - shear strength of cohesive and non-cohesive soils
   - Factors affecting shear strength of soil and its applications in engineering.
   - Laboratory and field tests for determination of shear strength.
   - Related numerical problems
2. **Lateral Earth Pressure**
   - Definition, pressure at rest
   - Active and passive earth pressures
   - Coulomb's and Rankine's theories
   - Trial wedge and Culmann's method
   - Earth pressure diagrams for different configurations loading
   - Related numerical problems
3. **Consolidation of Soils**
   - Consolidation of soils
   - Mechanics of consolidation
   - Theory of one-dimensional consolidation, related assumptions, and validity
   - Oedometer test and graphical representation of data
   - Compression index and co-efficient of compressibility
   - Time factor, coefficient of volume change and degree of consolidation
   - Primary and secondary consolidation
   - Normal and pre-consolidated soils
   - Related numerical examples.
4. **Settlement Analysis**
   - Definition, total settlement, and differential settlement
   - Angular distortion
   - Consolidation settlement
   - Elastic or immediate settlement
   - Primary and secondary consolidation settlements

- Computation of elastic and consolidation settlement
- Causes of settlement and methods of controlling it
- Limits of allowable total and differential settlement
- Related numerical problems

5. Slope Stability Analysis

- Types of slopes
- Factors affecting slope instability and remedial measures
- Types of failure modes
- Critical slip circle and its location
- Infinite slope stability analysis
- Swedish circular method
- Ordinary method of slices
- Bishop's simplified method
- Taylor's slope stability number method
- Related numerical problems
- Earth and Rockfill Dams
- Definition and types of dams
- Components of a dam and their functions
- Coffer dams and their types
- General design considerations and typical cross-sections

6. Soil Improvement

- Basic principles and objectives of soil improvement
- Mechanical and chemical stabilization of soil
- Different methods and their application to various soil types

Recommended Books:

Textbook:

1. Baraja M. Das (2020), Principles of Geotechnical Engineering, 10th Ed, Cengage Learning, Inc. USA.

Reference Books:

1. Braja M. Das, (2020), Advanced Soil Mechanics, 5th Ed, CRC Press, 734 pp.
2. Craig, R. F. (2019). Craig's Soil Mechanics, 9th Ed., CRC Press, 654 pp
3. Doland P. Coduto (1999), Geotechnical Engineering Principles and Practices, Prentice-Hall, Upper Saddle River, NJ 07 458.
4. Bowles J. E. (1984). Physical and Geotechnical properties of soils, 2nd Ed. McGraw-Hill, New York, 578 pp.
5. Holtz and Kovac (2012), An Introduction to Geotechnical Engineering, Latest Edition, Prentice Hall.

Course Code: **CEE211**

Course Title: **Advanced Surveying**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **CEE201**

Course Objectives:

The course objective is to acquire knowledge of control surveys and their use in advanced branches of surveying. The course will enable the students to apply principles of surveying and modern tools in related field problems.

Course Outline:

1. **Highway and Railway Curves**
   - Circular curves, deflections and chord calculations, Setting out circular curves by various methods, Compound curves, reverse, vertical, parabolic curves, Computation of high or low point on a vertical curve, Design considerations, spiral curves, spiral curve computations, Approximate solution for spiral problems, super elevations

2. **Construction Surveys**
   - Introduction, horizontal and vertical control, Buildings, rail roads, Route surveys, Pipeline and other construction surveys

3. **Control Surveys**
   - Geodesy universal transverse Mercator grid system, Modified transverse Mercator grid system, Lambert projection, Computations for lambert projection

4. **Hydrographic Surveys**
   - Objectives of hydrographic survey and electronic charting, Vertical control, depth and tidal measurements, Position fixing techniques, sounding plan, horizontal control

5. **Field Astronomy**
   - Solar and stellar observations for position and azimuth determination

6. **Photogrammetry**
   - Introduction, Application of aerial and terrestrial photogrammetry, Stereoscopy

7. **Tunnel Surveying**
   - Introduction, Surface Alignment, Setting out from Ends, Transferring Alignment Underground, Use of gyroscope

Recommended Books:

Textbook:

1. Surveying and Leveling by "T.P Kanetkar & S.V. Kulkarni" Part I and II

Reference Books:

1. Surveying Theory and Practice, R.E. Davis, 7th Edition
2. Wolf P. R. & Ghilani C. D., (2004), Elementary Surveying – An introduction to Geomatics, 11th Edition, Prentice Hall, USA.
3. Thomas, M. Lillesand & Ralph W. Kiefer, (2005), Remote Sensing and Images Interpretation, 5th edition, John Wiley & Sons, Inc.
4. Kavanagh Barry, (2010), Surveying with Construction Applications, 7th Edition, Pearsons Education.

Course Code: **CEE212**
Course Title: **Engineering Surveying Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **Nil**

Course Objectives:

The main purpose of the course is to enable students to understand theory and practice of land surveying. This course is also aimed to enable students in reading and preparing surveying maps and to develop their skills to use modern survey instruments.

List of Experiments:

1. Introduction to basic surveying instruments
2. Measurement of distances with linear instruments
3. Chain Surveying and plotting
4. Compass Traversing and plotting
5. Two Points Problem
6. Three Points Problem
7. Finding magnetic bearing of traverse with the help of compass
8. Introduction to level and Level adjustments by two-peg method
9. Profile leveling
10. Cross-Sectioning and plotting
11. Plane table surveying by radiation method.
12. Plane table surveying by intersection methods.
13. Open ended lab

Recommended Books:

Text Book

1. Surveying and Leveling by "T.P Kanetkar & S.V. Kulkarni" Part I and II

Reference Books

1. Surveying Theory and Practice, R.E. Davis, 7th Edition
2. Wolf P. R. & Ghilani C. D., (2004), Elementary Surveying – An introduction to Geomatics, 11th Edition, Prentice Hall, USA.
3. Thomas, M. Lillesand & Ralph W. Kiefer, (2005), Remote Sensing and Images Interpretation, 5th edition, John Wiley & Sons, Inc.
4. Kavanagh Barry, (2010), Surveying with Construction Applications, 7th Edition, Pearsons Education.

Course Code: **CEE213**
Course Title: **Mechanics of Solids I Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **Nil**

Course Objectives:

The practical component includes hands-on activities such as assessing the compressive and tensile strength of cement, determining the tensile strength and elongation of steel bar, and determining the modulus of elasticity and modulus of rigidity of different materials.

List of Experiments:

1. To determine the compressive strength of cement.
2. To determine the tensile strength of cement.
3. To determine the yield strength, ultimate strength, rupture strength, and elongation of steel bar.
4. To determine the modulus of elasticity of concrete.
5. To perform compression test on wood samples with load parallel to grains.
6. To perform compression test on wood samples with load perpendicular to grains.
7. To find the experimental deflection of beam and compare it with theoretical values.
8. To study the effect of change in height and width of beam on deflection and compare it with theoretical values.
9. To determine the modulus of elasticity of the material of the given rectangular beam.
10. To perform bending test on 1.5"x3"x30" concrete specimen.
11. To perform bending test on 1.5"x3"x30" wooden specimen.
12. To determine and compare modulus of rigidity of different materials.
13. Open ended lab.

Recommended Books:

Text Books

1. Strength of Materials by Pytel. A & F.L.Singer, Harper & Row Publishers, New York.
2. Hibbler, R. C., Mechanics of Materials, Prentice Hall, 10th Edition

Reference Books

1. Engineering Mechanics of Solids by E.P. Popov and T.A. Balan
2. Mechanics of Materials by J.M. Gere and B.J. Goodno
3. Mechanics of Solids and Strength of Materials by WarnocK and Benham

Course Code: **CEE214**

Course Title: **Elementary Fluid Mechanics Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

The purpose of this course is to provide students with hands-on experience in applying the theoretical concepts learned in the classroom.

List of Experiments:

1. To determine the density, specific gravity, specific weight, of different fluids
2. Demonstration of Archimedes Principle
3. To determine the viscosity of fluid using falling sphere viscometer
4. Measurement and calibration of pressure gauge by dead weight pressure tester
5. To determine the magnitude of a hydrostatic force on submerged surface and locate the center of pressure
6. To determine the Metacentric Height of floating body using Metacentric Height Apparatus
7. Demonstration and operation of various parts of Hydraulic Bench
8. To measure the discharge flow rate and calculate the head loss using Venturi meter
9. To measure the discharge flow rate and calculate the head loss using Orifice plate meter
10. To determine the characteristics of flow over a rectangular and a triangular weir using flow over notch apparatus
11. To determine the coefficient of velocity and coefficient of discharge using orifice and jet flow apparatus
12. Open ended lab

Recommended Books:

Textbook:

1. Fluid Mechanics with Engineering Applications by Franzini, J.B., Daugherty and Finnemore E.J., McGraw Hill. 10th Edition

Reference Books:

1. Fundamentals of Fluid Mechanics by Munson, B.R., Young, D.F. and Okiishi, T.H., John Wiley & Sons. 6th Edition
2. Fluid Mechanics by Frank M. White 7th edition

Course Code: **CEE215**
Course Title: **Soil Mechanics Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **Nil**

Course Objectives:

The Soil Mechanics Laboratory course aims to provide students with a comprehensive understanding of soil properties and behavior through hands-on experience with standard testing techniques. Students will learn to measure and analyze key soil parameters such as moisture content, density, compaction, and permeability using specialized laboratory equipment. Emphasis is placed on accurate data collection, analysis, and interpretation to solve practical soil mechanics problems.

List of Experiments:

1. To determine the gradation of coarse-grained soil
2. To determine the gradation of fine-grained soil by hydrometer
3. To determine moisture content by oven dry test and speedy moisture tester
4. To determine liquid limit
5. To determine plastic limit
6. To determine specific gravity of soil by Pycnometer
7. To determine the permeability of granular soil by constant head permeameter
8. To determine the permeability of granular soil by falling head permeameter
9. To determine optimum moisture content and maximum dry density by standard compaction test
10. To determine optimum moisture content and maximum dry density by modified compaction test.
11. To determine In-situ density of soil by core cutter test
12. To determine In-situ density of soil by sand replacement test
13. Open ended lab

Recommended Books:

Textbook:

1. Baraja M. Das (2020), Principles of Geotechnical Engineering, 10th Ed, Cengage Learning, Inc. USA.

Reference Books:

1. Braja M. Das, (2020), Advanced Soil Mechanics, 5th Ed, CRC Press, 734 pp.
2. Craig, R. F. (2019). Craig's Soil Mechanics, 9th Ed., CRC Press, 654 pp
3. Doland P. Coduto (1999), Geotechnical Engineering Principles and Practices, Prentice-Hall, Upper Saddle River, NJ 07 458.
4. Bowles J. E. (1984). Physical and Geotechnical properties of soils, 2nd Ed. McGraw-Hill, New York, 578 pp.
5. Holtz and Kovac (2012), An Introduction to Geotechnical Engineering, Latest Edition, Prentice Hall.

Course Code: **CEE216**

Course Title: **Mechanics of Solids II Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE202**

Course Objectives:

The practical component includes hands-on activities such as to determine the symmetric and unsymmetric bending, critical load, and stresses in thick and thin cylinders.

List of Experiments:

1. To determine the symmetric and unsymmetric bending in beams.
2. To determine critical load for struts of varying slenderness ratios.
3. To determine critical load for struts of varying end fixing conditions.
4. To determine the shear force in a beam.
5. To determine the bending moment in a beam.
6. To perform impact test on metals.
7. To find shear center of different sections.
8. To study about Fatigue phenomena in Rotating Fatigue Machine.
9. To determine the stresses in thin cylinder.
10. Study the behavior of thin cylinder under both open and closed-end conditions.
11. To determine the stresses throughout the wall of thick cylinder.
12. To determine the stresses in the wall of thick cylinder.
13. Open ended lab.

Recommended Books:

Text Book

1. Arthur P. Boresi. & Richard J. Schmidt, Advanced Mechanics of Materials, John Wiley; 6th Edition (2002)
2. Pytel, A. & Ferdinand L. Singer, Strength of Material, Harper and Row Harper Collins College Div; 4th Sub Edition (1987)
3. Hibbler, R. C., Mechanics of Materials, Prentice Hall, 10th Edition

Reference Books

1. James M. Gere & Barry. J. Goodno, Mechanics of Materials, 8th Edition, CL Engineering
2. James M. Gere & Stephen P. Timoshenko, Mechanics of Materials, 4th Edition, 1997, PWS Pub Co.
3. Mechanics of Materials by Zahid Ahmed Siddiqi, 2015

Course Code: **CEE217**

Course Title: **Advanced Fluid Mechanics Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE203**

Course Objectives:

The purpose of this course is to provide students with hands-on experience in applying the theoretical concepts learned in the classroom.

List of Experiments:

1. To determine the flow based on Reynold's Number
2. To determine the major head loss of flow through pipe friction apparatus
3. To find minor head loss in bends and fittings apparatus
4. To study the working of Pelton Wheel and Francis Turbine
5. To find the performance and efficiency of the Pelton Wheel Turbine with different spear valve settings
6. To find the performance and efficiency of the Francis Turbine with different guide vane settings
7. To determine the performance characteristics of a compact reciprocating pump at a constant speed
8. To determine the performance characteristics of a Centrifugal pump
9. To investigate the operational characteristics of two centrifugal pumps connected in series and parallel
10. To demonstrate the cavitation phenomenon in a liquid using cavitation panel
11. To measure the hydraulic parameters of open channel flow
12. To visualize flow patterns around immersed objects in an open channel using mini flow channel apparatus
13. To investigate the reaction force produced by impact of a jet of water on various target plates
14. Open ended lab

Recommended Books:

Textbook:	1. Fluid Mechanics with Engineering Applications by Franzini, J.B., Daugherty and Finnemore E.J., McGraw Hill. 10th Edition
Reference Books:	1. Fundamentals of Fluid Mechanics by Munson, B.R., Young, D.F. and Okiishi, T.H., John Wiley & Sons. 6th Edition 2. Fluid Mechanics by Frank M. White 7th edition

Course Code: **CEE218**
Course Title: **Geotechnical Engineering Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **CEE204**

Course Objectives:

The Geotechnical Engineering Laboratory course offers students practical experience in understanding the physical and mechanical properties of soil and rocks. Through hands-on experiments using state-of-the-art equipment, students learn to measure and analyze critical geotechnical parameters such as soil density, shear strength, consolidation characteristics, and permeability. The course emphasizes accurate data collection, analysis, and interpretation to address real-world geotechnical challenges. Students gain proficiency in standard testing techniques essential for evaluating soil and rock behavior, preparing them for solving complex geotechnical problems in engineering practice.

List of Experiments:

1. To determine the angle of internal friction (φ) and cohesion (C) of sand by direct shear test
2. To determine the angle of internal friction (φ) and cohesion (C) of clay by direct shear test
3. To determine the unconfined compressive strength of soil by unconfined compression test
4. To determine bearing capacity of soil by standard penetration test
5. To determine the angle of internal friction (φ) and cohesion (C) of soil by unconsolidated undrained (UU) triaxial compression test
6. To determine modulus of compressibility and coefficient of consolidation by oedometer test
7. To determine relative density of coarse-grained soil
8. To determine optimum moisture content and maximum dry density of soil by modified compaction test
9. To determine California bearing ratio of soil by one-point CBR test
10. To determine California bearing ratio of soil by three-point CBR test
11. To determine California bearing ratio of soil by unsoaked CBR test
12. To determine California bearing ratio of soil by soaked CBR test
13. Open ended lab

Recommended Books:

Textbook:

1. Baraja M. Das (2020), Principles of Geotechnical Engineering, 10th Ed, Cengage Learning, Inc. USA.

Reference Books:

1. Braja M. Das, (2020), Advanced Soil Mechanics, 5th Ed, CRC Press, 734 pp.
2. Craig, R. F. (2019). Craig's Soil Mechanics, 9th Ed., CRC Press, 654 pp
3. Doland P. Coduto (1999), Geotechnical Engineering Principles and Practices, Prentice-Hall, Upper Saddle River, NJ 07 458.
4. Bowles J. E. (1984). Physical and Geotechnical properties of soils, 2nd Ed. McGraw-Hill, New York, 578 pp.
5. Holtz and Kovac (2012), An Introduction to Geotechnical Engineering, Latest Edition, Prentice Hall.

Course Code: **CEE219**

Course Title: **Advanced Surveying Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE201**

Course Objectives:

The course objective is to acquire knowledge of control surveys and their use in advanced branches of surveying. The course will enable the students to apply principles of surveying and modern tools in related field problems.

List of Experiments:

1. Study and Use of advanced surveying equipment.
2. Study and Use of advanced surveying equipment theodolite by doing traversing.
3. Study and Use of advanced surveying equipment theodolite by doing triangulation.
4. Study and Use of advanced surveying equipment auto level by doing Fly Leveling.
5. Study and Use of advanced surveying equipment auto level by doing grid Contouring.
6. Study and Use of advanced surveying equipment total station by doing radial Contouring
7. Setting out of Simple Curve by Intersection Method
8. Setting out of Simple Curve by deflection angel method
9. Setting out of Simple Curve by both methods.
10. Setting out of Compound Curve
11. Setting out of Transition Curve
12. GPS
13. Open-ended Lab

Recommended Books:

Textbook:

1. Surveying and Leveling by "T.P Kanetkar & S.V. Kulkarni" Part I and II

Reference Books:

1. Surveying Theory and Practice, R.E. Davis, 7th Edition
2. Wolf P. R. & Ghilani C. D., (2004), Elementary Surveying – An introduction to Geomatics, 11th Edition, Prentice Hall, USA.
3. Thomas, M. Lillesand & Ralph W. Kiefer, (2005), Remote Sensing and Images Interpretation, 5th edition, John Wiley & Sons, Inc.
4. Kavanagh Barry, (2010), Surveying with Construction Applications, 7th Edition, Pearsons Education.

Course Code: **CEE300**

Course Title: **Engineering Economics**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

The purpose of this course is to enable students of civil engineering to understand the impact of economic decisions and the role economic decisions play during the lifecycle of a construction project. It further aims to allow students to appreciate the concept of time value of money and how it influences the metrics of economic viability such as IRR, B/C ratio, NPV, etc. The basic premise of this course is to allow civil engineering students to understand and internalize the concepts of engineering economics such that they are able to choose alternatives that make most sense economically.

Course Outline:

1. **Introduction**
   - Engineering Costs
   - Estimating Models & Cash Flow Diagram
   - Life cycle cost

2. **Time value of money**
   - Time value of money, equivalence, use of spread sheet, simple and compound interest
   - Uniform series & Arithmetic and geometric gradient
   - Nominal and effective, continuous compounding economic criteria
   - Present worth, future worth & annuity

3. **Rate of Return**
   - Minimum acceptable rate of return (MARR)
   - Internal rate of return, External rate of return
   - Choosing the best alternative
   - Incremental analysis

4. **Benefits and Cost ratio Payback period**
   - Benefit and cost ratio (B/C ratio), discounted benefit and cost ratio
   - Simple payback period, discounted payback period
   - Sensitivity & breakeven analysis
   - Principle of comparative advantage

5. **Depreciation**
   - Depreciation
   - Depreciation using unit of production
   - Depreciation using straight line method

- Depreciation using depletion

6. Taxes
- Income taxes, After Tax RoR
- Replacement analysis
- Design life, salvage value
- Upgradation VS replacement

7. Risk and uncertainty
- Estimation of future events
- Monte Carlo simulation
- Bayes theorem

8. Risk and uncertainty
- Basic Concepts of Import and Export
- Dumping and anti-dumping and related laws

Recommended Books:

Textbook:
1. Fundamentals of engineering economics by Chan S. Park (Third Edition)

Reference Books:
1. William G. Sullivan and Elin M. Wicks, Estimation of future events
2. N. M. Fraser and E. M Jewkes, Engineering Economics: Financial decision making for engineers
3. D. G. Newman, J Whittaker, T.G. Eschenback and J.P Lavelle, Engineering Economic Analysis.
4. J. Tarquin, L.T. Blank, Engineering Economy, McGraw Hill.

Course Code: **CEE301**
Course Title: **Highway & Traffic Engineering**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of about highway and traffic engineering fundamentals. The course will also provide detailed guidance on the understanding of the relevant concepts of roadways, geometrics and traffic engineering by adopting suitable principles of transportation engineering. Students shall be able to apply principles of highway and traffic engineering to get a better functional performance from roads.

Course Outline:

1. **Highway Engineering**
   - Introduction to transportation systems (modes, models, infrastructure etc.)
   - Highway planning; principles, location survey in rural & urban areas, location controls.
   - Elements of a typical cross-section of road, types of cross-sections
   - Classification of highways, highway materials, types & characteristics, specification & tests.

2. **Highway Geometric Design (Alignments)**
   - Introduction to geometric design,
   - Horizontal curves, super elevation,
   - Vertical curves,
   - Grade line, transition curve, curve widening, sight distance requirements, introduction to Civil 3D.

3. **Traffic Engineering**
   - Traffic studies & estimates, speed-flow-density relationship, traffic lane capacity, level of service, design speed.
   - Traffic safety (signs, marking, signals), channelization
   - Design of intersection at grade & grade separated (access control)
   - Parking and accident studies, conflict analysis
   - Intelligent Transportation System (ITS), Advanced Transportation Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Delays and • Que formation, Que theory (DD1 & MD1)
   - Public transport system, rapid transit modes (BRT), basic methods for estimating public transport demand, corridor and network development.
   - Traffic impact assessment & mitigation planning
   - Introduction to Vissim/Synchro Plus Sim Traffic.

Recommended Books:

Text & Reference Books:

1. Fred. L. Mannering and Scott S. Washburn, (2013), Principles of Highway Engineering and Traffic Analysis, 5th Edition (or Latest), John Wiley & Sons. NY.
2. Salter R. J., and Hounsell, N.B., (1996), Highway Traffic Analysis and Design, 3rd Edition (or latest), Palgrave Macmillan, Red Globe Press London.
3. Roger P. Roess, Elenna S. Prassas and William R. Mc. Shane, (2011), Traffic Engineering 4th Edition (or latest), Pearson Higher Education.

Course Code: **CEE302**
Course Title: **Structural Analysis-II**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **CEE207**

Course Objectives:

This course delves into the analysis of indeterminate structures under static and dynamic loads. Students will learn classical methods, become familiar with various techniques, and develop proficiency in state-of-the-art structural analysis approaches. The theoretical framework covers force and displacement methods, including compatibility techniques, moment distribution, and slope deflection for beams and frames. Matrix methods are introduced, encompassing flexibility and stiffness approaches. The course also covers the utilization of 2D software for the structural analysis of planar structures. Students who complete this course will gain the analytical abilities necessary for indeterminate structural analysis.

Course Outline:

1. **Analysis of Indeterminate Structures Using Force Approach**
   - Method of Consistent Deformations for Beams, Frames and Trusses
   - Method of Least Work for Beams, Frames and Trusses

2. **Analysis of Indeterminate Structures Using Displacement Approach**
   - Moment distribution method for analysis of beams and frames with and without side-sway and support settlement
   - Slope deflection method for analysis of beams and frames with and without side-sway and support settlement

3. **Analysis of Indeterminate Beams under Moving Load**
   - Qualitative and Quantitative Influence Line Diagrams
   - Influence Lines for Reactions, Shear Force and Bending Moment in Statically Indeterminate Beams
   - Calculation of Maximum Stress Function (Reaction, Shear, Bending Moment) using Influence Line Diagrams

4. **Matrix Methods**
   - Introduction to flexibility method
   - Introduction to stiffness method
   - Development of member and structure stiffness matrices
   - Use of appropriate software for matrix operations

5. **2D Structural Analysis Software**
   - Use of appropriate 2D Structural Analysis Software for analyzing Planer Structures

Recommended Books:

Textbook:

1. R. C. Hibbler, Structural Analysis, Prentice Hall, 10th Edition (2021).

Reference Books:

1. Aslam Kassimali, (2014), Structural Analysis, 5th Edition
2. Wang, C. K., (1984), Intermediate Structural Analysis, McGraw-Hill Education - Europe.
3. West, H. H., (1989), Analysis of Structures: An Integration of Classical and Modern Methods , John Wiley and Sons Ltd; 2nd Edition.
4. Alexander, Chajes, (1990), Structural Analysis 6. Rizwan, S.A., (2003), Theory of Indeterminate Structures, 2nd Ed.

Course Code: **CEE304**

Course Title: **Quantity Surveying and Cost Estimation**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

This course comprises estimating quantities and costs of various activities in a typical construction project. The students will be exposed to the necessary skills of taking quantities off the engineering drawings for preparing the cost estimates.

Course Outline:

1. **Quantity Takeoff**
   - Review of basic take-off mathematics and measurement Units.
   - Takeoff Rules and Measurement Accuracy
   - Organization of take-off
   - Quantity take-off and Pricing of Labor, Material and Equipment for; Sitework, Concrete, Masonry, Carpentry, and Finishes Works.
   - Estimating Procedures and Considerations for Concrete Retaining Wall, Piles, Steel Truss, Road, Sewer and Water Mains Pipe Works.
   - Maintaining of Measurement Books

2. **Development of Estimates, Pricing and Related Aspects**
   - Types and methods of estimates (conceptual estimates, preliminary, detailed estimates)
   - Rate analysis
   - Labor productivity
   - Cost analysis of construction materials
   - Estimate Setup, Overhead, Profit, Sources of Estimating Errors, Escalation, Contingency, Life-Cycle Costing and Analysis.
   - Concept of Cost Code
   - Use of different types of indices for conceptual estimates

3. **Contractual Aspects Related to Bidding**
   - Specifications and their types for various items of construction projects
   - Overview of payment schemes in construction projects
   - Preparation of Civil Engineering tender/bid proposal documents evaluation methods of proposals and bids.
   - Preparation of documents for bid submissions
   - Overview of Standard form of contract/bidding documents with special reference to clauses related to cost related issues of the projects (such as PEC, FIDIC, AIA etc.) General practice in government departments for schedule of rates and specifications.

Recommended Books:

Textbook:

1. Steven J. Peterson and Frank R. Dagostino, Estimating in Building Construction (2015) 8th Edition, Pearson Publishing.

Reference Books:

1. Marks Kalin, Robert S. Weygant, Harold J. Rosen & John R. Regenar, Construction Specifications Writing: Principles and Procedures (2010), Wiley.
2. Steven J. Peterson, Construction Estimating Using Excel (2017) 3rd edition Pearson publishing.
3. Standard Form of Bidding Documents by Pakistan Engineering Council.
4. David Chappell, Construction Contracts Questions and Answers (2021), 4th Edition, Taylor & Francis. Jimmie Hinze, Construction Contracts (2010), 3rd Edition, McGraw-Hil

Course Code: **CEE305**

Course Title: **Matrix Analysis of Structures**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE302**

Course Objectives:

This course will introduce students with the matrix methods of structural analysis.

Course Outline:

Introduction to matrix analysis of structures, Types of Analysis, Methods of Analysis, Force or flexibility method. Stiffness or displacement method. Indirect flexibility method, Matrix formulation of the flexibility method, Application of the flexibility method to beams. Application of the flexibility method to frames, Application of the flexibility method to trusses. Direct flexibility method, Derivation of flexibility matrix for flexural element. Composite flexibility matrix, Force transformation matrix, Structure flexibility matrix for beams, frames and trusses, Examples of statically indeterminate beams, Examples of statically indeterminate frames, Analysis of statically indeterminate beams, trusses, Introduction to displacement or stiffness method. Stiffness, stiffness coefficient and stiffness matrix, Introduction to direct stiffness method for trusses, Procedure for the formation of total structure stiffness matrix for an element using direct stiffness method, Formation of element stiffness matrix in local co-ordinates Formation of deformation transformation matrix. Formation of structure stiffness matrix for an element, Formation of total structure stiffness matrix, Examples regarding the formation of K matrix, Examples regarding complete analysis of trusses using direct stiffness method. Introduction. Element stiffness matrix for flexural element. Element stiffness matrix for beam/frame element subjected to moments only. Element stiffness matrix for beam/frame element subjected to axial load, shearing force and moments. Deformation transformation matrix. Structure stiffness matrices. Analysis of frames subjected to moments only. Analysis of beams and frames subjected to moments and shear force. Analysis of beams and frames subjected to moments, shear force and axial force. Introduction to finite element method.

Recommended Books:

1. Matrix Analysis of Structures by Aslam Kassimali
2. Matrix Structural Analysis by William McGuire, Richard H. Gallagher, and Ronald D. Ziemian

Course Code: **CEE306**
Course Title: **Engineering Hydrology**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course will provide an understanding of complexity of movement and distribution of water on the earth, while emphasizing an application to engineering practices. It covers engineering applications of principles of hydrology, including fundamentals of hydrologic cycle, to quantify evaporation and infiltration processes, rainfall and runoff, hydrographs, stream flow routing and groundwater. The focus will be to determine the water balance for a particular region and provides guidance for undergoing proper planning and management of water resources.

Course Outline:

1. **Introduction**
   - Hydrology
   - Hydrologic Cycle and the Water Balance Equation
   - Practical uses of Hydrology
   - Importance of Hydrology

2. **Meteorology**
   - The Atmosphere and its Components
   - Relative Humidity, Dew Point and Saturation Deficit
   - Solar Radiation, Lapse Rate and Adiabatic Changes
   - Measurement of Air Temperature, Relative Humidity, Radiation, Sunshine, Atmospheric Pressure and Wind Velocity with Direction

3. **Precipitation**
   - Types of Precipitation
   - Factors Necessary for the Formation of Precipitation
   - Measurement of Precipitation
   - Interpretation of Precipitation Data
   - Computation of Average Rainfall over a Basin

4. **Evaporation and Transpiration**
   - Factors Affecting Evaporation
   - Measurement of Evaporation
   - Evapotranspiration

5. **Stream Flow**
   - Water Stage and its Measurement

- Selection of Site for Stage Recorder
- Selection of Control and Metering Section
- Methods of Measurement of Stream Flow
- Interpretation of Stream Flow Data

6. Runoff & Hydrograph

- Factors Affecting Runoff
- Estimating the Volume of Storm Runoff
- Characteristic of Hydrograph
- Components of a Hydrograph
- Hydrograph Separation
- Estimating the Volume of Direct Runoff
- Introduction to unit Hydrograph Concept
- S-Curve Preparation
- Application of Probability in Determining Maxima/Minima of Discharge
- Types of Histogram and Distribution

7. Stream Flow Routing

- Introduction to Floods and its Causes
- Frequency and Duration Analysis
- Reservoir Routing
- Channel Routing
- Flood Control
- Introduction to Hydrological Modeling

8. Ground Water

- Sources and Discharge of Ground Water
- Water Table and Artesian Aquifer
- Aquifer characterization
- Pumping Test
- Tube Well Technology

9. Water Resources Management

- Purpose of Water Resources Planning and Management
- Principles of Water Resources Management

Recommended Books:

Textbook:

1. Subramanya, K., (2020), Engineering Hydrology, 5th Edition, McGraw Hill

Reference Books:

1. Eslamian S., (2014), Handbook of Engineering Hydrology (Fundamentals and Applications), CRC Press
2. Viessman, W., and Lewis, J. L., (2002) Introduction to Hydrology, 5th Edition, Pearson Hall.

3. David, A. Chin, (2010) Water Resources Engineering, 2nd Edition, John Wiley & Sons.

Course Code: **CEE307**

Course Title: **Environmental Engineering**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will introduce the concept of environmental pollution, contamination and its sources particularly in context to water. The course will elaborate principles of water treatment applied to the design and implementation of water supply schemes. At the end of course, students would be able to explain the various concepts of water treatment and wastewater treatment, apply appropriate processes for water pollution control and analysis the physical and chemical unit operations of water treatment.

Course Outline:

1. **Introduction**
   - Water Engineering
   - Sanitary Engineering

2. **Water Pollution**
   - Water chemistry and water quality characteristics
   - Introduction to sources of pollution
   - Effects on water quality
   - Control parameters

3. **Water Demand and Supply**
   - Population forecast
   - Water uses & consumption
   - Types and variations in demand
   - Maximum demand

4. **Water Quality**
   - Water impurities & their health significance
   - Water quality guidelines/standards (US-EPA, WHO and NSDWQ Pakistan)
   - Water quality monitoring

5. **Water Sampling and Testing**
   - Sampling techniques and examination of water (physical, chemical and microbiological parameters)
   - Water borne diseases

6. **Water Treatment**
   - Treatment of surface & ground water

- Screening (Course and Fine Screens)
- Coagulation and Flocculation
- Sedimentation
- Filtration
- Design aspects of slow sand and rapid sand filters and their operations
- Pressure filters
- Membrane Technology (Reverse Osmosis, Nanofiltration, Ultrafiltration, Microfiltration)

7. Miscellaneous Water Treatment Techniques

- Fluoridation, Iron & Manganese removal
- Water softening methods
- Water disinfection and chemicals (Chlorination, Ozonation, Ultraviolet disinfection methods)
- Emergency treatment methods

8. Water Distribution

- Layout and design of water transmission works and distribution networks (Hardy Cross and Equivalent Pipe method)
- Service reservoirs
- Fixtures and their installation
- Tapping of water mains
- Urban and Rural Water Supply

9. Introduction to building drainage.

10. Introduction to EIA.

Recommended Books:

Textbook:

1. Mackenzie L. Davis and David A. Cornwell "Introduction to Environmental Engineering (4th Edition, 2007)

Reference Books:

1. Mark J. Hammer, Jr. Viessman, Elizabath M. Perez, Paul A. Chadik "Water Supply and Pollution Control" (8th Edition, 2015)
2. Sajjad Haider Sheikh, Javed A. Azeez "Water Supply and Sewerage (Theory & Applications)" (1st Edition, 2022)
3. Tom D. Reynolds and Paul A. Richards "Unit Operations and Processes in Environmental Engineering" (Second Edition, 1996)
4. John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous "MWH's Water Treatment: Principles and Design" Third Edition, 2012)
5. E.W. Steel and Terence J. McGhee Water supply and sewerage (6th Edition, 2007)

Course Code: **CEE308**
Course Title: **Reinforced Concrete Design I**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **CEE206**

Course Objectives:

The purpose of this course is to provide students with a thorough understanding of the design of reinforced concrete buildings/structures with particular emphasis on using the locally available steel rebars and concrete. Topics covered will include: Properties, Application and Testing of Plain Concrete, Basic Principles for Reinforced Concrete design, design of beams and slabs for flexure and shear; detailing of flexural and shear reinforcement; behaviour of reinforced concrete members under combined flexure and axial load; design of short columns; as well as detailing of steel for bond & development length and laps & splices, with focus on local practices.

Course Outline:

1. **Plain Concrete (Properties, Application and Testing)**
   - Concrete constituent material and its mechanical properties
   - Properties of freshly mixed concrete
   - Durability aspects and factors contributing towards durability
   - Creep and shrinkage of concrete
   - Mix design and quality control
   - Additives and admixtures
   - Air entrainment
   - Lightweight concrete
   - Hot and cold weather concrete
   - Precast concrete with special reference to cement concrete blocks
   - Determination of fundamental structural properties of concrete and nondestructive testing (NDT)

2. **Reinforced Concrete (Basic Principles, Working Stress and Ultimate Strength Method)**
   - Basic principles of reinforced concrete design and associated assumptions behavior of reinforced concrete members in flexure, design philosophy, design codes, factor of safety and load factors, prevailing methods of design of reinforced concrete members.
   - Working stress method, serviceability criteria and checks for deflection, crack width, and crack spacing, Importance of working stress method related to pre-stress.
   - Ultimate strength method, analysis of prismatic and non-prismatic sections min flexure, compatibility-based analysis of sections and code requirements for flexure

3. **Structural Framing and Load Calculations of a Simple Structure for Gravity Design**
   - Structural framing
   - Load calculations, types of basic loads, service and factored load combinations

- Load distribution and calculations for slabs, beams, columns

4. Slab Analysis and Design for Gravity Loading

- One-way solid and ribbed slabs
- General discussion on other slab systems
- Design detailing

5. Beam Analysis and Design for Gravity Loading

- Flexure analysis and design of beams (singly, doubly, rectangle section, T/L sections, simple span, one end and both end continuous)
- Shear analysis and design of beams
- Design detailing

6. Columns

- Analysis of sections in pure compression,
- Design of short columns under pure compression and with eccentric loading,
- Design detailing

7. Steel Detailing (Bond, Anchorage & Development Length)

- Design and detailing for bond, anchorage, development length, laps and splices

Recommended Books:

Textbooks:

1. M. Neville, (2011), Properties of Concrete, 5th edition, John Wiley.
2. Design of Concrete Structures by Nelson/Winter 15th Edition.

Reference Books:

1. James K Wight and James G. Macgregor, Reinforced design: Mechanics and design, (2011), 6th (or latest) Edition.
2. Hassoun, M. N. & Al-Manaseer, A, (2015), Structural Concrete: Theory and Design, 7th (or latest) Edition.
3. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2017), Reinforced Concrete Design, Wiley; 8th (or latest) Edition.
4. N.V.Nayak & A.K.Jain, Handbook on Advanced Concrete Technology.
5. Concrete Structures, Part-I, 3rd (or latest) Edition, by Zahid Ahmed Siddiqi, 2016.
6. ACI Building Code Requirement for Reinforced Concrete Structures 318.

Course Code: **CEE309**

Course Title: **Introduction to Architecture and Town Planning**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will give students an introductory understanding of various components of various types of buildings from an architectural point of view. Moreover, this course will provide basic guidance on ancient and modern forms of living and various terms related to planning and development of inhabitant areas

Course Outline:

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

2. **Qualities, Factors and Use of Materials**
   - Strength, vitality, grace, breadth and scale proportion
   - Colour and balance
   - Stone, wood, metals, concrete, composites, ceramics

3. **Architectural Aspects of Building Planning**
   - Walls and their construction
   - Openings and their position, character and shape Roofs and their development and employment
   - Columns and their position, form and decoration
   - Moulding and their form decoration
   - Ornament as applied to any buildings

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

5. **Preliminary Studies**
   - Study of natural resources, economic resources, legal and administrative problems
   - Civic surveys
   - Preparation of relevant maps

6. Land Use Patterns, Street Patterns

- Various theories of land use pattern
- Location of Parks and recreation facilities
- Public and semi-public buildings
- Civic centers, commercial centers, local shopping centers
- Public schools, industry & residential areas
- Layout of streets, road crossing & lighting Community planning

7. City Extensions and Urban Planning

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

Recommended Books:

Textbook:	1. Dan Cruickshank, Sir Banister Fletcher's A History of Architecture, Architectural Press; 20th Edition (September 25, 1996) 2. Leonard Benevolo; Origins of Modern Town Planning, MIT Press, 15-Aug- 1971
Reference Books:	1. Sir Rymond Unwin, Town Planning in Practice, FQ Legacy Books (December 31, 2010)

Course Code: **CEE310**

Course Title: **Civil Engineering Construction and Graphics**

Credit Hours: **1(1, 0)**

Pre-requisite(s): **CEE102**

Course Objectives:

This course will give students a detailed understanding of architectural and civil engineering drawings. The course will provide detailed guidance on the working drawings related to civil engineering projects. Emphasis will be placed on using the frequently used software in industry as well as emerging software to ensure the industry needs.

Course Outline:

1. **Introduction to Auto Cad, Contour Plan, Infrastructure layout, and Site Plan**
   - General introduction to Auto Cad for civil engineering drawings
   - Auto Cad different commands of latest version
   - 2D and 3D drawings
   - General notes
   - Contour plan
   - Infrastructure layout
   - Site plan

2. **Architectural Details of a Simple Two Storied Building**
   - Broad prospective about architectural details
   - General notes
   - Ground floor plan
   - First floor plan
   - Roof and mumty plan
   - Elevations
   - Longitudinal and transverse sections

3. **Structural Details of a Simple Two Storied Framed RCC Building**
   - Broad prospective about structural RCC details
     General notes
   - Foundation plan and related details
   - Framing of plinth beams and related details
   - Framing of floor beams and related details
   - Framing of roof and mumty beams and related details
   - Slab reinforcement layout
   - Misc. details (stair case and water tank)
   - Structural details of boundary wall

4. **Plumbing and Electrical Details of a Simple Two Storied Building**

- Broad prospective about plumbing and electrical details
- General notes for plumbing details
- External water supply and sewerage layout
- Internal water supply and sewerage layout (all plans)
- General notes for electrical details
- Electrification for all plans

5. Structural Details of Steel Roof Truss

- Broad prospective about structural steel details
- General notes
- Framing plan
- Truss elevation
- Member cross-sections and connection details

6. Construction Machinery

- Excavating Equipment
- Hauling Equipment
- Excavating and Hauling Equipment
- Excavation of earth
- Screens

7. Introduction to Building Information Modeling (BIM)

- Different functions of BIM tools, e.g. REVIT etc.
- 2D and 3D drawings
- Architectural drawings in REVIT

Recommended Books:

Textbook:

1. M. Chakarborti, Civil Engineering Drawing, UBS Publications, (Latest Edition).

Reference Books:

1. Gurcharan Singh, Civil Engineering Drawing, (Latest Edition). Malik Book Dept., Lahore
2. Mastering AutoCAD 2017 and AutoCAD LT 2017 by George Omura with Brian Benton, (latest edition), 2016.
3. Boughton, B. Reinforced Concrete Detailer's Manual (Reference Book), HarperCollins, Publishers Ltd. London

Course Code: **CEE311**

Course Title: **Fundamentals of Disaster Management**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

To familiarize students with the basic concepts of natural and human-induced hazards, to enable students to learn the techniques for pre and post-disaster management.

Course Outline:

Introduction to Hazards and Disasters (earthquakes, floods, droughts, landslides, cyclones, etc.), Social & Economic Aspects of Natural and human-induced hazards, Hazard and Disaster Investigation, Disaster Management, Pre-Disaster Phase (Prevention, Mitigation & Preparedness), Disaster Phase (Response, relief and recovery), Post-Disaster Phase (Rehabilitation, Development), Damage assessment, Disaster management policies and institutional infrastructure from national to local level. Monitoring of Infra-structure facilities; strategies for protection against possible damages; maintenance for different infrastructure facilities. Rehabilitation and repair strategies, Predictions and preparedness strategies for natural disasters such as Earthquakes etc; Emergency management; Awareness Programs; Follow-on Disasters; Recovery plans; Strategies for protection, Risk and Vulnerability Analysis; Disaster Mitigation

Recommended Books:

1. Thomas D. Schneid, Disaster Management and preparedness, CRC Press; 1 Edition (November 22, 2000)
2. David Alexander, Principles of Emergency planning and Management, Published in the United State of America by Oxford University Press Inc. 1998 Madison Avenue, New York 10016
3. Timothy Beatley, Philip Berke, David J. Brower 1999 Natural Hazard Mitigation: Recasting Disaster Policy and Planning Island Press ISBN: 1559636025
4. Charlotte Benson, Edward J. Clay (2004) Understanding the Economic and Financial Impacts of Natural Disasters World Bank Publications ISBN: 0821356852
5. The primer on Disaster Risk management in Asia
6. Mr. Aloysius J. Rego Director of Knowledge Sharing and partnerships and Co Team Leader of Disaster management System team Asian Disaster preparedness Center (ADPC) 2003.

Course Code: **CEE312**
Course Title: **Construction Management**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

This course aims to equip students with a comprehensive understanding of the principles and practices essential to managing construction projects effectively. By the end of the course, students will be proficient in project planning and scheduling, cost estimation and control, and understanding various construction contracts and their legal implications. They will learn to manage construction methods and equipment, ensure quality and safety on construction sites, and apply risk management techniques. The course also covers human resource management, sustainable construction practices, and the application of information technology in construction management. Through case studies and best practices, students will gain practical insights and be prepared to address the dynamic challenges of the construction industry, ultimately fostering their ability to lead and manage construction projects successfully.

Course Outline:

1. Introduction to Construction Management
- Overview of the construction industry
- Roles and responsibilities of construction managers
- Construction project lifecycle
- Key stakeholders in construction projects

2. Project Planning and Scheduling
- Principles of project planning
- Work breakdown structure (WBS)
- Gantt charts and bar charts
- Critical path method (CPM)
- Program evaluation and review technique (PERT)
- Scheduling software and tools

3. Cost Estimation and Control
- Types of cost estimates
- Cost estimation techniques
- Budgeting and financial management
- Cost control methods
- Earned value management (EVM)
- Construction project accounting

4. Construction Contracts and Legal Aspects

- Types of construction contracts
- Contract documents and specifications
- Bidding and procurement processes
- Legal aspects of construction
- Contract administration and management
- Dispute resolution and claims management

5. Construction Methods and Equipment

- Construction methods for various types of projects (residential, commercial, industrial, infrastructure)
- Selection and management of construction equipment
- Construction site layout and logistics
- Material management and supply chain

6. Quality Management in Construction

- Quality control and quality assurance
- Construction standards and codes
- Quality management systems (QMS)
- Inspection and testing procedures
- Managing defects and non-conformance

7. Safety Management in Construction

- Principles of construction safety
- Occupational safety and health regulations
- Safety management systems (SMS)
- Hazard identification and risk assessment
- Safety training and awareness programs
- Incident reporting and investigation

8. Risk Management in Construction

- Types of risks in construction projects
- Risk identification and analysis
- Risk mitigation strategies
- Risk management plans
- Contingency planning

9. Human Resource Management in Construction

- Workforce planning and recruitment
- Labor laws and regulations
- Training and development

- Team building and leadership
- Conflict resolution and labor relations

10. Sustainable Construction Practices

- Principles of sustainable construction
- Green building standards and certifications (LEED, BREEAM, etc.)
- Energy-efficient construction methods
- Waste management and recycling
- Environmental impact assessment

11. Information Technology in Construction Management

- Building Information Modeling (BIM)
- Construction management software
- Project management information systems (PMIS)
- Emerging technologies in construction (drones, IoT, AI)

12. Case Studies and Best Practices

- Analysis of successful construction projects
- Lessons learned from project failures
- Best practices in construction management
- Industry trends and future directions

Recommended Books:

1. Construction Project Management: A Practical Guide to Field Construction Management by S. Keoki Sears, Glenn A. Sears, Richard H. Clough, and Jerald L. Rounds:
2. Construction Management JumpStart: The Best First Step Toward a Career in Construction Management by Barbara J. Jackson

Course Code: **CEE313**

Course Title: **Modelling and Simulation in Civil Engineering**

Credit Hours: **1(1, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

Introduction to fundamental concepts, techniques, and tools for creating mathematical models and conducting simulations to analyze complex systems. Covers mathematical modelling principles, simulation techniques, model validation, optimization, and real-world applications. Hands-on experience with simulation software. Ideal for engineering students seeking to enhance problem-solving skills and decision-making in civil engineering domain.

Course Outline:

1. **Simulation**
   - Prepare Model Inputs and Outputs
   - Configure Simulation Conditions
   - Run Simulations
   - View and Analyze Simulation Results
   - Test and Debug Simulations
   - Optimize Performance
   - Simulation Guidelines & Best Practices

2. **Modeling**
   - Design Model Architecture
   - Manage Design Data
   - Design Model Behavior
   - Configure Signals, States, and Parameters
   - Configure Inputs and Visualizations
   - Analyze and Remodel Design
   - Test Model Components
   - Modeling Guidelines & Best Practices

Recommended Books:

Textbook:
1. Introduction to MATLAB for Engineering Students by David Houcque, Northwestern University latest edition.

Reference Links:
1. https://www.mathworks.com/help/simulink/simulation.html
2. https://www.mathworks.com/help/simulink/modeling.htm

Course Code: **CEE314**

Course Title: **Engineering Hydrology Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will provide an understanding of complexity of movement and distribution of water on the earth, while emphasizing an application to engineering practices. It covers engineering applications of principles of hydrology, including fundamentals of hydrologic cycle, to quantify evaporation and infiltration processes, rainfall and runoff, hydrographs, stream flow routing and groundwater. The focus will be to determine the water balance for a particular region and provides guidance for undergoing proper planning and management of water resources

List of Experiments:

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

Recommended Books:

Textbook:

1. Subramanya, K., (2020), Engineering Hydrology, 5th Edition, McGraw Hill

Reference Books:

1. Eslamian S., (2014), Handbook of Engineering Hydrology (Fundamentals and Applications), CRC Press
2. Viessman, W., and Lewis, J. L., (2002) Introduction to Hydrology, 5th Edition, Pearson Hall.
3. David, A. Chin, (2010) Water Resources Engineering, 2nd Edition, John Wiley & Sons.

Course Code: **CEE315**

Course Title: **Environmental Engineering Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

The purpose of this course is to equip students with hands-on experience in applying theoretical concepts of sampling techniques, Physical, and chemical water quality testing. Students will engage in examinations of water and wastewater samples, conduct testing, and evaluation of various results of water quality parameters.

List of Experiments:

1. Jar test for optimal coagulant dosage
2. Analysis of PH, alkalinity and acidity of various water samples
3. Conductivity, and total dissolved solids (TDS) of surface water samples
4. Analysis of total suspended solids (TSS) of surface water samples
5. Analysis of turbidity of surface water samples
6. Analysis of dissolved oxygen of surface water samples
7. Analysis of salinity of surface water samples
8. Analysis of Hardness as $CaCO_3$
9. Analysis of Residual Chlorine
10. Analysis of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) in wastewater
11. Investigate nitrogenous compounds in wastewater (Ammonium-nitrogen, nitrates, nitrites) in wastewater
12. Investigate phosphate concentrations in wastewater (Total Phosphorus, Phosphate-Phosphorus in wastewater
13. Open ended lab

Recommended Books:

Textbook:

1. Mackenzie L. Davis and David A. Cornwell "Introduction to Environmental Engineering (4th Edition, 2007)

Reference Books:

1. Mark J. Hammer, Jr. Viessman, Elizabath M. Perez, Paul A. Chadik “Water Supply and Pollution Control” (8th Edition, 2015)
2. Sajjad Haider Sheikh, Javed A. Azeez “Water Supply and Sewerage (Theory & Applications)” (1st Edition, 2022)
3. Tom D. Reynolds and Paul A. Richards “Unit Operations and Processes in Environmental Engineering” (Second Edition, 1996)
4. John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous “MWH's Water Treatment: Principles and Design” Third Edition, 2012)
5. E.W. Steel and Terence J. McGhee Water supply and sewerage (6th Edition, 2007)

Course Code: **CEE316**

Course Title: **Reinforced Concrete Design I Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE206**

Course Objectives:

The purpose of this course is to equip students with hands-on experience in applying theoretical concepts of plain and reinforced concrete design. Students will engage in material testing, design and casting of concrete specimens, load testing, and evaluation of various characteristics of concrete.

List of Experiments:

1. To study the compressive strength of concrete using cube and cylinder
2. To prepare mix design for various strengths of concrete.
3. To find workability of concrete using slump cone method, compacting factor method, VeBe time method
4. To study the effect of w/c ratio on the strength of concrete
5. To study effect of aggregate/cement ratio on workability and compressive strength of concrete.
6. To determine the effect of curing and age on the compressive strength of concrete
7. To determine the tensile strength of concrete by split cylinder test
8. To study the permeability of concrete samples with various mix ratio.
9. To study the ultrasonic pulse velocity test and Schmidt hammer test on hardened concrete
10. To determine the strength of concrete using core extraction and to discuss the results from control cylindrical samples.
11. To study the behaviour of balanced reinforced, under-reinforced and over-reinforced concrete flexural members.
12. To study the behaviour of shear deficient flexural members.
13. Open ended lab

Recommended Books:

Textbooks:

1. M. Neville, (2011), Properties of Concrete, 5th edition, John Wiley.
2. Design of Concrete Structures by Nelson/Winter 15th Edition.

Reference Books:

1. James K Wight and James G. Macgregor, Reinforced design: Mechanics and design, (2011), 6th (or latest) Edition.
2. Hassoun, M. N. & Al-Manaseer, A, (2015), Structural Concrete: Theory and Design, 7th (or latest) Edition.
3. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2017), Reinforced Concrete Design, Wiley; 8th (or latest) Edition.
4. N.V.Nayak & A.K.Jain, Handbook on Advanced Concrete Technology.
5. Concrete Structures, Part-I, 3rd (or latest) Edition, by Zahid Ahmed Siddiqi, 2016.
6. ACI Building Code Requirement for Reinforced Concrete Structures 318.

Course Code: **CEE317**

Course Title: **Civil Engineering Construction and Graphics Lab**

Credit Hours: **2(0, 2)**

Pre-requisite(s): **CEE102**

Course Objectives:

This course will give students a detailed understanding of architectural and civil engineering drawings. The students will gain knowledge about the detailed working drawings related to civil engineering projects.

List of Experiments:

1. Introduction to auto cad, auto cad practice, contour plan, infrastructure layout and site plan
2. Architectural details of a simple two storied building.
3. Structural details of a simple two storied framed RCC building.
4. Plumbing and electrical details of a simple two storied building.
5. Structural details of steel roof truss
6. BIM (Architectural drawings in REVIT)
7. Open ended lab.

Recommended Books:

Textbook:

1. M. Chakarborti, Civil Engineering Drawing, UBS Publications, (Latest Edition).

Reference Books:

1. Gurcharan Singh, Civil Engineering Drawing, (Latest Edition). Malik Book Dept., Lahore
2. Mastering AutoCAD 2017 and AutoCAD LT 2017 by George Omura with Brian Benton, (latest edition), 2016.
3. Boughton, B. Reinforced Concrete Detailer's Manual (Reference Book), HarperCollins, Publishers Ltd. London

Course Code: **CEE318**

Course Title: **Modelling and Simulation in Civil Engineering Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

Introduction to fundamental concepts, techniques, and tools for creating mathematical models and conducting simulations to analyze complex systems. Covers mathematical modelling principles, simulation techniques, model validation, optimization, and real-world applications. Hands-on experience with simulation software. Ideal for engineering students seeking to enhance problem-solving skills and decision-making in civil engineering domain.

List of Experiments:

1. Familiarize students with MATLAB and Python environment, basic commands, and scripting relevant to civil engineering applications.
2. Introduction to techniques for collecting and pre-processing data relevant to civil engineering projects using MATLAB/Python. Cover data cleaning, filtering, and normalization.
3. Introduction to basic modeling principles using linear regression in MATLAB. Apply regression techniques to civil engineering data for predictive analysis and model fitting.
4. Implement neural networks in MATLAB/Python to analyze data for civil engineering related problems like material design, performance prediction.
5. Introduction to various bagging and boosting Machine Learning techniques and implementation in MATLAB/Python.
6. Introduction to Hyperparameter
7. Introduction to advanced techniques for improving model accuracy
8. Employ MATLAB/ Python for predicting strength and other performance parameters using different ML Algorithms
9. Employ MATLAB/Python for hydraulic modeling and simulations, including flow analysis in open channels, pipes, and water distribution networks.
10. Traffic Flow Prediction, Accident Prediction and Analysis using various ML Algorithms in MATLAB/Python
11. Predicting settlement of foundations and Estimating soil bearing capacity using ML algorithms
12. Data Visualization and Reporting
13. Open ended lab

Recommended Books:

Textbook:	1. Introduction to MATLAB for Engineering Students by David Houcque, Northwestern University latest edition.
Reference Links:	1. https://www.mathworks.com/help/simulink/simulation.html 2. https://www.mathworks.com/help/simulink/modeling.htm

Course Code: **CEE319**
Course Title: **Quantity Surveying and Cost Estimation Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **Nil**

Course Objectives:

The Quantity and Cost Estimation Laboratory course aims to equip students with practical skills and theoretical knowledge essential for accurate estimation and management of construction project costs. Students will develop a thorough understanding of the cost estimating process, encompassing various types of estimates and their applications in construction projects. Practical exercises will include conducting comprehensive resource price surveys to assess the costs and availability of construction materials, equipment, and labor in the local market.

List of Experiments:

1. Introduction (Cost estimating process, Design process and Types of cost estimates). Budget Estimates (Budget estimates, Design budget estimates and Budget estimate accuracy).
2. Resources price survey report (prices of all construction materials, equipment and manpower along with their types and availability in local market). Tender notice (Construction / consultancy work)
3. Summary of PPRA document.
4. Quantity estimation of single room house using long wall method and centerline method.
5. Quantity estimation of one-story residential building using long wall method and centerline method.
6. Quantity estimation of earthwork (excavation for foundation and underground structures).
7. Quantity estimation of a RCC Building (RCC column, beam, slab).
8. Quantity estimation of a water tank, septic tank, staircase and retaining wall.
9. Quantity estimation of pavement of a typical road network.
10. Quantity estimation of sewer and pipeline system.
11. Quantity estimation of flexible and rigid pavement.
12. Rate Analysis and preparation of BOQs.
13. Open ended lab

Recommended Books:

Textbook:

1. Steven J. Peterson and Frank R. Dagostino, Estimating in Building Construction (2015) 8th Edition, Pearson Publishing.

Reference Books:

1. Marks Kalin, Robert S. Weygant, Harold J. Rosen & John R. Regenar, Construction Specifications Writing: Principles and Procedures (2010), Wiley.
2. Steven J. Peterson, Construction Estimating Using Excel (2017) 3rd edition Pearson publishing.
3. Standard Form of Bidding Documents by Pakistan Engineering Council.
4. David Chappell, Construction Contracts Questions and Answers (2021), 4th Edition, Taylor & Francis. Jimmie Hinze, Construction Contracts (2010), 3rd Edition, McGraw-Hil

Course Code: **CEE402**
Course Title: **Steel Structures**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

The main purpose of this course is to differentiate between different design philosophies related to working stress and ultimate strength conditions. This course will also help the students to classify types of loads and load combinations, types of steel structures, General steel manufacturing and historic back ground, various processes and property modifications by Quenching, Tempering, Annealing and obtaining specific steel properties, residual stresses and their effect on various structural elements (tension, flexure, compression).

Course Outline:

1. **Introduction**
   - Use of steel as a structural material
   - Mechanical properties
   - Types and shapes of structural steel members
   - Specifications and design codes
   - Design philosophies, load and safety factors

2. **Fundamentals of Working Stress Method**
   - Overview of Allowable Stress Design (ASD)
   - Service load and allowable stresses

3. **LRFD Method of Design**
   - Factor of safety, loads and load combination
   - Concept of load and resistance factors
   - Plastic design and limits on design
   - Analysis and design of tension members
   - Analysis and design of Compression Members.
   - Local and overall stability
   - Euler's buckling load in columns

4. **Analysis and design of beams**
   - Compact, non-compact and slender sections
   - Bending strength
   - Shear Strength
   - Lateral torsional buckling
   - Biaxial Bending
   - Purlins, sag rods

5. Beam-column and axial-flexure interaction

- Second order effects
- Moment magnification
- Plate girder proportioning and design

6. Simple welded and bolted connections

7. Overview of moment and shear connections

Recommended Books:

Textbooks:	1. Steel Design by William T. Siggui, 6th edition 2. Structural Steel Design by Jack C. McCormac, 5th Edition
Reference Books:	1. American Institute of Steel Construction-AISC Manual 15th Edition 2. Simplified design of steel structures by James E. Ambrose, Harry Parker, 1997 John Wiley & sons Inc.

Course Code: **CEE404**

Course Title: **Hydraulics Engineering**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **CEE208**

Course Objectives:

To enable students to learn fundamentals of hydraulic engineering, particularly related to open channel flow, flow through pipes, hydraulic structures, dam and hydropower engineering. In this course student will learn the application of the principles of fluid mechanics to problems dealing with the collection, storage, control, transport, regulation, measurement, and use of water.

Course Outline:

1. **Steady Flow in Open Channel**
   - Specific energy and critical depth
   - Dynamic equation of gradually varied flow, surface profiles and back water curves
   - Humps and constrictions Hydraulic jump
   - Broad crested weirs, venturi flume and critical depth meters

2. **Unsteady Flow**
   - Flow through pipes, orifices and over weirs under varying heads
   - Unsteady flow through pipe lines, water hammer, instantaneous and slow closure of valves
   - Surges in open channel

3. **Dimensional Analysis and Similitude**
   - Similitude in hydraulic models
   - Similitude requirements, geometric, kinematics and dynamics similarities, dimensionless numbers and their significance
   - Raleigh's method
   - Buckingham's PI-theorem and its application, physical models, techniques and analysis
   - Introduction to numerical models

4. **Hydraulic Structures**
   - Canal Falls, flumes, canal outlets
   - Cross drainage works: types and functions

5. **Dams and Hydro Power Engineering**
   - Selection of hydropower sites
   - Components and layout of hydropower schemes
   - Types of storage dams, forces on dams, design of gravity dams
   - Reservoir engineering, operation and regulation of storage reservoirs

- Sediment Transport in Channels
- Sedimentation Problems in Reservoirs

6. Drainage

- Definition, Land reclamation Surface Drainage
- Subsurface Drainage
- Estimation of discharge capacity of Cross-drainage structures Disposal of drainage effluents

7. Advanced Topics in Hydraulics

- Modern trends in hydraulic engineering
- Computational fluid dynamics (CFD)
- Case studies and real-world applications

Recommended Books:

Textbook:	1. Roberson J. A., Cassidy J. J., and Chaudhry M. H., (1998) Hydraulic Engineering, John Wiley & Sons
Reference Books:	1. Wynn P., (2014) Hydraulics for Civil Engineers, ICE Publishing. 2. Lindell J. E., Moore W. P., and King H. W., (2018), Handbook of Hydraulics, 8th Edition, McGraw Hill

Course Code: **CEE406**

Course Title: **Reinforced Concrete Design II**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE308**

Course Objectives:

The purpose of this course is to provide students with a thorough understanding of the design of reinforced concrete structures. The course will enable students to design various reinforced and pre-stressed structural elements using conventional and advanced design approaches. Topics covered will include: design of various types of slabs, design for torsion, slender columns, prestressed concrete design, introduction to earthquake design of reinforced concrete structures, and computer aided design of structures

Course Outline:

1. **Two-way Slab (coefficient method), Flat Plate & Waffle Slab**
   - Analysis and design of two-way slab (coefficient method) for flexure and shear under gravity loading.
   - Analysis and design of flat Plate for flexure and shear under gravity loading.
   - Analysis and design of waffle slabs for flexure and shear under gravity loading.

2. **Design for Torsion Slender Columns**
   - Analysis and design of slender columns subjected to combined flexure and axial loading,
   - Guidelines for design of shear walls-an over view.

3. **Design of Different Types of Foundations**
   - Analysis and design of isolated footing, combined footing, strip and mat footings, Pile caps.
   - Analysis and design of various types of stairs and staircases.

4. **Prestressing Principles & Design Philosophy**
   - Principles of prestressing, properties of high strength materials,
   - Behavioral aspects of prestressed beams and comparison with reinforced concrete beams,
   - Post tensioning and pre-tensioning techniques,
   - Prestress losses, immediate and time dependent losses, lump sum prestress loss.
   - Analysis and design of prestressed beams.

5. **Introduction to earthquake-resistant design of structures.**

6. **Design of gravity and cantilever retaining walls.**

7. Introduction to computer-aided analysis and design

Recommended Books:

Textbooks:

1. M. Neville, (2011), Properties of Concrete, 5th edition, John Wiley.
2. Design of Concrete Structures by Nelson/Winter 15th Edition.

Reference Books:

1. James K Wight and James G. Macgregor, Reinforced design: Mechanics and design, (2011), 6th (or latest) Edition.
2. Hassoun, M. N. & Al-Manaseer, A, (2015), Structural Concrete: Theory and Design, 7th (or latest) Edition.
3. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2017), Reinforced Concrete Design, Wiley; 8th (or latest) Edition.
4. N.V.Nayak & A.K.Jain, Handbook on Advanced Concrete Technology.
5. Concrete Structures, Part-I, 3rd (or latest) Edition, by Zahid Ahmed Siddiqi, 2016.
6. ACI Building Code Requirement for Reinforced Concrete Structures 318.

Course Code: **CEE410**

Course Title: **Design of Concrete Structures**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **CEE308**

Course Objectives:

To introduce students with the analysis and design of a complete concrete structure and to make preliminary drawings

Course Outline:

Basic Considerations: Types and magnitude of loads (live, Dead, EQ, and wind), Load combinations, ACI 318-08 requirements. Positioning and sizing of structural members for gravity and lateral loads and Choice of material properties for analysis. Analysis of Concrete Structures (Analysis of a complete apartment structure for various load combinations, Ensuring correctness of analysis using equilibrium and Retaining analysis results for governing load combination. Training of relevant software (SAP2000, ETABS etc.) Strong ground motion and calculation of base shear for given building frame system. Seismic design of reinforced concrete columns according to provisions of ACI code. Static seismic design of concrete structures. Detailing of reinforced concrete structures for earthquake resistance as per code. General seismic design considerations. Common mistakes in practice, regularity, lateral force resisting mechanism and ductility. Bridge Engineering: Types of bridges. Site selection. Bridge loadings. Load distribution on bridge deck. Introduction to design of deck for a simple concrete bridge.

Recommended Books:

1. Reinforced concrete: a fundamental approach by Edward G. Nawy
2. ACI committee 318, Building Code Requirement for Structural Concrete
3. Reinforced concrete structures by Park. R and T. pauly Wiley, Newyork, 1975
4. Design of Highway Bridges: An LRFD Approach, 3rd Edition, Richard M. Barker, Jay A. Puckett

Course Code: **CEE414**
Course Title: **Pavement Design and Rehabilitation**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **CEE301**

Course Objectives:

This course provides solid working knowledge of pavement design, construction, maintenance, and preservation. This course covers the methods and procedures to address the issues in pavement design, construction, and performance for new construction, reconstruction, and rehabilitation (e.g., road widening) pavement projects.

Course Outline:

Pavement Systems (Introduction, Pavement types, Wheel loads, Design factors, Comparison of flexible and rigid pavements, Flexible pavement design & stresses, Layered system concept, Two layered system, Three layered system, Rigid pavement design and Measured material variability of pavement systems). Pavement Design (ASSHTO design methods Flexible and Rigid). Road Drainage Design work (Surface drainage for roads, Importance of surface drainage, Types and uses of surface drains, Draining the carriageway, Subsurface moisture control for road pavements, Protecting the road pavement and foundation and Designing filter for drainage). Pavement Rehabilitation and Pavement Distresses (Causes of road failures, Distresses in flexible and rigid pavements and Distress evaluation). Field Work (Distress survey). Introduction to Pavement Design Software. Practicals (Application of Rolling Surface Profiler for Transverse Profilograph and Finding IRI by Using Longitudinal Profilometer).

Recommended Books:

1. Pavement Analysis and Design Yang, H. Huang, second Edition, Pearson, Prentice Hall, 2004
2. Principles of Pavement Design Yoder, E.J, and Witczak M.W., New York, John Wiley and Sons,1975.
3. Pavement Management for Airports, Roads, & Parking Lots, Shahin, M. Y., Chapman and Hall, 2002
4. Transportation Engineering by Paul H. Wright and Norman J. Ashford.

Course Code: **CEE415**

Course Title: **Traffic Engineering and Safety**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE301**

Course Objectives:

The primary objective of this course is to introduce undergraduate students to topics in traffic safety engineering and equip them with various critical spots identification techniques through various field studies as spot speed study, turning movement counts/vehicle counts, vehicle delay study, saturation flow study etc. State-of-the-art computer applications, statistical analysis, and current research findings will be presented throughout this course.

Course Outline:

Traffic Engineering (Introduction, Elements of traffic engineering, Traffic characteristic, Traffic survey and Mass transit and rapid transit). Traffic Flow Characteristics (Introduction, Nature of traffic flow, Parameters connected with traffic flow, Categories of traffic flow, Analysis of speed flow and density relationship, Traffic stream characteristics, Interrupted and uninterrupted traffic flow models and Queuing theory and shock wave theory). Traffic Safety (Introduction, Traffic regulation and control, Traffic signs, Traffic marking, Traffic control devices and system, Clear roadside recovery areas, Guardrail design, Median barriers, Crash cushions and Highway lighting, Measures of safety and identification of hazardous location and Safety considerations in highway design), Traffic Signals (Basic concepts of traffic signals, Signal design/control for arterial roads and delays at isolated traffic signals). Practicals (Spot speed study, Turning movement counts/vehicle counts, Vehicle delay study, Saturation flow study and Parking study).

Recommended Books:

1. Introduction to Traffic Engineering, a manual for data Collection and analysis by Thomas R Currin.
2. Traffic Engineering by Roger P. Roess, Elena S. Prassas.
3. Transportation Engineering by C. Jotin Khisty, B.Kent Lall.
4. Principles of Highway Engineering and Traffic Analysis, 6th Edition by Fred L. Mannering, Scott S. Washburn
5. Traffic Engineering (4th Edition) 4th Edition by Roger P. Roess, Elena S. Prassas, William R. McShane

Course Code: **CEE416**

Course Title: **Road Construction, Materials and Practices**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE301**

Course Objectives:

The course is designed for senior undergraduate students interested in the field of civil engineering materials and highway design. It emphasizes teamwork and involves collection of information from local state agencies and local industry regarding materials, design and specification requirements. The course objective is to develop technical competence in the fundamental behavior of materials used in building pavements including soil-aggregate mixtures, asphalt binders and mixtures and Portland cement concrete, methods of field construction and quality control of these materials, role of material properties in design of pavements, testing methods, selection criteria, and standard specifications.

Course Outline:

Road Construction: Subgrade (Function of soil as subgrade, Subgrade stabilization and Principles of subgrade design), Base and Sub base (Introduction, Types of base course, Laying of base/sub-base), Wearing Course (Asphalt concrete wearing course, Types of surface dressing, Factors governing the performance of surface dressing), Construction of Rigid Pavements (Functions of sub-base, Laying of rigid pavements). Materials and Characterization: Asphaltic Materials (Introduction, Chemical composition of asphalt binders, Asphalt binder properties, Asphalt grades, Sampling and handling, Marshall mix design, Asphalt concrete properties, Batch mixing, transporting and handling of asphalt), Portland Cement Concrete (Introduction, PCA mix design, Batch mixing, transporting and handling of concrete), Construction Practices: Road Construction (Construction equipment, Equipment output, Equipment employment). Asphalt and Concrete Batching Plants: Concrete Batching Plant (Introduction, Material calculations, Layout and material handling), Asphalt Batching Plant (Introduction, Material calculations, Layout and material handling). Practicals (Standard viscosity test for bituminous materials, bituminous materials extraction test, Marshall stability and flow test, Preparation of job mix and PG binder testing).

Recommended Books:

1. Concrete Pavement Design, Construction, and Performance (2nd edition) Norbert J. Delatte
2. Highway Engineering: Pavements, Materials and Control of Quality by Athanassois Nikaloides
3. Asphalt: Its Composition, Properties and Uses by Ralph Newton Traxler - Reinhold

Course Code: **CEE420**

Course Title: **Construction Project Scheduling**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **MGT462**

Course Objectives:

Understanding and applying scheduling and control to today's construction projects is essential to successful construction management. Project scheduling emphasizes network-based schedules, such as critical path management (CPM), network calculations, critical paths, resource scheduling, probabilistic scheduling, and computer applications.

Course Outline:

Introduction (Schedule, Need for scheduling, Purposes of construction schedules). Gantt Chart (Construction activities, Activity duration, Gantt charts). CPM Diagrams (CPM diagrams, Arrow diagram, Node diagram). CPM Calculations (Float, Arrow diagram calculations, Critical path), Least-Cost Scheduling. Resource Leveling. Scheduling by Probabilistic Models (Project evaluation & review technique - PERT, Statistical tools, Computing PERT durations). Developing the Project Schedule (Understanding the project, Specifications, Contract, Construction drawings, Conceptual approach, Physical creation of the schedule, Use of computer software like MS Project, etc. in project planning and scheduling). Using a Schedule to Prove Delay Claims.

Recommended Books:

1. Construction Project Scheduling by Callahan, T., Michael Quackenbush, G. Daniel and Rowings, E. James
2. Professional Construction Management: Including C.M, Design-Construct, and
3. General Contracting' by Barrie and Paulson, (1992), McGraw-Hill, Inc.
4. Techniques for Construction Network Scheduling by Stevens, D. James

Course Code: **CEE421**
Course Title: **Contract Management**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **MGT462**

Course Objectives:

Construction industry is project based and every project involves contact between client, contractor and consultant. Therefore, understanding of the project contract management is required to complete a project successfully.

Course Outline:

Introduction (Principles of administration of construction contracts, Types of Construction Contracts). Option for Project Delivery (Formation of Construct Contracts and Subcontracts, Lump-Sum Contracts, Unit-Price Contracts, Cost-Plus-Fee Contract, Guaranteed Maximum Price Contract and Time-and-Material Contract). Procurement Methods (Bid Method, Negotiated Method). Subcontracting Partnering (Subcontracting, Partnering and Strategic Alliances). Analysis of Contracts (Analysis of Selected Contracts, Contract Clauses and Comparison). Contract Disputes (Reasons of Contract Disputes, Clauses of Contract to Prevent Disputes). Dispute Resolution (Methods of Dispute Resolution; Mediation, Arbitration and DAB). Contract claims. International Contracting (International contracting, Joint Ventures, FIDIC Form of Contract).

Recommended Books:

1. Construction Contract: Law and Management by John Murdoch and Will Hughes.
2. Fundamental of Construction Law by Carina Y Enhada
3. Construction Law by Brian M Samuel
4. Construction Management in Practice by Fellows, R. Langford, D. Newcombe, R. and Urry, S. (2002), Blackwell Science Ltd.
5. Project Management in Construction by Levy, M. Sidney
6. Project Management for Engineering and Construction by Oberlender, D. Garold
7. A Guide to the Project Management Body of Knowledge, Project Management Institute, USA.

Course Code: **CEE423**

Course Title: **Environment Management and Impact Assessment**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE307**

Course Objectives:

The objective of this course is to give students an introduction to environmental concepts and their relevance to construction. The course includes a discussion of key environmental management issues, assessment of impact and analysis based on a construction case-study.

Course Outline:

Introduction (Environmental management, National environmental policy). Environmental legislation, Environmental Impact Assessment (EIA) process, Environmental Impact Prediction and Evaluation during construction & operation of projects, Mitigation measures, Modeling, Environmental monitoring & auditing, Environmental management issues, Case Studies, Environmental Assessment (Framework for environmental assessment, Description of the environmental setting). Environmental Impacts (Prediction and assessment of impacts on the water, Socio-economic environment). Methods of impact analysis. Environmental Decision Making. Writing Impact Statement. Water Quality (Water quality and impact of project on water quality). Future of Environmental Impact Assessment (Future of environmental management, Environmental issue and Future of environmental impact assessment). Mitigation of environmental impacts. World Bank (WB) and Asian Development Bank (ADB) guidelines

Recommended Books:

1. ASCE, Environmental Impact Assessment Handbook, Barbara Carroll & Nicholas Pearson, Thomas Telford, 2002.
2. ASCE, Environmental Handbook for Building and Civil Engineering Projects – Volume 1: Design and Specification, CIRIA Special Publication 97, Thomas Telford, 1994.
3. ASCE, Environmental Handbook for Building and Civil Engineering Projects – Volume 2: Construction Phase, CIRIA Special Publication 98, Thomas Telford, 1994.
4. Environmental Assessment in Practice by Owen Harrop and Ashley Nixon.
5. Environmental Impactsfor Water Resources Planning by Mehmet Ali Yurdusev
6. Environmental Impact Assessment by A. K. Shrivastava
7. Methods of Environmental Impact Assessment by Peter Morris & Riki Therivel
8. Environmental Impact Assessment: A Methodological Approach by Richard K. Morgan.
9. Environmental Impact Assessment by Canter L. W (1996), 2nd Ed., Mc Graw Hill, New York

Course Code: **CEE424**
Course Title: **Elementary Structural Dynamics**
Credit Hours: **3(3, 0)**
Pre-requisite(s): **CEE308**

Course Objectives:

The objectives of the course are to give students' the ability to understand the basic theories of seismology and seismic response of structures. The course has been designed to introduce to the students structural dynamics and its application in earthquake engineering. The course will include calculation of base shear and its distribution at different story levels. The detailing of concrete structures and inclusion of seismic requirements in design of steel structures will also be introduced. The course will be conducted in the form of lectures followed by the homework assignments. The students will be assessed based on their overall performance in the quizzes, class tests, homework assignments, and end semester examination.

Course Outline:

Introduction to Seismology and earthquake engineering (Introduction to earthquake engineering. Major tectonic plates and earthquake phenomena. Types of faults and major tectonic features in Pakistan. Types of seismic waves and introduction to some major earthquakes in the Pakistan and world. Introduction to parameters of seismic response of structures. Introduction to Seismic hazard assessment. General seismic design considerations: common mistakes in practice, regularity, lateral force resisting mechanisms and ductility). Introduction to structural dynamics (Introduction to equation of motion and solution methods, Degrees of freedom and their inclusion in equation of motion. Introduction damping, Undamped and damped free vibration, critical damping, overdamped and underdamped system, equation of motion for each type of system. D'Alembert's Principle, free body diagram, frequency, period, amplitude of motion, natural frequency, Introduction to SDOF system, undamped SDOF system, damped SDOF system. Introduction to earthquake excitation, equation of motion of SDOF system for earthquake excitation. Generalized SDOF system, rigid body assemblages, lumped mass system: shear building. Equation of motion for SDOF Lumped mass system: shear building and solution of various examples. Strong Ground Motion (Equivalent lateral force procedure and Calculation of base shear for given building frame system. Seismic design of reinforced concrete columns, according to provisions of ACI. Seismic design of concrete Structures. Seismic design of steel structures. Detailing of reinforced concrete structures for earthquake resistance as per Code).

Recommended Books:

1. Mario Paz, (1996), Structural Dynamics, Theory and Computation, 1st Indian Edition, CBS Publishers and Distributed, New Delhi.
2. Anil K. Chopra, (2006), Structural Dynamics and its Application in Earthquake Engineering, 2nd Edition, John Wiley and Sons, New York, NY, USA.

3. Alan Williams, Ph. D., S.E., C. Eng.,2003, Seismic Design of Buildings and Bridges, (2002-2003 Edition), Oxford University Press, USA.
4. Bozorgnia Y, Bertero V V, (2004), EARTHQUAKE ENGINEERING: From Seismology to Performance-Based Engineering, CRC Press LLC, ISBN: 0-8493-1439-9
5. Chen, W F, Scawthorn, C (2003), Earthquake Engineering Handbook, CRC Press LLC, ISBN:0-8493-0068-1
6. Chopra AK, (3rd Ed.), (2007), Dynamics of Structures: Theory and Application to Earthquake Engineering, Prentice-Hall Inc., ISBN: 9780131561748
7. Paulay, T. and. Priestley, M.J.N (1992), Seismic design of reinforced concrete and masonry buildings, Wiley. ISBN: 0-471-54915-0
8. Clough RW, Penzien J (1993), Dynamics of Structures, McGraw Hill. ISBN: 0-07- 011394-7

Course Code: **CEE425**

Course Title: **Geo Informatics**

Credit Hours: **1(1, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

This course is designed to familiarise the students of Civil Engineering with the field of Geoinformatics which has at its core the technologies supporting the processes of acquiring, analysing and visualizing spatial data. This includes Field Surveying, Photogrammetry, Geographic Information System (GIS), Global Navigation Satellite System (GNSS) and Remote Sensing.

Course Outline:

1. **Introduction to Geo Informatics and Resources of Information**
   - Photogrammetric surveying
   - Satellite System
   - Aerial and Satellite photogrammetry

2. **Geographic Information System (GIS)**
   - Fundamentals of GIS
   - Spatial Data types and acquiring consideration
   - Data models and structures
   - Coordinate System
   - Datum and map projection and their transformation
   - Attribute-based operation
   - Introduction to Spatial Analysis

3. **Remote Sensing (RS)**
   - Basic Concepts
   - Physical basis of Remote Sensing
   - Earth Resources Satellites / Platforms
   - Sensors
   - Types of Resolutions
   - Geo-referencing
   - Image Processing Techniques and Classification
   - Global Positioning System (GPS)
   - Navigational Satellites
   - Positioning Systems (GLONASS, GPS & Galileo)
   - Fundamentals and Elements of GPS
   - System Operation & Characteristics
   - Errors and Atmospheric effects
   - Differential GPS (DGPS)

Recommended Books:

Textbook:	1. Remote Sensing and Image Interpretation, Thomas M. L., Ralph W. K., 5th Edition
Reference Books:	1. Introduction to Geographic Information Systems, Chang K. T., 3rd Edition 2. Getting started with Geographic Information System, Clarke, K. (2004), 2nd Edition

Course Code: **CEE426**

Course Title: **Foundation Engineering**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **CEE204**

Course Objectives:

In this course, students will learn how to examine a site for geotechnical investigations. They'll then be taught to design different types of shallow foundations that suit various loads and ground conditions. Additionally, the course covers the assessment of how much load deep foundations can bear in different ground situations. This knowledge helps students create sturdy and effective foundation designs based on the specific characteristics of the site and loading condition.

Course Outline:

1. **Soil Exploration**
   - Significance/objectives of soil exploration
   - Planning of soil exploration program
   - Soil exploration methods: probing, test pits, auger boring, wash percussion, rotary drilling, and geophysical methods,
   - Types of 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
   - Soil liquefaction
   - Borehole logs and subsoil exploration report

2. **Introduction to Foundations**
   - Purpose and types of foundations
   - Selection of foundation type and depth
   - Design requirements for the foundations
   - Foundation design Criteria
   - Allowable settlements and angular distortion

3. **Bearing Capacity and Design of shallow foundations**
   - Types of bearing capacities: gross and net bearing capacity/pressures
   - Modes of bearing capacity failures
   - Development of bearing capacity theory.
   - Methods to evaluate soil bearing capacity: Terzaghi's, Meyerhof's, Hansen's, Vesic's, Skempton's method.
   - Effects of water table on bearing capacity of soils.
   - Bearing capacity from in-situ tests; SPT, CPT, Plate load test
   - Presumptive values of bearing capacity.

- Design of strip, isolated, combined and raft foundations, concept of floating/compensated foundations.
- Foundations on difficult soils: design and preventive measures
- Related numerical problems.

4. Pile Foundations

- Introduction to deep foundations
- Types of deep foundations
- Reasons to use deep foundations.
- Classification of piles
- Methods of installation of Piles
- Load transfer mechanism of piles
- Load carrying capacity of piles in different soils.
- Empirical correlations for pile capacity evaluation
- Settlement of Piles.
- Pull out resistance of piles.
- Pile driven formulas.
- Negative skin friction
- Pile load test and interpretation.
- Pile group capacity, group efficiency, elastic, and consolidation settlement of group of piles, uplift capacity of pile group.
- Rock socketed piles

5. Introduction to relevant software

- GeoStudio, Plaxis etc.

Recommended Books:

Textbook:

1. Baraja M. Das (2017). Principles of Foundation Engineering, 9th Ed, Cengage Learning, Inc., USA.

Reference Books:

1. Robert Wade Brown (2004), Practical Foundation Engineering Handbook, McGraw-Hill.
2. Donald P. Coduto (2001), Foundation Design: Principals and Practice, (Latest Ed), Prentice Hall, NJ.
3. Tomlinson, M. J. (2001) Foundation Design and Construction, 7th Ed (or latest), Pearson Education.
4. Bowles, J. E. (1998), Foundation Analysis and Design, 6th Edition (or latest ed), McGrow-Hill International Press.
5. Smith and Ian Smith (1998), Elements of Soil Mechanics, 7th Ed (or latest), Blackwell Science.

Course Code: **CEE427**

Course Title: **Pavement Analysis and Design**

Credit Hours: **2(2, 0)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of about the fundamentals of Pavement Engineering. The course will also provide detailed guidance on both quantitative and computerized techniques for solving problems related to Pavement Design and Analysis. Students shall be able to apply principles of Pavement Engineering to evaluate, analyze and design asphalt mix and asphalt pavement.

Course Outline:

1. **Concept of Pavement Design and Material Specification**
   - The Pavement, Types of Pavements, Principle of Pavement Design
   - Approaches to Pavement Design, Pavement Design Standards
   - Resilient behavior of Unbound Granular Material
   - Asphalt Binder Rheology, Asphalt Mixtures Design (Marshall Method of Mix Design)
   - Introduction to SHRP Specification and Superpave Method of Mix Design

2. **Pavement Design Methods and Analysis**
   - Axle load, equivalent single axle load, classification of commercial vehicles, axle loading of commercial vehicles, influence of axle configuration and loading on the damaging effect
   - Contact area between the tyre and road, repetition, and impact factors
   - Methods of pavement design (Empirical ~Mechanistic), AASHTO pavement design method, Group Index Method, CBR Method, Wester Guard method, Road Note, AASHTO 1993 pavement design methodology and practice, Road Note 31 pavement design methodology
   - Concept of mechanistic-empirical pavement design, stresses and strains in flexible & rigid pavements.

3. **Pavement Evaluation and Rehabilitation**
   - Pavement failures, construction and maintenance
   - Pavement evaluation and rehabilitation, introduction to non-destructive testing
   - Recycling methods and reclaimed asphalt pavement (RAP), pavement drainage system and design

Recommended Books:

Text & Reference Books:

4. Yang H. Huang, (2003), Pavement Analysis and Design, 2nd Edition (or latest), Pearson Higher Education.

5. Fred. L. Mannering and Scott S. Washburn, (2013), Principles of Highway Engineering and Traffic Analysis, 5th Edition (or Latest), John Wiley & Sons. NY.
6. Asphalt Institute, (2005), Mix Design Methods for asphalt concrete and other Hot-Mix Types, MS-2, 2nd Edition (or latest), Asphalt Institute.
7. Asphalt Institute, (2005), Superpave Mix Design, SP-2, 3rd Edition, Asphalt Institute.

Course Code: **CEE428**
Course Title: **Irrigation Engineering**
Credit Hours: **2(2, 0)**
Pre-requisite(s): **CEE208**

Course Objectives:

This course aims to introduce knowledge and skills namely the principles and basics of irrigation methods, design of irrigation systems and irrigation network for the purpose of irrigation applied to traditional and modern irrigation systems

Course Outline:

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
   - 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

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
   - Lacey's theory, Rational approach, Channel design software

- Canal Lining and its types
- Permissible velocities in lined channels
- Design interpretation of lined irrigation channels

6. 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
- Design of weir on permeable foundation
- Types, Essential requirements and characteristics of outlets
- Canal Falls, Cross drainage works: types and functions

7. 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:

Text & Reference Books:

1. Peter, W., and Yitayew, M., (2015) Irrigation and drainage engineering, Springer
2. Hossain, A., Practices of irrigation & on-farm water management, Springer
3. Singh V, P., and Su Q., (2022) Irrigation Engineering (Principles, Processes, Procedures, Design, and Management), Cambridge University Press
4. Madan Mohan Das, Irrigation and Water power Engineering

Course Code: **CEE429**

Course Title: **Hydraulics Engineering Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE208**

Course Objectives:

To enable students to learn fundamentals of hydraulic engineering, particularly related to open channel flow, flow through pipes, hydraulic structures, dam and hydropower engineering. In this course student will learn the application of the principles of fluid mechanics to problems dealing with the collection, storage, control, transport, regulation, measurement, and use of water.

List of Experiments:

1. To measure water level and velocity along the channel.
2. To estimate flow rate through changes in the channel section.
3. To analyze water hammer phenomena through water hammer apparatus.
4. Characterization of the hydraulic jump.
5. To study the subcritical and supercritical flows.
6. Application and understanding of Manning formula.
7. To demonstrate flow over weir in open channel.
8. Perform experiment on flume to plot E~y diagram for uniform flow.
9. To examine the flow through sluice gate in open flow channel.
10. To produce a hydraulic jump in tilting flume.
11. Relationship between backwater level and discharge level.
12. To examine the sediments transport and settling mechanisms.
13. Simulation of water structure interaction using hydraulic modeling software.
14. Open ended lab

Recommended Books:

Textbook:

1. Roberson J. A., Cassidy J. J., and Chaudhry M. H., (1998) Hydraulic Engineering, John Wiley & Sons

Reference Books:

1. Wynn P., (2014) Hydraulics for Civil Engineers, ICE Publishing.
2. Lindell J. E., Moore W. P., and King H. W., (2018), Handbook of Hydraulics, 8th Edition, McGraw Hill

Course Code: **CEE430**

Course Title: **Reinforced Concrete Design II Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE308**

Course Objectives:

The purpose of this course is to provide students with a thorough understanding of the design of reinforced concrete structures. The course will enable students to design various reinforced and pre-stressed structural elements using conventional and advanced design approaches. Topics covered will include: design of various types of slabs, design for torsion, slender columns, prestressed concrete design, introduction to earthquake design of reinforced concrete structures, and computer aided design of structures

List of Experiments

1. Development of excel sheets for slab design and beam design.
2. To design and to draw structural drawings of slabs
3. To design and to draw structural drawings of continuous beams.
4. ETABS introduction, grids layout, material properties, member sizes, modifiers, and other details
5. Geometric layout (beams, column, shear wall slabs) replication (mirror, liner, story)
6. Load generation (basic and factors load, seismic load cases, mass source)
7. Extracting column design, extracting beam and slab design
8. Support reaction, extracting reaction for tentative footing sizes
9. Exporting ETABS file for safe foundation design.
10. Preliminary foundation layout and drawings,
11. Checking bearing pressures, shear check and foundation sizes
12. Detailing of structural members
13. Open ended lab

Recommended Books:

Textbooks:
1. M. Neville, (2011), Properties of Concrete, 5th edition, John Wiley.
2. Design of Concrete Structures by Nelson/Winter 15th Edition.

Reference Books:
1. James K Wight and James G. Macgregor, Reinforced design: Mechanics and design, (2011), 6th (or latest) Edition.

2. Hassoun, M. N. & Al-Manaseer, A, (2015), Structural Concrete: Theory and Design, 7th (or latest) Edition.
3. Chu-Kia Wang, Charles G. Salmon, José A. Pincheira, (2017), Reinforced Concrete Design, Wiley; 8th (or latest) Edition.
4. N.V.Nayak & A.K.Jain, Handbook on Advanced Concrete Technology.
5. Concrete Structures, Part-I, 3rd (or latest) Edition, by Zahid Ahmed Siddiqi, 2016.
6. ACI Building Code Requirement for Reinforced Concrete Structures 318.

Course Code: **CEE431**
Course Title: **Geo Informatics Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **Nil**

Course Objectives:

The purpose of this course is to provide students with hands-on experience in applying the theoretical concepts learned in the classroom. Through a series of practical exercises, students will become proficient in using GIS and remote sensing software, as well as GPS instruments for spatial data acquisition and analysis.

List of Experiments:

1. Introduction to Arc GIS interface and its related terminologies / tools.
2. To locate the features on the ground / measure lengths and area of the object using Google Earth /Arc GIS.
3. To execute the basic commands of point, polyline and polygon layer in Green Valley map.
4. To reference, digitize and edit the feature in map / raster image using Arc GIS.
5. To find the coordinates of a point on ground using GPS instrument. To generate a point showing the coverage of Met. Station in map.
6. To model and analyze spatial dataset using tiff file/ satellite image.
7. To convert coordinate and projection system of a map using GIS software.
8. To apply image processing techniques using remote sensing software.
9. Detect changes in land use over time by comparing satellite images from different periods.
10. Perform a suitability analysis for urban planning using GIS.
11. Conduct a hydrological analysis to determine watershed and flow accumulation using DEM (Digital Elevation Model).
12. Create professional-quality maps and layouts.
13. Open ended lab

Recommended Books:

Textbook:
1. Remote Sensing and Image Interpretation, Thomas M. L., Ralph W. K., 5th Edition

Reference Books:

1. Introduction to Geographic Information Systems, Chang K. T., 3rd Edition
2. Getting started with Geographic Information System, Clarke, K. (2004), 2nd Edition

Course Code: **CEE432**

Course Title: **Pavement Analysis and Design Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of about the fundamentals of Pavement Engineering. The course will also provide detailed guidance on both quantitative and computerized techniques for solving problems related to Pavement Design and Analysis. Students shall be able to apply principles of Pavement Engineering to evaluate, analyze and design asphalt mix and asphalt pavement.

List of Experiments:

1. To determine particle shapes (elongation & flakiness index) of various aggregate samples and then to discuss the results.
2. To determine resistance to degradation of coarse aggregate by abrasion and impact in the Los Angeles abrasion machine.
3. To determine penetration grade of bituminous sample.
4. To determine the softening point of bituminous sample by using Ring & Ball apparatus.
5. To determine the flash and fire point of bituminous sample by Cleveland Open Cup apparatus.
6. To determine the ductility of bituminous sample using a ductilometer.
7. To perform the CBR test for the sub-grade on the given soil sample.
8. Non-repetitive static plate load test of soils and flexible pavement components for use in evaluation and design of airports and highway pavements.
9. To find out JMF for specified paving job (Marshall Method).
10. Open ended lab

Recommended Books:

Text & Reference Books:

8. Yang H. Huang, (2003), Pavement Analysis and Design, 2nd Edition (or latest), Pearson Higher Education.
9. Fred. L. Mannering and Scott S. Washburn, (2013), Principles of Highway Engineering and Traffic Analysis, 5th Edition (or Latest), John Wiley & Sons. NY.
10. Asphalt Institute, (2005), Mix Design Methods for asphalt concrete and other Hot-Mix Types, MS-2, 2nd Edition (or latest), Asphalt Institute.
11. Asphalt Institute, (2005), Superpave Mix Design, SP-2, 3rd Edition, Asphalt Institute.

Course Code: **CEE433**

Course Title: **Irrigation Engineering Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **CEE208**

Course Objectives:

This course aims to introduce knowledge and skills namely the principles and basics of irrigation methods, design of irrigation systems and irrigation network for the purpose of irrigation applied to traditional and modern irrigation systems

List of Experiments:

1. Evapotranspiration measurement using simple pan evaporimeters
2. Demonstration of irrigation furrows: water distribution and efficiency
3. Impact of water quality on soil and crop health
4. Measurement of flow rate in open channels
5. Measurement of infiltration rate in soils
6. Measuring runoff in simple sloped surfaces
7. Analysis of irrigation water conveyance efficiency in canals
8. Estimation of storage capacity of reservoirs/ dams
9. Irrigation water requirement calculation
10. Design and layout of drip irrigation system
11. Layout and design of an irrigation canals using software
12. Design of a weir on permeable foundation
13. Open ended lab

Recommended Books:

Text & Reference Books:

12. Peter, W., and Yitayew, M., (2015) Irrigation and drainage engineering, Springer
13. Hossain, A., Practices of irrigation & on-farm water management, Springer
14. Singh V, P., and Su Q., (2022) Irrigation Engineering (Principles, Processes, Procedures, Design, and Management), Cambridge University Press
15. Madan Mohan Das, Irrigation and Water power Engineering

Course Code: **CEE434**
Course Title: **Design of Concrete Structures Lab**
Credit Hours: **1(0, 1)**
Pre-requisite(s): **CEE308**

Course Objectives:

To introduce students with the analysis and design of a complete concrete structure and to make preliminary drawings

List of Experiments

1. Use of Microsoft Excel in design calculations
2. Development of excel sheet for slab design and beam design
3. Etabs introduction, grids layout, material properties, member sizes, modifiers, and other details
4. Geometric layout (Beams, column, shear wall slabs) Replication (Mirror, liner, story)
5. Load generation (Basic and factors load, Seismic load cases, Mass source)
6. Extracting column design
7. Support reaction, extracting reaction for tentative footing sizes
8. Extracting beam and slab design
9. Exporting Etabs file for safe foundation design.
10. Preliminary foundation layout and drawings
11. Checking bearing pressures, shear check and foundation sizes
12. Detailing of structural members
13. Open Ended Lab

Recommended Books:

1. Reinforced concrete: a fundamental approach by Edward G. Nawy
2. ACI committee 318, Building Code Requirement for Structural Concrete
3. Reinforced concrete structures by Park. R and T. pauly Wiley, Newyork, 1975
4. Design of Highway Bridges: An LRFD Approach, 3rd Edition, Richard M. Barker, Jay A. Puckett

Course Code: **CEE200**
Course Title: **Community Service**
Credit Hours: **0(0, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

The aim of this a non-credit course on community service for Civil Engineering students is to promote social responsibility, teamwork, and civic engagement.

A. Course Structure

- **Course Type:** Non-credit (Mandatory)
- **Participation Requirement:** Students can participate in individual and group activities aimed at addressing real-world challenges, Each student must participate in **at least one activity per semester**.
- **Assessment:** Submission of **individual reports** detailing personal involvement, reflections, and outcomes.
- **Duration:** Community service activities must be completed within **one semester**.

B. Implementation

- Each student of BS Civil Engineering program will have to be involved in the community services during his/her study duration.
- A departmental community services committee (preferably consisting of class councilors) will monitor and evaluate the community services activities of the students. The committee will maintain the data semester wise.
- A list of proposed community service activities is given at the end of this document. Each activity carries 5 points. A student must earn 5 points in each semester, a total of 40 points during their entire degree.
- A student will provide pictorial proof or certificate(s) of his/her activities to the committee within two weeks of the activity. The committee will update his points accordingly.
- The committee will submit data to the HoD at the end of each semester.

C. Special Cases

- In case of disabilities or medical emergencies, a student may write an application to the Head of Department (HoD). He/She will be facilitated by the department in fulfilling the community services requirements.

- In case a student does not take part in any community service activity during a semester, he/she may write an application to the HoD specifying valid reasons. He can be given an opportunity to carry out additional activities in the next semester to meet the requirements. However, this will not be allowed in consecutive semesters as a habit.
- In unavoidable situations, the department may relax this policy for a specified semester or year. Additional activities may be carried out to fill the remaining gap.

D. Sustainable Development Goals (SDGs):

The students must link their activities with the United Nation's SDGs. Any activity with no linking to an SDG will not be accepted as community service.

E. Proposed Community Service **Activities**

Examples of community service activities may include:

1. **Local Infrastructure Assessment:**
    - Evaluating the conditions of roads, bridges, or drainage systems in underdeveloped areas.
    - Recommending sustainable solutions and presenting findings to local authorities.
2. **Water Conservation Awareness Campaign:**
    - Organizing awareness drives in rural or urban areas to educate communities about rainwater harvesting or water-efficient practices.
3. **School/Community Facility Improvement Projects:**
    - Working with schools or public spaces to design and implement low-cost infrastructure, such as playgrounds, benches, or green spaces.
4. **Disaster Relief and Preparedness:**
    - Conducting workshops on disaster preparedness (flood mitigation, earthquake safety) and supporting disaster-prone communities.
5. **Recycling and Waste Management Campaigns:**
    - Designing campaigns for waste segregation, plastic collection, or recycling initiatives within local neighborhoods.

The following list contains proposed community service activities. Each activity carries 5 points. Any other activity may be added to the list after the approval of the Community Services committee of the department.

Sr #	Activities	Category
1	Food Drive (Food Collection for Poor People)	Social
2	Recycling Program / Go Green Project	Environmental
3	Community Garden / Plantation Drive	Environmental
4	Community Cleanup Drive	Environmental
5	Blood Donation Drive	Social
6	Clothes Drive for poor people	Social
7	Community Newsletters (Networking)	Education Outreach
8	Volunteer Services	Social
9	Teaching / Coaching for poor children	Education Outreach
10	Raise money for indigenous problems	Social
11	Hold bake sale for charity	Social
12	Visit to hospital / charity institution	Social
13	Organize wheelchair for special persons	Social
14	Participate in youth activities/competition	Social
15	Help / guide impartially register voters to vote	Social
16	Help deliver meals and gifts to patients in local hospitals	Social
17	Write article / give speech to advocate literacy.	Education Outreach
18	Donate toys to needy children in hospital	Social
19	Collect baby clothes and supplies to donate to poor parents	Social
20	Organize events / games for children and teenagers	Health And Sport
21	Collect used sports equipment to donate to families and after school activities	Health And Sport
22	Sponsor child education (individual or group)	Education Outreach
23	Coach a youth sports team	Health And Sport
24	Put a performance / play for children in hospitals	Health And Sport
25	Guidance counseling to poor children	Education Outreach
26	Donate used children's books to school library	Education Outreach
27	Coordinate with local health department to set up immunization day or clinic to immunize children against childhood disease. (eg. Polio)	Health And Sport
28	Visit to a nursing home for senior citizen. (eg. Reading, other chores)	Social
29	Deliver groceries and meals to elderly neighbour	Social

30	Teach computer skills to elderly people	Education Outreach
31	Drive seniors / elderly to doctor appointment	Social
32	Make birthday / event cards for children and elderly	Social
33	Ask residents of retirement home / nursing home for elderly to tell you about their life	Education And Outreach
34	Help elderly neighbors to clean their house and organize their belongings	Environmental
35	Take care of pets in animal shelter	Environmental
36	Place a bird feeder and bird fountain in your backyard	Environmental
37	Start a butterfly/insects garden in your community	Environmental
38	Sponsor a recycling contest	Environmental
39	Help create /repair new/old walking trail at nature center or park	Environmental
40	Update / redecorate signs along the nature trail / parks	Social
41	Participate in the cleanup of local rivers, ponds or lake	Environmental
42	Build and setup bird house	Environmental
43	Organize a carpool to reduce car emissions	Environmental
44	Promoting bicycles for short commute to reduce emissions	Environmental
45	Volunteer at nature camp and teach kids about the environment	Environmental
46	Test the water quality of lake or river near you	Environmental
47	Donate your old clothes	Social
48	Help repair / maintenance of local homeless shelter	Social
49	Raise money / make first aid kits for homeless shelters	Social
50	Volunteer at police station or firehouse	Social
51	Organize self-defense workshop	Health And Sports
52	Organize drug free campaign	Health And Sport
53	Learn / teach first aid and CPR for emergency response	Health And Sports
54	Create and distribute list of hotlines / emergency numbers for who might need help	Social
55	Paint park benches	Social
56	Raise money / install new playground equipment in the local community park	Social
57	Promote awareness to reduce energy crisis	Environmental
58	Attending Seminars / Workshops / Conference	Education Outreach
59	Clean up the campus	Environmental
60	Traffic regulations awareness	Education Outreach
61	Say no to drugs	Health And Sports

Course Code: **CEE432**

Course Title: **Pavement Analysis and Design Lab**

Credit Hours: **1(0, 1)**

Pre-requisite(s): **Nil**

Course Objectives:

This course will give students a detailed understanding of about the fundamentals of Pavement Engineering. The course will also provide detailed guidance on both quantitative and computerized techniques for solving problems related to Pavement Design and Analysis. Students shall be able to apply principles of Pavement Engineering to evaluate, analyze and design asphalt mix and asphalt pavement.

List of Experiments:

11. To determine particle shapes (elongation & flakiness index) of various aggregate samples and then to discuss the results.
12. To determine resistance to degradation of coarse aggregate by abrasion and impact in the Los Angeles abrasion machine.
13. To determine penetration grade of bituminous sample.
14. To determine the softening point of bituminous sample by using Ring & Ball apparatus.
15. To determine the flash and fire point of bituminous sample by Cleveland Open Cup apparatus.
16. To determine the ductility of bituminous sample using a ductilometer.
17. To perform the CBR test for the sub-grade on the given soil sample.
18. Non-repetitive static plate load test of soils and flexible pavement components for use in evaluation and design of airports and highway pavements.
19. To find out JMF for specified paving job (Marshall Method).
20. Open ended lab

Recommended Books:

Text & Reference Books:

16. Yang H. Huang, (2003), Pavement Analysis and Design, 2nd Edition (or latest), Pearson Higher Education.
17. Fred. L. Mannering and Scott S. Washburn, (2013), Principles of Highway Engineering and Traffic Analysis, 5th Edition (or Latest), John Wiley & Sons. NY.
18. Asphalt Institute, (2005), Mix Design Methods for asphalt concrete and other Hot-Mix Types, MS-2, 2nd Edition (or latest), Asphalt Institute.
19. Asphalt Institute, (2005), Superpave Mix Design, SP-2, 3rd Edition, Asphalt Institute.

Course Code: **CEE423**

Course Title: **Environment Management and Impact Assessment**

Credit Hours: **3(3, 0)**

Pre-requisite(s): **CEE307**

Course Objectives:

The objective of this course is to give students an introduction to environmental concepts and their relevance to construction. The course includes a discussion of key environmental management issues, assessment of impact and analysis based on a construction case-study.

Course Outline:

Introduction (Environmental management, National environmental policy). Environmental legislation, Environmental Impact Assessment (EIA) process, Environmental Impact Prediction and Evaluation during construction & operation of projects, Mitigation measures, Modeling, Environmental monitoring & auditing, Environmental management issues, Case Studies, Environmental Assessment (Framework for environmental assessment, Description of the environmental setting). Environmental Impacts (Prediction and assessment of impacts on the water, Socio-economic environment). Methods of impact analysis. Environmental Decision Making. Writing Impact Statement. Water Quality (Water quality and impact of project on water quality). Future of Environmental Impact Assessment (Future of environmental management, Environmental issue and Future of environmental impact assessment). Mitigation of environmental impacts. World Bank (WB) and Asian Development Bank (ADB) guidelines

Recommended Books:

1. ASCE, Environmental Impact Assessment Handbook, Barbara Carroll & Nicholas Pearson, Thomas Telford, 2002.
2. ASCE, Environmental Handbook for Building and Civil Engineering Projects – Volume 1: Design and Specification, CIRIA Special Publication 97, Thomas Telford, 1994.
3. ASCE, Environmental Handbook for Building and Civil Engineering Projects – Volume 2: Construction Phase, CIRIA Special Publication 98, Thomas Telford, 1994.
4. Environmental Assessment in Practice by Owen Harrop and Ashley Nixon.
5. Environmental Impactsfor Water Resources Planning by Mehmet Ali Yurdusev
6. Environmental Impact Assessment by A. K. Shrivastava
7. Methods of Environmental Impact Assessment by Peter Morris & Riki Therivel
8. Environmental Impact Assessment: A Methodological Approach by Richard K. Morgan.
9. Environmental Impact Assessment by Canter L. W (1996), 2nd Ed., Mc Graw Hill, New York

Course Code: **EGG497**
Course Title: **Internship**
Credit Hours: **0(0, 0)**
Pre-requisite(s): **Nil**

Course Objectives:

The aim of an internship for civil engineering students encompasses a blend of academic, professional, and personal growth objectives. Specific goals of internship are listed below:

a) Real-world Application of Academic Knowledge:

- Apply theoretical concepts from the classroom to practical, hands-on engineering projects.
- Bridge the academic knowledge gap through practical field application.

b) Professional Skill Enhancement:

- Improve technical skills in areas such as structural analysis, design, project management, and construction.
- Develop proficiency in utilizing industry-standard software and tools.

c) Exposure to Industry Practices:

- Gain insight into the daily operations and practices of civil engineering firms, construction companies, or government agencies.
- Understand industry standards, regulations, and best practices.

d) Problem-Solving Skills Development:

- Refine problem-solving abilities by addressing challenges encountered during project work.

e) Self-Assessment and Career Planning:

- Reflect on personal strengths, weaknesses, and career interests.
- Utilize the internship experience for future career planning and goal setting.
- Internships offer valuable experiences that contribute significantly to a student's evolution into a future civil engineer.

B. Internship Policy for BS Civil Engineering Students

a) Eligibility Criteria:

- Students must be enrolled in a civil engineering program.

- Preferred candidates should have completed a minimum of three years of their academic program.

b) Internship Duration:

- The internship duration should range from 6 to 8 weeks, preferably scheduled during the summer break.
- Carrying out internship activities during class hours is not allowed. Fulfilment of CUI attendance policy regarding classes must be followed.
- For any reason, if a student internship attachment cannot be continued with a single host institution, then he/she can work flexibly with different host institutions and in different semesters to complete the requirement in 2 to 3 phases.

c) Work Schedule:

- Interns are expected to work 5 days per week.
- The internship may be either full-time or part-time, depending on project requirements.

d) Academic Supervision

- Throughout the internship period, academic supervisors appointed by the department will provide guidance and support to the designated group of students.
- Students are required to submit mid-term and final progress reports to the internship committee via their academic supervisors.

e) Project Domain:

- Interns will participate in various civil engineering projects, such as building construction, infrastructure development, dam construction, university projects, contracts, consulting, and design office activities. The internship may be availed in an industry, laboratory, educational institute, or any other office where relevant engineering knowledge may be practiced.
- Opportunities for collaboration with various professionals will be provided.

f) Performance Evaluation:

- The internship is a non-graded course, but it will be evaluated, and the students have to qualify the course.
- The student will have to submit an internship report to the department within one month of the internship completion date. The department will evaluate the report in collaboration with the field supervisor of the internee. The department may also call the student for a presentation or viva if it decides so. The department will provide an internship report

format to all the students. Each student must link his/her internship work with a relevant Sustainable Development Goal (SDG) of United Nation, which shall be mentioned in the internship report.

- The department will provide an internship feedback form to the corresponding host institution to get feedback from the employer. This evaluation will be shared with DQEC for Quality Enhancement purposes.
- A final evaluation will be conducted at the end of the internship using:
    - Feedback from Internship Employer = 50%
    - Attendance during Internship Program = 10%
    - Departmental Evaluation = 40%
- At least 75% attendance is mandatory during internship program.
- Qualifying weightage for internship is 70%.
- The department will conduct a student presentation or viva if deemed necessary

g) <u>Internship Completion Requirements:</u>

- Interns must provide a copy of their internship completion certificate along with the student internship feedback form.

h) <u>Special Cases:</u>

- In case of national/international crises e.g., medical emergencies, lockdowns, political unrest etc., the department may assign alternate assignments/projects to the students, only if HEC/PEC allows.