Part A

1. Title of the Academic Program: Bachelor of Science (Engineering)

2. Name of the University: Shahjalal University of Science and Technology

3. Vision of the University:

To be a leading university of excellence in Science and Technology with a strong national commitment and significant international impact.

4. Mission of the University:

1) To advance learning and knowledge through teaching and research in science and technology
2) To serve as a center for knowledge creation, technological innovation and transfer among academia, industry, and society
3) To assist in transferring Bangladesh a country with sustainable economic growth and equitable social development

5. Name of the Program Offering Entity (Department/Faculty/Institute):

Department of Civil and Environmental Engineering (CEE)

6. Vision of the Program Offering Entity:

To create high-quality engineering professionals who will keep significant role in sustainable infrastructure development and environmental safety with a motto "Build the Earth, Save the Earth".

7. Mission of the Program Offering Entity:

1) Produce world-class engineers with technical competency, analytical thinking ability, ethical standard, life-long learning ability and leadership skill, who can have successful careers as professionals and will contribute to the advancement of knowledge and novelty in civil and environmental engineering and similar fields,

2) Educate its students in a modern-dynamic learning environment by providing them in-depth knowledge so that they add value in the wide areas of infrastructure development and environmental safety,
3) Promote teaching, research, innovation and maintain an effective industry-academia relationship at national and international level.

8. Objectives of the Program Offering Entity:

Graduates obtaining a certified degree in Civil and Environmental Engineering should be well educated in the broad areas of infrastructure development and environmental safety. However to be an effective and productive engineer students need to grab a variety of skills that go beyond their course content. The objectives or learning targets of the curriculum are categorized in the following dimensions:

- Knowledge
- Skill
- Attitude

9. Name of the Degree:

B.Sc. in Civil and Environmental Engineering

10. Description of the Program:

The program **B.Sc. in Civil and Environmental Engineering (CEE)** is one of the best programs in Shahjalal University of Science and Technology (SUST). This program deals with various disciplines of Civil and Environmental Engineering, such as, Structural and Constrution Engineering, Geotechnical Engineering, Envronmental and Water Resouces Engineering, Transportation Engineering.

Structural and Construction Engineering division is equipped with the state of the art hardware and software facilities for carrying out testing of various structural materials in the laboratory (i.e. mild steel, concrete, stone, sand, cement, and bricks) and in-field (core cutting and testing, structural health assessment, and nondestructive testing of RCC and masonry structures). Apart from teaching, consultancy services for design and construction of civil structures and infrastructures including but not limited to buildings, bridges, culverts, retaining walls, reservoirs, terminals, steel structures, and other civil

structures are also provided. As the quality of soil in construction sites plays a key role, it is needed to identify the physical characteristics of the soil to determine its ability to support the structure.

Geotechnical Engineering division deals with matters related to soil mechanics, foundation engineering, slope stability, retaining wall, soil improvement, geotechnical design of different structures. This branch of CEE carries out research, teaching and different basic and geotechnical testing on soil (sand, clay), foundation materials, site investigations, geotechnical reporting, etc.

Environmental and Water Resources Engineering division, with the support of a well-equipped laboratory, has been providing academic services as well as providing testing, design and consultancy services in various areas of environmental engineering. Some of the areas include but not limited to water and wastewater quality assessment along with their treatment, solid and hazardous waste management, air and sound pollution measurement with mitigation techniques, environmental management planning, environmental auditing, and environmental impact assessment and monitoring.

Transportation Engineering division offers a broad range of specialized transportation services covering laboratory testing (e.g., bitumen, aggregate, soil, full-scale pavement and rail track performance), specialized training and related consultancy services (e.g., pavement performance evaluation, structural and geometrical design of pavement, management of traffic control system, accident analysis and safety measures, transport modelling and planning and so on).

11. Graduate Attributes:

Code	Graduate Attributes	Domain
GA 1	In-depth discipline-specific knowledge and professional skills	Fundamental
GA 2	Capacity for critical, creative, and evidence-based thinking to solve complex problems	Thinking
GA 3	Valuing integrity, environmental sustainability, and civic engagement	Social
GA 4	Understanding of social and civic responsibilities and the rights of individuals and groups	Social
GA 5	Capable of communicating effectively in a range of contexts	Personal
GA 6	Willingness to life-long learning through directed/guided and self-directed/independent study	Personal

12. Program Educational Objectives (PEOs):

To achieve the targets of the program, program educational objectives (PEOs) are set as follows:

1) Graduates will become leading researchers and educationalists who create and disseminate new knowledge in the field of sustainable development ensuring environmental safety,
2) Graduates will become key decision makers in the industries associated with civil and environmental engineering applications. They will become recognized experts working in government sector, consulting firms and international organizations around the country and around the world addressing some of the most challenging problems of modern times,
3) Graduates engage themselves toward lifelong learning and the pursuit of post graduate or other professional education including continuous professional development,
4) The graduates demonstrate professionalism, ethics and ability to work in inter and multi-disciplinary team and to adapt the latest trends and technology in the field of Civil and Environmental Engineering.

13. Program Learning Outcome (PO)

At the completion of the program the students will be able to:

A. Fundamental Skills	
PO1	**Acquire and apply knowledge** of basic mathematics, science, engineering and to formulate or solve Civil and Environmental Engineering problem
PO2	**Analyze and identify** a relevant problem and reach to valid conclusions using first principles of mathematics, the natural sciences and the engineering sciences
PO3	**Design** a system, component, or process to meet desired needs while incorporating engineering standards and realistic constraints such as economic, environmental, constructability, social, political, ethical, health and safety, manufacturability and sustainability issues
B. Thinking Skills	
PO4	**Investigate problems, conduct experiments**, and **evaluate** the results critically
C. Social Skills	
PO5	**Interprete the impact** of civil and environmental engineering solutions in a global/political/societal context
PO6	Perform effectively with **multi-disciplinary** team to accomplish a common goal

D. Personal Skills	
PO7	Apply the **modern engineering tools, techniques and computational methods** necessary for engineering practice
PO8	**Communicate** effectively in oral and written forms
PO9	Practice **professional norms and ethical responsibilities**
PO10	Engage in **project planning and management issues** such as procurement of work, bidding versus quality selection processes, interactions among design and construction professionals
PO11	Be engaged in **life-long learning including continuing education**
PO12	Be proficient in **recognized discipline of civil and environmental engineering** bearing a good attitude and intellectual ability

14. Mapping mission of the university with PEOs:

PEO Statement	M1	M2	M3
PEO1	3	2	
PEO2	2	1	3
PEO3		3	2
PEO4	2	3	

Correlation: 3-High, 2-Medium, 1-Low

15. Mapping POs with the PEOs:

PO / PEO	PEO1	PEO2	PEO3	PEO4
PO1	2	2	3	2
PO2	3	3	3	2
PO3	2	1	-	3
PO4	2	2	2	2
PO5	1	2	-	3
PO6	2	2	1	3
PO7	2	-	2	3
PO8	1	-	-	2
PO9	1	-	-	2
PO10	2	1	1	-
PO11	-	3	3	1
PO12	3	2	2	2

Correlation: 3-High, 2-Medium, 1-Low

16. Mapping courses with the POs:

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CEE 0541 1131	3	2										
CEE 0712 1181	3	3					2					
CHE 0531 1101C	3	1										
ECO 0311 1107C	2	3	2	3	3	3		2		3		

ENG 0231 1101C	3	3	3				3		3			
MAT 0541 1103C	3	3		2	2						2	2
SSS 0312 1100	x	x								x		
PHY 0533 1107C	3	3				2						
CEE 0732 1132		2	3									2
ENG 0231 1102C	3	3	3				3		3			
PHY 0533 1204C	3	3	1	2		2		3			2	
CEE 0541 1233	3	3										
CEE 0732 1235	3	3		3								
CEE 0541 1237	3	3										
BUS 0411 1201C	√					√			√		√	
MAT 0541 1204C	3	3			2							
SCW 0923 1203C	2		1		2	2	1	1	2	2		
CEE 0732 1230	2							3	1		2	3
CEE 0732 1234	2		3									
CHE 0531 1202C		1		3			3	3		1		
EEE 0713 1228C	2	2	1	1	1					1		
IPE 0715 1204C												
CEE 0731 2123	3	3		2			2			3		2
CEE 0732 2131	3	2	2									2
CEE 0732 2135	3	3	2									
CEE 0532 2137	1		3		2	2						2
CSE 0011 2103C			3			2	2				2	
MAT 0541 2107C	3	2	1									
CEE 0732 2122	3	3					3		2	3		
CEE 0732 2134	1	2		2		2	3					2
CEE 0732 2138	1		2	2			3					
CSE 0011 2104C			3			2	3					
CEE 0532 2221	3	3						2				2
CEE 0732 2229	3	3	3				3					
CEE 0732 2233	3		2	2								
CEE 0732 2271	3		3				2					
CEE 1021 2281	3	3	3		2							
STA 0542 2211C	1	2		3		2					1	
CEE 0732 2224	3	3		3			2			3		
CEE 0532 2226	3						2					
CEE 0731 2228	3	3	3	3		2	3			3		2
CEE 0732 2230	2							3	1		2	3
CEE 0732 2232	3						3					
CEE 0732 2236	2	3		3			3					
STA 0542 2212C	2	2		3		2					1	
CEE 0732 3141	3	2	2	2			1	1		2		3
CEE 0732 3145	3		3									1
CEE 0732 3151		2		3								1
CEE 0732 3171	3	3	3				2					2
CEE 0732 3181	3	3	3									
CEE 0712 3183	3	3	3		2		2					
CEE 0732 3142	2		3				2					2
CEE 0732 3146	2		3	3			2					
CEE 0732 3182	3		3									
CEE 0712 3184		3	2	3			2					
CEE 0732 3186	3	3		3			2					
CEE 0732 3243	2	2	3									1

CEE 0732 3247	3	2	3	2								2
CEE 0732 3253		2	3	2	2							2
CEE 0732 3261	3	3	3				2					
CEE 0732 3273	2	3	3		2		2					
ARC 0731 3201C		3					2			2		
CEE 0732 3230	2							3	1		2	3
CEE 0732 3232	3							3	2			
CEE 0732 3244			3				3					2
CEE 0732 3252	1	2		3		2	1					2
CEE 0732 4121	3	2	3				1					
CEE 0532 4133	3	3	2			2	3					
CEE 0732 4141	3	3	3				1					
CEE 0732 4143	2	2		3								1
CEE 0732 4149		3	3									1
CEE 0732 4151		2	2	3	2							2
CEE 0732 4161	2	3	3	3			2					
CEE 0732 4130	2	3		2		1		2		2	3	1
CEE 0732 4132	3	1					2	3	3	2	3	2
CEE 0732 4142	1		2	2			3					2
CEE 0732 4146		2		3								1
CEE 0732 4162	2			3			1					
CEE 0732 4263	2	1	3									
CEE 0732 4271	3	3	3				2				2	2
CEE 0712 4281		3	3	2								1
CEE 0712 4255	2	2	3	3	2		2					
CEE 0732 4230	2	3		2		1		2		2	3	1
CEE 0732 4244	2	2	3	3			2					1
CEE 0732 4252		2	3	3			1					2
CEE 0732 4264	1	3	3									
CEE 0732 4272	3	2	3				3					
CEE 0732 4282			3				3					
Correlation: 3-High, 2-Medium, 1-Low												

Part B

17. Structure of the Curriculum

a) Duration of the program: Years: 4, Semesters: 8
b) Admission Requirements: Accoding to University Admission Procedure
c) Graduating credits/Total minimum credit requirement to complete the program: 165
d) Total class weeks in a semester: 14
e) Minimum CGPA requirements for graduation: 2.00
f) Maximum academic years of completion: 6 years (12 semesters)
g) Category of Courses:

Category of Course	Percentage/ no. of courses
General Education	Minimum 25%
Core courses	Minimum 70%
Optional/Elective Courses	One course
Capstone course/Internship/Thesis/Projects/Portfolio	One Capstone and one Thesis

18. Year/Level/Semester/Term wise distribution of courses

First Year: Semester I

Course No.	Course Title	Course Category	Hours / Week Theory + Lab	Credit
CEE 0541 1131	Engineering Mechanics I	Core	2+0	2.0
CEE 0712 1181	Introduction to Environmental Engineering	Core	2+0	2.0
CHE 0531 1101C	General Chemistry	General Education	3+0	3.0
ECO 0311 1107C	Principles of Economics	General Education	2+0	2.0
ENG 0231 1101C	Effective communication in English	General Education	2+0	2.0
MAT 0541 1103C	Differential Calculus and Vector Analysis	General Education	3+0	3.0
PHY 0533 1107C	General Physics	General Education	3+0	3.0
SSS 0312 1100	History of the Emergence of Independent Bangladesh	General Education	3+0	3.0
CEE 0732 1132	Engineering Graphics I	Core	0+3	1.0
ENG 0231 1102C	English Language Lab I	General Education	0+3	1.0
	Total		**17+9= 26**	**22.0**

First Year: Semester II

Course No.	Course Title	Course Category	Hours / Week Theory + Lab	Credit
CEE 0541 1233	Engineering Mechanics II	Core	2+0	2.0
CEE 0732 1235	Engineering Materials	Core	3+0	3.0
CEE 0541 1237	Numerical Analysis	Core	2+0	2.0
BUS 0411 1201C	Cost Accounting for Engineers	General Education	2+0	2.0
MAT 0541 1204C	Integral Calculus and Ordinary Differential Equations	General Education	3+0	3.0
SCW 0923 1203C	Social Science for Engineers	General Education	2+0	2.0
CEE 0732 1230	Year Final Viva I	Core	-	0.5
CEE 0732 1234	Engineering Graphics II	Core	0+3	1.0
CHE 0531 1202C	Chemistry Practical	General Education	0+3	1.5
EEE 0713 1228C	Electrical Services Design	General Education	0+3	1.5
IPE 0715 1204C	Workshop Practice	General Education	0+2	1.0
PHY 0533 1204C	Basic Physics Sessional	General Education	0+3	1.5
	Total		**14+11=25**	**21.0**

Second Year: Semester I

Course No.	Course Title	Course Catergory	Hours / Week Theory + Lab	Credit
CEE 0731 2123	Surveying	Core	3+0	3.0
CEE 0732 2131	Mechanics of Solids I	Core	2+0	2.0
CEE 0732 2135	Fluid Mechanics	Core	3+0	3.0
CEE 0532 2137	Engineering Geology and Geomorphology	Core	2+0	2.0
CSE 0011 2103C	Introduction to Computer Language	General Education	2+0	2.0
MAT 0541 2107C	Vector Calculus, Matrix, Laplace Transformation and Partial Differential	General Education	3+0	3.0

	Equations			
CEE 0732 2122	Details of Construction	Core	0+3	1.0
CEE 0732 2134	AutoCAD for Civil and Environmental Engineers	Core	0+3	1.0
CEE 0732 2138	Engineering Materials Sessional	Core	0+3	1.0
CSE 0011 2104C	Introduction to Computer Language Lab	General Education	0+4	2.0
	Total		**15+13=28**	**20. 0**

Second Year: Semester II

Course No.	Course Title	Course Catergory	Hours / Week Theory + Lab	Credit
CEE 0532 2221	Hydrology	Core	3+0	3.0
CEE 0732 2229	Ground Water	Core	2+0	2.0
CEE 0732 2233	Mechanics of Solids II	Core	2+0	2.0
CEE 0732 2271	Water Supply Engineering	Core	2+0	2.0
CEE 1021 2281	Environmental Sanitation and Solid Waste Management	Core	2+0	2.0
STA 0542 2211C	Statistics	General Education	2+0	2.0
CEE 0732 2224	Quantity Surveying	Core	0+3	1.0
CEE 0532 2226	Remote Sensing and GIS Sessional	Core	0+3	1.0
CEE 0731 2228	Practical Surveying (Field work)	Core	2 weeks	1.0
CEE 0732 2230	Year Final Viva II	Core	-	0.5
CEE 0732 2232	Mechanics of Solids Sessional	Core	0+3	1.0
CEE 0732 2236	Fluid Mechanics Sessional	Core	0+3	1.0
STA 0542 2212C	Practical Statistics	General Education	0+3	1.0
	Total		**13+15=28**	**19.5**

Third Year: Semester I

Course No.	Course Title	Course Catergory	Hours / Week Theory + Lab	Credit
CEE 0732 3141	Structural Analysis I	Core	3+0	3.0
CEE 0732 3145	Reinforced Concrete Design I	Core	3+0	3.0
CEE 0732 3151	Geotechnical Engineering I	Core	3+0	3.0
CEE 0732 3171	Open Channel Hydraulics	Core	3+0	3.0
CEE 0732 3181	Wastewater Engineering	Core	3+0	3.0
CEE 0712 3183	Environmental Pollution Control Engineering	Core	2+0	2.0
CEE 0732 3142	Structural Analysis and Design Sessional I	Core	0+3	1.0
CEE 0732 3146	Reinforced Concrete Design Sessional I	Core	0+3	1.0
CEE 0732 3182	Plumbing for Water Supply and Drainage	Core	0+3	1.0
CEE 0712 3184	Environmental Engineering Sessional	Core	0+3	1.0
CEE 0732 3186	Water Supply and Sewerage Engineering Sessional	Core	0+3	1.0
	Total		**17+15 =32**	**22.0**

Third Year: Semester II

Course No.	Course Title	Course Catergory	Hours / Week Theory + Lab	Credit
CEE 0732 3243	Structural Analysis II	Core	3+0	3.0
CEE 0732 3247	Reinforced Concrete Design II	Core	3+0	3.0
CEE 0732 3253	Geotechnical Engineering II	Core	3+0	3.0
CEE 0732 3261	Transportation Engineering I	Core	3+0	3.0
CEE 0732 3273	Hydraulics and Hydraulic Structures	Core	3+0	3.0
ARC 0731 3201C	Urban and Regional Planning	General Education	2+0	2.0
CEE 0732 3230	Year Final Viva III	Core		0.5
CEE 0732 3232	Scientific Research (Tools and Techniques)	Core	0+3	1.0
CEE 0732 3244	Structural Analysis and Design Sessional II	Core	0+3	1.0
CEE 0732 3252	Geotechnical Engineering Sessional I	Core	0+3	1.0
	Total		**17+09=26**	**20.5**

Fourth Year: Semester I

Course No.	Course Title	Course Catergory	Hours / Week Theory + Lab	Credit
CEE 0732 4121	Project Planning and Management	Core	2+0	2.0
CEE 0532 4133	Disaster Management and Earthquake Engineering	Core	3+0	3.0
CEE 0732 4141	Reinforced Concrete Design III	Core	2+0	2.0
CEE 0732 4143	Steel Structure	Core	2+0	2.0
CEE 0732 4149	Structural Analysis III	Core	3+0	3.0
CEE 0732 4151	Geotechnical Engineering III	Core	2+0	2.0
CEE 0732 4161	Transportation Engineering II	Core	3+0	3.0
CEE 0732 4130*	Thesis/ Project work	Thesis	0+3	1.0
CEE 0732 4132	Field Work for Engineers	Capstone	1 week	1.0
CEE 0732 4142	Computer aided Structural Analysis and Design	Core	0+3	1.0
CEE 0732 4146	Reinforced Concrete Design Sessional II	Core	0+3	1.0
CEE 0732 4162	Transportation Engineering Sessional- I	Core	0+3	1.0
	Total		**17+12 =29**	**22.0**

Proposal submission, presentation and viva, whose marks will be added with CEE 0732 4230 in final semester. Therefore, the total credits of 21.0 in this semester is appeared instead of 22.0.*

Fourth Year: Semester II

Course No.	Course Title	Course Catergory	Hours / Week Theory + Lab	Credit
CEE 0732 4263	Transportation Engineering III	Core	3+0	3.0
CEE 0732 4271	Irrigation and River Engineering	Core	3+0	3.0
CEE 0712 4281	Environmental Impact Assessment	Core	2+0	2.0
CEE 0712 4255 (Presently offered)	One theory course from thesis related field	Elective	2+0	2.0
CEE 0732 4230**	Thesis/ Project work	Core	0+9	3.0

CEE 0732 4244	Bridge Design Sessional	Core	0+3	1.0
CEE 0732 4252	Geotechnical Engineering Sessional II	Core	0+3	1.0
CEE 0732 4264	Transportation Engineering Sessional II	Core	0+3	1.0
CEE 0732 4272	Design of Hydraulic Structures	Core	0+3	1.0
CEE 0732 4282	Environmental Design Sessional	Core	0+3	1.0
	Total		**10+24 =34**	**18.0**

***Thesis/project defense, where the marks obtained in CEE 0732 4130* will be included. Therefore, the total credits in CEE 0732 4230 will be 4.0 resulting the total credits of 19.0 in this semester instead of 18.0.*

Thesis Related Elective/Optional Courses

1. Environmental Engineering

Course No.	Course Title	Hours / Week Theory + Lab	Credit
CEE 0712 4283	Hazardous and Radioactive Waste Management	2+0	2.0
CEE 0712 4285	Bioenvironmental Engineering	2+0	2.0
CEE 0712 4287	Environmental Modeling	2+0	2.0
CEE 0712 4289	Environmental Management and Auditing	2+0	2.0

2. Geotechnical Engineering

Course No.	Course Title	Hours / Week Theory + Lab	Credit
CEE 0732 4253	Geotechnical Engineering IV	2+0	2.0
CEE 0712 4255	Geoenvironmental Engineering	2+0	2.0

3. Structural Engineering

Course No.	Course Title	Hours / Week Theory + Lab	Credit
CEE 0732 4245	Construction Practices and Management	2+0	2.0
CEE 0732 4247	Theory of Elasticity	2+0	2.0
CEE 0732 4291	Dynamics of Structures	2+0	2.0

4. Transportation Engineering

Course No.	Course Title	Hours / Week Theory + Lab	Credit
CEE 0732 4265	Transports and Traffic Planning	2+0	2.0
CEE 0732 4267	Transportation Planning and Management	2+0	2.0

5. Water Resources Engineering

Course No.	Course Title	Hours / Week Theory + Lab	Credit
CEE 0732 4273	Integrated Water Resource Management	2+0	2.0
CEE 0732 4275	Coastal Engineering	2+0	2.0

Total credits included in all semesters:

Semester	Credits
1/1	22.00
1/2	21.00
2/1	20.00
2/2	19.50
3/1	22.00
3/2	20.50
4/1	22.00
4/2	18.00
Total	**165.00**

NB: Every student has to complete all the cources indicated above for obtaining the B.Sc. Engineering degree in Civil and Environmental Engineering.

Part C

19. Description of all courses of the program

19.1 First Year First Semeter

Course Code: CEE 0541 1131	Credit: 2.0	Year: 1st	Semester: 1st
Course Title: Engineering Mechanics I		Course Status: Theory	

i) Rationale of the Course:

This course facilities for gathering the basic knowledge about the effects of force on solid mass and to develop student's ability to visualize the distribution of forces on a solid body. This knowledge is a prerequisite for many engineering courses offered in the subsequent semesters that capture the detailed analysis and design of engineering structures or structural components.

ii) Course Content:

Statics of particles This chapter is devoted to the study of forces contained in a single plane. The analysis of forces in three-dimensional space is also analyzed here.
Rigid bodies: Equivalent systems of forces In this chapter, the effect of forces exerted on a rigid body, and how to replace a given system of forces by a simpler equivalent system is shown.
Equilibrium of a rigid body This chapter shows how to solve rigid-body equilibrium problems using the equations of equilibrium.
Structural analysis The forces in the members of a truss using the method of joints and the method of sections are determined in this chapter.
Centroids Definitions, Center of gravity, Mass center and Centroid, Centroids of Areas, Centroids of Lines, Principle of Symmetry, Estimating location of Centroid by eye estimation, Integrating for Centroids (Arc of a Circle, Plane Triangle, Sector of Circle, Area without an axis of symmetry, Right circular cone), Composite figures, Theorem of Pappus and Guldinus, Center of pressure
Moment of inertia of areas Introduction, Rectangular moment of inertia, Polar moment of inertia, Radius of gyration, Determination of moment of inertia (Rectangle, Triangle, Circle), Transfer formula-parallel axes, Choice of differential element, Composite areas, Product of inertia, Moment of inertia about inclined axes, Maximum and minimum moment of inertia.

Moment of inertia of masses
Definition, Moment of inertia about planes and axes, Units, Radius of gyration, Transfer formula-parallel axes, Integrating for moment of inertia of masses (Cylinder, Sphere, Thin disk, Cone, Slender rod), Composite bodies.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Execute complete free-body diagrams of different structures.
2) Analyze external forces on various statically determinate structures such as beam, frame, truss.
3) Calculate the centroid and moment of inertial of an area, mass, and volume.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2										
CO3	3	2										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 05, TL 07	CA 01, CA 03, CA 04, SA 01
CO3	TL 01, TL 02, TL 05	CA 02, CA 03, SA 01
CO4	TL 01, TL 02, TL 05	CA 02, CA 03, SA 01

Course Code: CEE 0712 1181	Credit: 2.0	Year: 1st	Semester: 1st
Course Title: Introduction to Environmental Engineering		Course Status: Theory	

i) Rationale of the Course:

This course introduces the provision of not only the warnings of danger but lights to lead the way towards a sustainable standard of living to protect human health and the environment. The knowledge of this course is prerequisite to other latter courses such as Water and Wastewater Treatment, Water Supply Engineering, Groundwater, Geoenvironmental Engineering and so on.

ii) Course Content:

Identifying and Solving Environmental Problems:
This chapter describes the Origins of Environmental Engineering, Environmental engineering today, as well as Sustainability and Cradle-to-Cradle Design.

Engineering Decisions:
This chapter is a review of how environmental engineers make decisions, beginning with a short description of technical decisions and followed by a discussion of cost-effectiveness, possibly the second most commonly employed tool in environmental engineering decision making and the second most quantifiable. Next, the use of benefit/cost analysis is described, followed by a discussion of decisions based on risk analysis. Moving even further toward the more subjective forms of decision making, environmental impact analysis as an engineering tool is reviewed.

Material Balances and Separations: In this chapter the material balance around a black box unit operation is introduced first. Then these black boxes are identified as actual unit operations that perform useful functions. Initially, these black boxes have nothing going on inside them that affects the materials flow.
Energy Flows and Balances: In this chapter how the energy flows and is put to use, and the efficiencies of such use are discussed.
Applications of Environmental Engineering: In this chapter, various parameters used to measure water quality, water supply and treatment, wastewater treatment, Air quality assessment and control, solid waste management and noise pollution assessment are briefly discussed.

iii) Course Learning Outcomes (COs):

By end of this course, the students will able to:

1) Identify the major environmental problems,
2) Evaluate the possible environmental solutions,
3) Outline the procedure of solid waste management,
4) Distinguish between material and energy balance.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3										
CO2	3						2					
CO3		2										
CO4		2										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 03, SA 01

Course No: CHE 0531 1101C	Credit: 3.0	Year: First	Semester: Second
Course Title: General Chemistry		Course Status: Theory	

i) Course Rationale:

Candidates are expected to understand the structures, properties, and applications of atoms, molecules, and chemical compounds.

ii) Course Objectives:

The objectives of this course are to:

- Describe the basic concept of electronic structure in atoms and molecules.
- Acquire knowledge of the physical and chemical properties of elements in the periodic table

- Analyze the properties of molecular compounds from various types of mathematical calculations using chemical formulas.
- Identify properties of acids and bases based on various acid-base concepts.
- Understand the various state and properties of materials.
- Study and gain preliminary knowledge on reaction equilibrium and chemical kinetics.
- Familiarize the students with the basic chemistry of environment, agriculture, food and industry
- Recognize the fundamental aspects and applications in various fields for organic compounds.

iii) Course Content:

Electronic Structure: The quantum theory, atomic spectrum of hydrogen and the Bohr model, Quantum numbers, Energy levels and orbital, Electronic configuration, Chemical bonding, and molecular structure.

The periodic Table: Development of the periodic table, Electron arrangements, and the periodic table, Summarized chemical properties of s-block, p-block, d-block, and f-block elements.

Chemical formulas and equations: Types of formulas, Percent composition from the formula, Formulas from experiment, Formulas of ionic compounds, Names of compounds, Writing and balancing chemical equations, Mass relations in reactions, Limited reactant, and theoretical yield. Concept of mole, Solution: different concentration units.

Acids and Bases: Theories and Modern definitions of acids and bases, Dissociation constant, strength, pH, Buffer solution, etc.

Gases: Measurement of gases, the ideal gas law, Volumes of gases involved in reactions, Gas mixtures, Partial pressure, Kinetic theory of gases, and Real gases.

Introduction to Chemical Kinetics: Rate laws, rate constant, equilibrium constant, order of reaction, etc.

Organic Chemistry: Introduction**,** Classification, Nomenclatures, preparations and Properties (Physical & Chemical) of (i) Aliphatic and aromatic hydrocarbons, (ii) Aldehydes and ketones, (iii) Carboxylic acids and (iv) Alcohols and phenols (v) Carbohydrates (mono- and disaccharides).

Chemistry of Fuels (Hydrocarbon, Hydrogen), **Fertilizer, & Medicine.**

Electronic Structure: The quantum theory, atomic spectrum of hydrogen and the Bohr model, Quantum numbers, Energy levels and orbital, Electronic configuration, Chemical bonding and molecular structure.

The periodic Table: Electron arrangements and the periodic table, Summarized chemical properties of s-block and p-block elements.

Acids and Bases: Theories and Modern definition of acids and bases, Dissociation constant, Strength, pH, Buffer solution.

Gaseous State: Measurement on gases, the ideal gas law, Volumes of gases involved in reactions, Gas mixtures, Partial pressure, Real gases, Fugacity.

Introduction to Chemical Kinetics: Rate laws, rate constant, order of reaction.

Chemical Equilibrium: Equilibrium constant K_P, K_C, ΔS, ΔG, catalyst.

Surface Chemistry: Adsorption vs. Absorption, Types and mechanism of adsorption, Chemisorption.

Environmental Chemistry: Environmental aspects of **Energy**–Traditional, Fossil fuel, Nuclear, and Solar (photochemical smog, greenhouse gases, and acid-rain); **Agriculture–**Fertilizers, Pesticides, and Insecticides; **Food**– Preservatives, Flavor/Coloring materials.

Industry: Building materials, Metal industry, Detergent, Dye, Cement, Ceramic, Refrigerants, and Catalytic converters.

Organic Chemistry: Introduction**,** Classification, Nomenclatures, preparations and Properties (Physical & Chemical) of (i) Aliphatic and aromatic hydrocarbons, (ii) Aldehydes and ketones, (iii) Carboxylic acids and (iv) Alcohol s and phenols.

iv) Course Learning Outcomes:

After the successful completion of the course, students will be able to:

CO1 Recognize the basic structural properties in atomic and molecular levels of atoms and molecules, respectively, using various recognized Theories and Laws.

CO2 Describe the physical and chemical properties periodically of metal and non-metal.

CO3 Predict and analyze the properties of molecular compounds from various types of mathematical calculations using chemical formulas.

CO4 Identify and explain various properties in qualitatively and quantitatively solid, liquid, and gaseous substances based on fundamental parameters.

CO5 Distinguish the chemical features and properties between inorganic and organic substances and understand their potential application in various applied fields.

v) Mapping of Course Learning Outcomes (COs) with POs

3: Strongly aligned 2: Moderately Aligned 1: Weakly Aligned

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	3											
CO3	3	1										
CO4	3	1										
CO5	3											

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning & Assessment Strategy

COs	Teaching-Learning Strategies	Assessment Strategies
CO1	Lecture using PPT and demonstration of practical data	assignment
CO2	Lecture using PPT	Class test (Short Q and MCQ)
CO3	Lecture using PPT and model demonstration	Final Exam (Short Q, MCQ, Quiz, Explanation)
CO4	Lecture using PPT	Class test (Short Q and MCQ), presentation
CO5	Lecture using PPT and Group discussion	Final Exam (Short Q, MCQ, Quiz, Explanation)

Books Recommended:

1. S. Z. Haider, *Introduction to Modern Inorganic Chemistry.*
2. Haque and Mollah, *Physical Chemistry*
3. R. T. Morrison and R. N. Boyd, *Organic Chemistry* (6th edition)
4. Raymond Chang, *General Chemistry*

Course Code: ECO 0311 1107C	Credit: 2	Year: 1st	Semester: 1st
Course Title: Principles of Economics		Course Status: Theory	

i) Course Description and Objectives

This course offers a framework for comprehending how people, organizations, and governments make decisions in a world with scarce resources. It helps in illuminating the trade-offs that individuals must make as well as the motivating factors behind choices. It covers the basic knowledge of microeconomics as well as macroeconomics. The microeconomics topics include basic principles of economics, demand, supply, and market equilibrium and consumer theory. In addition, it emphasizes various macroeconomic measurements and the macroeconomic relationships within an economy.

The ECO0311 1107C course introduces the main ideas and concepts involved in modern economics and attempts to provide students with an understanding of how the economy works, what type of problems economists attempt to solve, and how they set about trying to solve them. The course is primarily concerned with the analysis of individual decision-making agents, the behavior of firms and industries in the economy (microeconomics), on the economy as a whole (macroeconomics) and the inherent problems facing underdeveloped and developing countries (economic development).

Microeconomics provides a brief and simple introduction to the subject matter and scope of Economics. This section aims to introduce microeconomic analysis. It outlines the theory of markets with relevant applications to business, social and individual issues. The course covers the principles and consequences of "rational" choice by individual economic agents in markets. The course also provides an introductory analysis of the role of governments in seeking to ensure the efficient operation of markets.

Macroeconomics provides a brief and simple introduction to the subject matter and scope of Macroeconomics. It also aims to introduce macroeconomic analysis outlining how the national income is measured and determined. It also provides a framework in which the interaction of money and goods and services markets can be developed, allowing students to understand the process by which the levels of economic activity and employment are determined.

Economic development provides students with an understanding of economic theories and analysis in the field of development economics. The section is designed to deal with a selection of issues and problems facing developing economies.

ii) Course Objectives

(i) To facilitate fundamental concepts of economics, such as scarcity, market mechanism, utility, budget line and their role in optimizing consumption as an individual and society,
(ii) To develop ability to compare different kinds of production processes, cost structures, and markets,
(iii) To provide the basic concept on the determination of national income and details in computation of GDP,
(iv) To get acquainted about inflation, and rate of unemployment\,
(v) To familiarize the students with the functions of money, central bank, commercial bank and the mechanism of forming monetary policy,
(vi) To grasp knowledge about economic growth and development, poverty measures.

iii) Course Content:

Introduction to Microeconomics:

1.Basic Concepts and Tools: Definition and Scope of Microeconomics, Scarcity, Choice, Opportunity Costs and Production Possibility Frontier (PPF) and Circular Flow of Economic Activities model; fundamental economic problems and solution systems.

2. Concepts of demand, supply, and market equilibrium

3. Concepts of elasticity, different types of elasticities, and their applications.

4. Concepts of total Utility, Marginal utility and Law of Diminishing Marginal Utility

5. Concepts of production, Cost and profit, characteristics of different types of markets.

Introduction to Macroeconomics: 6. Key macroeconomic indicators and their performance measurement – GNP and GDP. 7. Money and Banking: functions of money, function of commercial and central bank, 8. Economic Policies: Monetary policy and Fiscal policy and structure of govt. budget. 9. Inflation and Unemployment: Definition, Types, Causes, and Remedial Measures.
Development and Related Issues: 10. Economic Growth and development and concept of poverty and poverty measures. 11. Human Development Index (HDI); key human-socio-economic development indicators of Bangladesh 12. Sustainable Development Goals (SDG).

iv) Course Learning Outcomes (COs):

By end of this course, the students will able to:

1) Analyze individual decision-making agents, the behavior of firms and industries in the economy,
2) Measure the concept of elasticity quantitatively and qualitatively in economic analysis and know differences between different types of markets,
3) Explain macroeconomic concepts and use simple economic models to interpret the behaviour of key macroeconomic variables,
4) Investigate monetary and fiscal policy and Government budget,
5) Figure out the main issues confronting underdeveloped and developing countries.

v) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2		2									
CO3		3		2				2		3		
CO4					3	3						
CO5				3	3			2		2		

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL01, TL02 TL05	CA03, CA04, SA01, SA02
CO2	TL01, TL02 TL05	CA01, CA04, SA01, SA02
CO3	TL01, TL02 TL05	CA02, CA05, SA01, SA02
CO4	TL01, TL02 TL05	CA02, CA03, SA01, SA02
CO5	TL01, TL02 TL05	CA02, CA03, SA01, SA02

v) References:

1. *Arnold, R. A. (2014): Economics, Southwestern Publishing Company, Eleventh Edition*
2. *Browning, E. K. and Zupan,M. A. (2006): Microeconomics – Theory and Application, Ninth Edition*
3. *Koutsoyiannis, A. (2003): Modern Microeconomics, Palgrave Macmillan, Second Revised Edition*
4. *Mankiw, N. G. (2012): Principles of Economics, Thomson Southwestern Publishing, Sixth Edition*
5. *Samuelson, P. A. and Nordhaus,W. D. (2009): Economics, McGraw-Hill USA, Nineteenth Edition.*
6. Todaro, M. P. and Smith,S. C. (2012): Economics of Development in the Third World, Longman, Eleventh Edition
7. Bangladesh Economic Review, Various Issues, Ministry of Finance, Bangladesh

Course Code: ENG 0231 1101C	Credit: 2	Year: 1st	Semester: 1st
Course Title: Effective Communication in English		Course Status: Theory	

i) Course Rationale

This course is expected to develop two basic skills i.e. reading and writing. A variety of reading strategies and texts will be used to effectively develop first year students' academic reading skills thereby facilitating their future study. Also, the course focuses on developing the writing skills of students by familiarizing them with grammar rules, providing them with practice and enabling them to demonstrate the accurate use of grammar in their writing.

ii) Course Objectives

(i) To enable students to write with accuracy;
(ii) To facilitate effective and comprehensible writing;
(iii) To raise awareness of common errors that occur in writing;
(iv) To develop students' ability to understand write-ups on issues of general concern;
(v) To improve the vocabulary of learners for effective communication.

iii) Course Contents

a) Reading

- Different Reading Strategies
- Guessing Meaning from the Context
- Critical Reading (Analyze)
- Critical Reading (Synthesize)
- Critical Reading (Evaluate)
- Annotation
- Summary Writing

Materials

- A selection of 08-10 editorials and reports from newspapers/magazines/journals,etc.
- Reading texts in New Headway Upper Intermediate Student's Book (Current edition)
- Selected passages from recommended books
- A selection of other materials may be supplied as handouts by the instructor as necessary

b) Writing

- Forms and functions of different word categories (noun, verb, adjective, etc.)
- Aspects and uses of tense
- Subject-verb agreement
- Use of infinitive, gerund, present participle, past participle, modals, causatives, conditionals, subjunctives, modals.
- Use of sentence connectors/ cohesion markers/ punctuation
- Effective combination of sentences (simple, complex, compound)
- Developing a paragraph.

iv) Course Learning Outcomes

At the end of the course, students will be able to

CO1	Apply grammar rules
CO2	Express oneself correctly by using appropriate words, phrases, sentences or ideas
CO3	Critically reflect on a text (grasp abstract ideas and interpret them effectively, arrive at well-reasoned conclusions and solutions)
CO4	Create using earned knowledge both independently and in collaboration with peer groups
CO5	Demonstrate a comprehension of subject knowledge and its subsequent use

v) Mapping COs to POs:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				3		3			
CO2	3	3	3				3		3			
CO3	3	3	3				3		3			
CO4	3	3	3				3		3			
CO5	3	3	3				3		3			

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning & Assessment Strategy:

COs	Teaching-Learning Strategies	Assessment Strategies
CO1	TL 01, TL 02 TL 05	CA 01/CA 02, CA 03/CA 04
CO2	TL 01, TL 02 TL 05	CA 01/CA 02, CA 04/CA 05
CO3	TL 01, TL 02 TL 05	CA 04/CA 05
CO4	TL 02	CA 05
CO5	TL 01, TL 02 TL 05,06	CA 01/CA 02

Books Recommended

1. Tibbits, E. E., editor. Exercises in Reading Comprehension. Longman, 2013.
2. Liz and John Soars. New Headway Upper Intermediate Student's Book. Oxford University Press, 2014.
3. Payle, Michael. Cliff's TOEFL Preparation Guide. 12th ed., Cliffs Notes Inc., 2019.
4. Otherresources recommended by course instructors

Course Code: MAT 0541 1103C	Credit: 03	Year: 1st	Semester: 1st
Course Title: Differential Calculus and Vector Analysis		Course Status: Theory	

i) Rationale of the Course:

This course is about the basic mathematics that is fundamental and essential component in all streams of undergraduate studies in sciences and engineering.

ii) Course Content:

Differentiation: Differentiation of explicit and implicit functions and parametric equations.
Successive Differentiation: Successive differentiation of various types of functions; Leibnitz's theorem.
Expansion of Functions: Rolls theorem; mean value theorem. Taylor's theorem in finite and infinite forms; Maclaurin's theorem in finite and infinite forms; Lagrange's form of remainder; Cauchy's form of remainder; expansion of functions by differentiation and integration.

Partial Derivatives: Partial differentiation; Euler's theorem.
Tangent and Normal: Tangent and normal; subtangent and subnormal in Cartesian and polar coordinates.
Maximum and Minimum: Determination of maximum and minimum values of functions; point of inflexion and its applications.
L'Hospital's Rule: Evaluation of indeterminate forms by L'Hospital's rule.
Curvatures: Curvature, radius of curvature, centre of curvature and chord of curvature, evolute and involute; asymptotes; envelopes; curve tracing.
Vectors: Definitions of vectors; equality of vectors; addition and multiplication of vectors; triple products and multiple products.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate the indefinite, definite, and improper integrals,
2) Solve ordinary differential equations of first and second order using different methods,
3) Apply the ideas of accumulation to calculate areas and volumes,
4) Create differential equations in different areas of science and engineering,
5) Facilitate appropriate use of components of vectors and it's different applications.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2								
CO2	2											
CO3	1	3										
CO4	3	2		2	2						2	1
CO5	3				1						1	2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lecture using board/projectors	Quiz, Short answer, Midterm Exam 1, and Semester-end Exam
CO2	Lecture using board/projectors	Assignment and Semester-end Exam
CO3	Lecture using board/projectors, Group work	Problem solving task cards, Assignment, Midterm Exam 1, and Semester-end Exam
CO4	Lecture using board/projectors, audio-visual tutorial	Quiz, Midterm Exam 2, and Semester-end Exam
CO5	Lecture using board/projectors	Quiz, Midterm Exam 2 and Semester-end Exam

vi) References:

1) Mohammad and Bhattacharjee: Differential Calculus
2) Spiegel, M. R.: Vector Analysis
3) Das and Mukherjee: Differential Calculus
4) J. Edwards: Differential Calculus
5) Rahman and Bhattacharjee: A Text Book on Coordinate Geometry with Vector Analysis

Course Code: PHY 0533 1107C	Credit: 3	Year: 1st	Semester: 1st
Course Title: General Physics		Course Status: Theory	

i) Rationale of the Course: A student needs to learn the science behind everything that makes a modern technological lifestyle. This course provides necessary knowledge to understand phenomena related to crystalline solids, elasticity, propagation and Doppler effect of sound waves, moving charges, and thermodynamical processes of a system.

ii) Course Objectives:
The objectives of this course are:

1) to familiarize the students with various crystals and their microscopic structures, to realize microscopic models of various kinds of bond.
2) to provide knowledge on the elastic behaviors of materials for their application in engineering purposes.
3) to introduce students with various phenomena of electromagnetism, the laws of thermodynamics, Carnot's cycle, entropy and various laws of black body radiation.

iii) Course Content:
Structure of Matter: Classification of solids, amorphous, crystalline, binding energy and atomic separation in equilibrium in solid, different types of bond in crystals, lattice, basis, crystal, unit cell, packing fractions of *sc*, *bcc*, *fcc* and *hcp* crystals, Miller indices, Interplanar spacing, X-ray diffraction, Bragg's law, distinction between metal, insulator and semiconductor.

Elasticity: Elastic and plastic behaviors of materials, elastic moduli, stress-strain diagram.

Sound Waves: Simple harmonic motion, audible, ultrasonic and infrasonic waves, propagation and velocity of longitudinal waves in gaseous medium, Doppler effect, interference and diffraction, beats.

Electromagnetism: Coulomb's law, electric field, Gauss's law and its applications, electric potential and potential energy, dielectrics and Gauss's Law, magnetic field and field strength, magnetic forces on charge and current, torque on a current loop, Ampere's Law, Biot-Savart law and their applications.

Thermodynamics: First law of thermodynamics, isothermal and adiabatic changes, second law of thermodynamics, reversible and irreversible processes, Carnot's cycle, entropy and change of entropy in reversible and irreversible processes, black body radiation, Planck's law, Wein's law and Rayleigh-Jean's law.

iv) Course Learning Outcomes (COs):

By end of this course, the students will able to:

1) Explain the reasons of varieties of crystal structures on the basis of bonding mechanism, realize fact of compactness of atoms in the structure, and apply the fundamental equation of structural analysis
2) Distinguish between elastic and plastic materials, and able to control the applied stress for making a material either elastic or plastic
3) Interpret the phenomena related to simple harmonic motion, Doppler effect, and distinguish between sound wave and electromagnetic wave
4) Explain electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law and electric potential, and produce the required magnetic field from electric current
5) Acquaint with the laws of thermodynamics and the change of a system under isothermal and adiabatic conditions, and be able to realize the principle of Carnot's engine

iv) Mapping Course Learning Outcomes (COs) with the Program Learning Outcomes (POs):

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3										
CO2		3	3				2						
CO3		3	3				2						
CO4		3	3				2						
CO5		3	3				2						

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL1, TL03, TL05	CA01, CA03
CO2	TL1, TL03, TL05	CA01, CA03
CO3	TL1, TL03, TL05	CA01, CA03
CO4	TL1, TL03, TL05	CA02, CA03
CO5	TL1, TL03, TL05	CA02, CA03

Recommended Books

1. Kittel, C.: *Introduction to Solid State Physics*
2. Hannan, A. and Islam, M. A.: *Concepts of Solid State Physics Made Easy*
3. Beiser, A.: *Perspective of Modern Physics*
4. Halliday, D. and Resnick, R.: *Physics (Vol. I and II)*
5. Halliday, D, Resnick, R and Walker, J: *Fundamentals of Physics*
6. Sears, Zemansky and Young: *University Physics*
7. Puri, S. P.: *Fundamentals of Vibrations and Waves*
8. Zemansky M. W. and Dittman R. H.: *Heat and Thermodynamics*

Course Code: SSS 0312 1100	Credit: 3	Year: 1st	Semester: 1st
Course Title: History of the Emergence of Independent Bangladesh		Course Status: Theory	

Part A: Introduction

1.1 Course Description

This is a special compulsory course for all students of Bachelor program of Shahjalal University of Science and Technology, Sylhet. This course deals with the interrelated themes and topics that are essential to understand the emergence of Bangladesh.

1.2 Course Objectives

The objectives of this course in general are to make students understand the causes of Liberation War, growth and development of Bengali nationalism and identity, national emancipation of the Bangalis. The specific course objectives are:

1) To give an idea about the War of Liberation and freedom fighters
2) To clarify the role of different sections of people in the War of Liberation
3) To explain the role of Bangabandhu in Liberation War
4) To give an idea about the sacrifices of martyrs for the motherland.

1.3 Course Learning Outcomes:

Upon successful completion of the course, students will be able to

CO1: Explain fundamental characteristics of politics of East Pakistan from 1947 to 1971

CO2: Gather knowledge on the post-colonial nationalist resistance during Pakistan period and the background of the establishment of Bangladesh

CO3: Describe the disintegration of East-West Pakistan and emergence of new nation state, Bangladesh

CO4: Understand the nature and dynamics of different political movements of Pakistan from 1947 to 1971

CO5: Explain the background and elements of war of liberation and contributions of various actors

CO6: Evaluate the role of Bangabandhu Sheikh Mujibur Rahman in the creation of independent Bangladesh.

Part B: Teaching and Assessment

2.1 Teaching Strategies

The course materials are delivered through certain teaching-learning activities such as lectures, reading, assignments, exercise and workshop papers.

2.2 Assessment Strategies

No.	Description	Mark
1	Class attendance	10
2	Midterm test	20
3	Class Evaluation	10
4	Final Exam	60

Coursework = 40% of the overall mark, and the Final Examination = 60%.

The coursework consists of at least two tests with a combined weight of 20% of the final mark, 10% as a part of continuous assessment like the class test, quiz, problem-solving, short assignment and 10% of the final mark is reserved for class attendance as per rule of the university. Assignment submission date will be fixed by the Course Instructor.

Mid Semester Test Date: The mid-semester test is scheduled after the mid-semester break, and it covers topics in weeks 1-6. More details will be provided at lectures.

Final Exam Test Date: Final Exam Test schedule will be declared by the department before the preparatory leave. The final exam covers all the topics. Students must be able to show an understanding of the course material.

2.3 Assessment of Course Learning Outcome

CO	Test	Assignment	Final Examination
1	x	x	x
2	x	x	x
3	x	x	x
4	x	x	x
5	x		x
6	x	x	x

2.4. Grading System
The grading system has been detailed in Section 7 "Grading System" in Semester Ordinance

Part C: Course Content

3.1 Course Outline

Course Content	Teaching Strategy
1. Description of the land and its people b. Impacts of geographical features c. Ethnic composition of Bengal d. Development of Bengali language and its significance e. Cultural syncretism and religious tolerance f. Distinctive identity of Bangalis in the context of undivided Bengal	Lecture, tutorial and exercise
2. Proposal for United Independent Bengal State, Pakistan movement and foreshadowing of Bangladesh, the 1947 partition of the subcontinent a. Rise of communalism under the British colonial rule b. The 1940 Lahore Resolution c. Suhrawardy's move for undivided independent Bengal d. The establishment of Pakistan, 1947 e. Foundation of the Awami Muslim League (1949) and the struggle for emancipation of the Bangalis	Lecture, discussion and assignment
3. Pakistan: Structure of the state and disparity a. Central and provincial structures b. Influence of military and civil bureaucracies c. socio-economic, political and cultural disparities	Lecture, discussion and assignment
4. Language movement and quest for Bengali identity a. Misrule by Muslim League and struggle for democratic politics b. The Language movement: context, phases and international recognition of 21 February as Mother Language Day c. United Front elections of 1954 : Results and consequences	Lecture, tutorial and exercise
5. Military rule: the regimes of Ayub Khan (1958-1969) and Yahia Khan (1969-1971) a. Military rule and its characteristics b. Ayub Khan's rise to power and characteristics of his rule (political repression, Basic democracy, Islamisation) c. Fall of Ayub regime and Pakistan under Yahya military junta	Lecture, tutorial and exercise
6. Rise of Bangali nationalism and the movement for the right to self-determination a. Resistance against Pakistani cultural aggression and resurgence of Bengali nationalism b. Bangabandhu Sheikh Mujibur Rahman's 6-points programme (1966) : Its significance and reaction of the regime c. The Agartala Conspiracy Case, 1968	Lecture, tutorial and exercise

7. The mass- upsurge of 1969 and its consequences a. Background b. Movement based on 6-points and 11-points programmes **c.** Fall of the Ayub regime **d.** Emergence of Bangabandhu as an undisputed leader	Lecture, tutorial and exercise
8. Election of 1970 and its significance a. Legal Framework Order (LFO) of general Yahya Khan b. Programmes of different political parties c. Election results d. Pakistani military junta's conspiracy to thwart the results	Lecture, tutorial and exercise
9. Non-cooperation movement and 7th March address of Bangabandhu a. The non-cooperation movement against Pakistani rule and its salient features b. 7th March address of Bangabandhu : Background c Significance of 7th March address d. International recognition of 7th March address as world heritage by UNESCO (2017)	Lecture, discussion
10. Declaration of Independence of Bangladesh a. Operation Searchlight (25 March 1971) b. Declaration of Independence of Bangladesh by Bangabandhu c. Beginning of the Liberation War of Bangladesh	and assignment
11. The War of Liberation, 1971 a. Genocide, repression of women, Bangali refugees in India b. Formation of Bangladesh government and Constitutional proclamation of Independence c. The spontaneous early resistance and subsequent organized resistance by Mukti Fouz, Mukti Bahini, Guerrillas and the frontal war in December 1971 d. Campaign in favour of the War of Liberation (Shadhin Bangla Betar Kendra, campaigns in abroad and formation of international public opinion) e. Contribution of students, women, the mass people and different political parties in the War of Liberation f. The role of great powers and the United Nations in the Liberation War g. The contribution of India in the Liberation War h. The anti-liberation activities of the Peace Committee, Al-Badar, Al-Shams, Rajakars, pro-Pakistani political parties and other Pakistani collaborators , killing of the Bangali intellectuals at the end of the war i. Arrest and Trial of Bangabandhu in Pakistani custody and reaction of the World community j. Formation of joint command of Mukti Bahini and Indian allied forces and Victory in the war k. Evaluation of Bangabandhu's contributions in the Independence of Bangladesh	Lecture, discussion

12. The Bangabandhu government, 1972-1975 a. Homecoming of Bangabandhu and his address at Race Course on 10 January 1972 b. Making of the Bangladesh Constitution, 1972 c. Reconstruction of the war-ravaged country by Bangabandhu government d. Foreign policy of Bangabandhu; his first address at the United Nations in 1974 e. Bangabandhu's 'Second Revolution' or System change, 1975 f. The assassination of Bangabandhu and his family members and the ideological turn-around	Lecture, tutorial and exercise

3.1 Alignment of topics of the courses with COs

	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
Content 1	x	x				
Content 2	x	x	x		x	
Content 3	x	x	x		x	
Content 4	x		x	x		
Content 5	x			x	x	
Content 6				x	x	x
Content 7				x	x	x
Content 8			x	x	x	
Content 9				x	x	x
Content 10				x	x	x
Content 11				x	x	x
Content 12						x

Mapping CO with PO:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x	x								x		
CO2	x	x								x		
CO3	x									x		
CO4	x									x		
CO5	x	x								x		
CO6	x	x								x		

Part D: Learning Resources

Recommended Readings:

১. Ahmed, Salahuddin and Bazlul Mobin Chowdhury (eds.), *Bangladesh: National Culture and Heritage: An Introductory Reader* (Dhaka: Independent University Bangladesh, 2004)

২. Harun-or-Roshid, *The Foreshadowing of Bangladesh: Bengal Muslim League and Muslim Politics, 1906-1947* (Dhaka : The University Press Limited, 2012)

৩. Harun-or-Rashid, *The Foreshadowing of Bangladesh: Bengal Muslim League and Muslim politics, 1906-1947. (*Dhaka: The University Press Limited 2003)

৪. Harun-or-Rashid, *From 1947 Partition to Bangladesh: BANGABANDHU and State Formation in Perspective*. (Dhaka: The University Press Limited 2021)
৫. Jahan Rounaq, *Pakistan: Failure in National Integration,(Dhaka :* The University Press Limited, 1977)
৬. Jahan Rounaq, *Political Parties in Bangladesh*, (Dhaka: Prothoma Prokashan 2015)
৭. Talukder Maniruzzaman, *Radical Politics and the Emergence of Bangladesh, (Dhaka :* Mowla,Brothers, 2003)
৮. Talukdar Maniruzzaman , *The Bangladesh Revolution and Its Aftermath,* (Dhaka: UPL 2003)
৯. Nurul Islam, *Making of a Nation : Bangladesh- An Economist Tale, (*Dhaka: UPL 2013)
১০. হারুন-অর-রশিদ, *বাংলাদেশ : রাজনীতি সরকার ও শাসনতান্ত্রিক উন্নয়ন ১৭৫৭-২০১৮*, (ঢাকা: অন্যপ্রকাশ ২০১৮)
১১. হারুন-অর-রশিদ, *বঙ্গীয় মুসলিম লীগ : পাকিস্তান আন্দোলন, বাঙালির রাষ্ট্রভাবনা ও বঙ্গবন্ধু*, (ঢাকা: অন্যপ্রকাশ ২০১৮)
১২. হারুন-অর-রশিদ, *৭ই মার্চের ভাষণ কেন বিশ্ব-ঐতিহ্য সম্পদ, বঙ্গবন্ধু মুক্তিযুদ্ধ বাংলাদেশ*, (ঢাকা: অন্যপ্রকাশ ২০১৮)
১৩. শেখ মুজিবুর রহমান, *অসমাপ্ত আত্মজীবনী*, (ঢাকা: ইউপিএল ২০১২)
১৪. শেখ মুজিবুর রহমান, *কারাগারের রোজনামচা*, (বাংলা একাডেমি ২০১৭)
১৫. অলি আহাদ, *জাতীয় রাজনীতি, ১৯৪৫-১৯৭৫, (*ঢাকা: বাংলাদেশ কো-অপারেটিভ বুকস সোসাইটি ২০০৪)
১৬. সৈয়দ আনোয়ার হোসেন : *বাংলাদেশের স্বাধীনতাযুদ্ধে পরাশক্তির ভূমিকা*, (ঢাকা : ডানা প্রকাশনী, ১৯৮২)
১৭. আবুল মাল আবদুল মুহিত : *বাংলাদেশ: জাতিরাষ্ট্রের উদ্ভব, (ঢাকা :* সাহিত্য প্রকাশ, ২০০০)

Course Code: CEE 0732 1132	Credit: 1.0	Year: 1st	Semester: 1st
Course Title: Engineering Graphics I		Course Status: Sessional	

i) Rationale of the Course:

This course will provide the students with the basics of Engineering drawing mainly visualization, design hypothesis, standards & conventions of drawing, the tools of drawing, and the utilize of Drawings in designing applications. Engineering drawing is the graphical dialect to precise considerations, thoughts, and ideas. The expression by drawing is precise, exact, and brief. This information is fundamental for understanding the detailed description of a building/any other structures.

ii) Course Content:

Fundamentals of engineering graphics: This chapter provides introduction to different instruments like Set square, T-scale, Cardboard Scale, etc. and their uses. Different types of plane geometry are described.
Fundamentals of Multi-view & Projection: This chapter presents Multi-view & Projection like revolution and auxiliary views, sectional views, isometric, diametric, and oblique projections.
Fundamentals of Perspectives: This chapter presents Perspectives like one point, two-point, and three-point perspectives.
Fundamentals of descriptive geometry: This chapter presents Descriptive Geometry like points lines and planes, parallelism, and perpendicularly surfaces. This chapter also discusses building block drawing, stair drawing and plan drawing,.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the basic types of plane geometry,
2) Analyze and draw multi-views and projection,

3) Explain the drafting to some extent.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2										
CO2			2										
CO3				3									2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 02, TL 03, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 02, TL 03, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: ENG 0231 1102C	Credit: 1.0	Year: 1st	Semester: 1st
Course Title: English Language Lab I		Course Status: Lab	

i) Course Rationale

This course is designed to improve the speaking and listening skills of students in the English language. Emphasis is laid on proper pronunciation for accurate articulation and recognition of speech sounds as well as correct stress, intonation and language use in varied situations.

ii) Course Objectives

(i) To enable students' understanding of the variations in pronunciation;
(ii) To teach proper pronunciation and accurate articulation;
(iii) To facilitate appropriate stress and intonation in speech;
(iv) To encourage use of English effectively in everyday situations;
(v) To ensure overall improvement of oral communication through listening and speaking.

iii) Course Contents

(a) Speaking

- Articulators
- English Phonetic Alphabet (British and American) and International Phonetic Alphabet (IPA)
- Stress rules of English
- Intonation rules and functions of intonation
- Communication styles and cultural context
- Fluency, mistakes, misunderstandings, audience, taboos, self-esteem, confidence
- Activities: dialogue, debate, extempore speech, interview, role-play

(b) Listening

- Basics of listening
- Various types of pronunciation
- IPA, RP, transcription
- Different accents and intonation patterns
- Activities for meaning-focused listening
- Information transfer strategies

- Listening practice through selection of audio clips

iv) Course Learning Outcomes

At the end of the course, students will be able to

CO1	Read the symbols of the International Phonetic Alphabet used to represent the sounds of the English language
CO2	Apply appropriate intonation and stress patterns in English words and sentences
CO3	Interpret information accurately
CO4	Collaborate and apply intonation and stress patterns.
CO5	Produce continuous speech clearly and convincingly

v) Mapping COs to POs

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3				3		3			
CO2	3	3	3				3		3			
CO3	3	3	3				3		3			
CO4	3	3	3				3		3			
CO5	3	3	3				3		3			

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02 TL 05	CA 01/CA 02, CA 03/CA 04
CO2	TL 01, TL 02 TL 05	CA 01/CA 02, CA 04/CA 05
CO3	TL 01, TL 02 TL 05	CA 04/CA 05
CO4	TL 02	CA 05

Books Recommended:

Anderson, Anne C., et al.*Listening*.Oxford University Press, 1988.
Anderson, Kenneth, et al. *Study Speaking*. Cambridge University Press, 2007.
Hancock, Mark. *English Pronunciation in Use*. Cambridge University Press, 2004.
Jones, Daniel. *Cambridge English Pronunciation Dictionary*. Cambridge University Press, 2011. Richards, Jack C., and David Bohlke. *Speak Now: 1*. Oxford University Press, 2013.
Richards, Jack C., et al. *Person to Person*. Oxford University Press, 2007.
Roach, Peter. *English Phonetics and Phonology*. Cambridge University Press, 2009.

19.2 First Year Second Sesemester

Course Code: CEE 0541 1233	Credit: 2.0	Year: 1st	Semester: 2nd
Course Title: Engineering Mechanics II		Course Status: Theory	

i) Rationale of the Course:

This course introduces the relevant physical properties and fundamental laws governing materials and structures' behavior, and students will learn how to solve various problems of interest to civil and environmental engineers. In this course, the emphasis is on the physical understanding of why a material or structure behaves the way it does in the engineering design of materials and structures.

ii) Course Content:

Fundamentals of Friction: This chapter presents frictional force, limiting frictional force, coefficient of kinetic friction, laws of friction, angle of friction, belt friction, and pivot friction.
Flexible Cord:

This chapter presents the parabolic chord, the length of the parabolic curve, the catenary.
Plane Motion: Review of Displacement, Velocity, Acceleration, Constant Acceleration-Rectilinear Motion, Variable Acceleration, Angular Velocity, Relation Between Angular And Linear Speeds, Angular Acceleration, Constant Angular Acceleration, Curvilinear Motion, Tangential And Normal Accelerations.
Fundamentals of Relative Motion: This chapter presents relative displacement, relative velocity, and relative motion of points in a rigid body.
Force System that Produces Rectilinear Motion: Introduction, Newton's Laws of Motion, Component Forces and Accelerations, Motion on an Inclined Planes, Motion of Connected Bodies, Motion of Center of Gravity of a Rigid Body, Location of the Resultant – Body in Rectilinear Translation, Inertia Force, Methods of Solving Problems.
Work, Kinetic Energy and Power: Work, Work of a System of Forces Acting on a Rigid Body, Principle of Work and Kinetic Energy, Kinetic Energy of a Rigid Body in Translation, Potential Energy, Work of a Couple, Kinetic Energy of a Rotating Body, Bodies in Plane Motion, Frictional Force in Plane Rolling, Power, Efficiency.
Fundamentals of Impulse and Momentum: This chapter presents impulse and momentum, principle of impulse and momentum, angular impulse and angular momentum, linear momentum and conservation of linear momentum.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain basic friction concepts and solve problems on wedges, belts, and bearings using these concepts,
2) Interpret parabolic cable and catenary and calculate force on a cable support systems,
3) Identify basic concepts of kinematics and calculate displacement, velocity and acceleration of a particle and rigid body in motion.
4) Apply different principles of kinetics to solve retaled problems.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3										
CO2		1	3										
CO3		1	3										
CO4		1	3										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 07	CA 01, CA 04, SA 01
CO2	TL 01, TL02, TL 07	CA 03, SA 01
CO3	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 05, TL 07	CA 02, CA 03, CA 04, SA 01

Course Code: CEE 0732 1235	Credit: 3.0	Year: 1st	Semester: 2nd
Course Title: Engineering Materials		Course Status: Theory	

i) Rationale of the Course:

Engineering materials are important both from a scientific perspective, as well as towards applications. In the race of modern science and technology, to make things stronger, cheaper, lighter, more functional, and more sustainable, the manipulation of materials, their properties, and processes is key. So, materials are of the utmost importance for engineers (or other applied fields), as the usage of the appropriate materials is crucial when designing systems. This course will provide the students with a comprehensive understanding of the composition, manufacturing, properties, and engineering behavior of materials used in various civil engineering applications.

ii) Course Content:

Introduction: General consideration, Properties of engineering materials, Selection of engineering materials, and commonly used construction materials in Bangladesh.
Bricks: Factors affecting the quality of bricks, constituents of bricks and their function, the composition of good brick earth, harmful constituents of brick-clay, the process of manufacturing, characteristics of good bricks, field testing of bricks, tests of bricks (laboratory) classification bricks in general, classification bricks according to PWD and BDS 208, special bricks, uses of bricks.
Aggregates: Introduction to aggregates and their uses, classification of aggregates (based on size, source, and specific gravity), aggregate characteristics affecting concrete behavior, characteristics controlled by porosity, different moisture condition of aggregate, absorption, and surface moisture quantity terms, characteristics dependent on prior exposure and processing factors, the influence of aggregate on concrete strength, specification of coarse aggregate, brick aggregate, stone aggregate, availability of stone in Bangladesh, recycled aggregate.
Fine Aggregate/ Sand: Sand/clay/silt, particle size ranges, classification of sand based on source and size, properties of good sand, tests on the sand, specification of fine aggregate, standard specification for standard sand, sand characteristics in Bangladesh, availability of sand in Bangladesh, use of sand, fineness modulus (FM), computation of FM, sieve analysis and gradation, types of grading curves, bulking of sand.
Cement: Introduction, Portland cement, chemical compounds in Portland cement and their role of them, functions of various ingredients of cement, manufacturing of cement, properties of cement (hydration, setting, hardening, fineness, soundness, compressive strength, etc.), types of Portland cement and their specifications, field testing of cement, standard physical requirements of Ordinary Portland cement.
Steel: Steel, cast iron, wrought iron, Compositions and typical applications of various carbon steel, TMT steel, Tor-steel, Weathering steel, High-performance steel, Prestressing steel, common forms of steel, rebar size and grade, the feasibility of steel in reinforced concrete constructions, steel making process (scrap to billet, billet to final products), properties of steel, computation of properties of steel from stress-strain diagram.
Concrete: This chapter discusses about ingredients of concrete; Properties of concrete; Factors controlling properties of concrete; Types of concrete; Light weight concrete; Water cement ratio; Carbonation of concrete; Curing of concrete; Workability of concrete; Creep of concrete; Concreting in cold and hot weather and Design of concrete mix by different methods.
Timber: Uses of timber in engineering work, Mechanical properties, Advantages of timber, Structure of tree, Conversion of timber, seasoning of timber, Defects in timber, Deterioration of timber, Preservation of timber, Making timber as Fire resistant element, and Characteristics of good timbers have been described in this chapter.
Rubber: Types of rubber, Sources of natural rubber, Physical properties of natural rubber, Chemical treatment of latex, Raw materials, Synthetic reactions and properties of synthetic rubber, and vulcanization of rubber.

Plastic: This chapter discusses in detail about characteristics of plastic, their classification, some typical examples of plastics, and their uses.
Glass: Properties of glasses, Various uses of glass in construction, Major constituents, Manufacture of glass, Basic types of glass and their uses.
Paints and Varnishes: Objectives of paints & varnishes, Characteristics of good paint & varnish, Constituents of Paints & varnishes, Types of paints & varnishes, and finally Common defects in painting (causes, prevention, and remedial methods) have been discussed.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the physical and engineering properties, manufacturing process, and quality control procedure of various construction materials i.e., brick, steel, aggregate, cement, glass, rubber, and plastic.
2) Identify the key factors that affect the strength of concrete.
3) Analyze design requirements and perform cement concrete mix design to obtain desired strength for realistic civil engineering projects.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3				3								

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05	CA 01, CA 04, SA 01
CO2	TL 01, TL 02, TL 05	CA 02, CA 03, SA 01
CO3	TL 01, TL 02, TL 05, TL 08	CA 03, SA 01

Course Code: CEE 0541 1237	Credit: 2.0	Year: 1st	Semester: 2nd
Course Title: Numerical Analysis		Course Status: Theory	

i) Rationale of the Course:

This course introduces different computational methods to solve a mathematical problem numerically. Based on sound knowledge in computational mathematics, numerical methods will enable the students to develop the ability to solve various complicated mathematical problems associated with different branches of Civil and Environmental Engineering.

ii) Course Content:

Introduction to Numerical Analysis: This chapter presents a brief discussion on the significance of numerical methods, difference between analytical and numerical approach, some simple problems on different civil and environmental engineering fields.

Numerical differentiation: Introduction, Numerical differentiation: Errors in numerical differentiation, The cubic spline method, Maximum and minimum values of a tabulated function.
Numerical integration: Introduction, Trapezoidal rule, Simpson's 1/3-rule, Simpson's 3/8 rule, Weddle's rule, Romberg Integration.
Interpolation: Introduction, Finite differences: Forward differences, Backward differences, Central differences, Newton's formula for Interpolation, Central differences interpolation formula Stirling's formula, Bessel's formula, Everett's formula, Practical Interpolation, Lagrange's Interpolation formula, Divided differences, and their properties, Inverse Interpolation, Interpolation by iteration.
Accuracy and error: This chapter presents different types of error occurring in numerical computation. Difference between accuracy and precision is also discussed with examples. Computation of error in successive iteration involved in the numerical method is also practiced in this section.
Root finding algorithm: This chapter presents different open and bracketing methods for finding the roots of equations with examples. Generally, Bisection, False-position, Newton-Raphson and Secant methods are discussed along with their advantages and limitations.
Ordinary differential equation: This chapter presents the importance of formation and solution of ordinary differential equations (ODE) in the engineering field. A detailed description on Euler's, Midpoint and Heun's method to solve ODE is presented. Moreover, a brief introduction on Runge-Kutta method is also delivered in this section.
Curve fitting: This chapter presents the use of curve fitting techniques to find out the interrelationship between variables. Theoretical and practical demonstration is also made on various linear and non-linear relations that exist in different civil and environmental engineering fields.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain the core ideas and concepts of numerical methods for solving complicated Engineering calculations approximately
2) Apply various numerical methods for performing tasks, such as interpolation, differentiation, integration, and their application using MATLAB and MS Excel
3) Exloere rigorous, analytic, highly numerate strategies to analyze problems such as finding roots of equations, differential equations, curve fitting to a given data set, and analyze errors induced from those approximate methods.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3		3										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 07, TL 08	CA 03, CA 05, SA 01
CO3	TL 01, TL 06, TL 07, TL 02	CA 02, CA 03, SA 01

Course Code: BUS 0411 1201C	Credit: 02	Year: 1st	Semester: 2nd
Course Title: Cost Accounting for Engineers		Course Status: Theory	

i) Rationale of the Course:

The contents of the course shed light on deep insight about cost concepts, prerequisite knowledge for cost control and application of management by exception at different organizational arena for sustainable long run operation.

ii) Course Objectives:

The course aimed to:

1) Describe the cost concepts, cost behaviour, and cost accounting techniques that are applied to manufacturing and service businesses.
2) Be capable to interpret cost accounting statements.
3) Provide the students with the capability to apply theoretical knowledge in decision making.
4) Be able to analyse and evaluate information for cost ascertainment, planning, control of business operations.
5) Discuss the various techniques available to measure managerial performance and to motivate employees toward organizational goals.
6) Identify and analyse both qualitative and quantitative standards to formulate best control methods.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Know about how cost accounting is used for decision making and performance evaluation.
2) Demonstrate how materials, labor and overhead costs are added to a product at each stage of the production cycle.
3) Express the place and role of cost accounting in the modern economic environment.
4) Recognize and apply the skills necessary for carrying out effective management decision-making and strategic management planning
5) Select the costs according to their impact on business and society.
6) Interpret the impact of the selected costs method.
7) Design management control process in different business areas.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√					√			√	√		
CO2	√					√			√	√		
CO3	√					√			√	√		
CO4	√					√			√	√		
CO5	√					√			√	√		
CO6	√					√			√	√		
CO7	√					√			√	√		

v) Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs:

Week	Topic/ Course Content	Teaching-Learning Strategy	Assessment Strategy	Corresponding COs
1	Introduction to Cost Accounting: Definition of Cost Accounting, Comparison of Cost Accounting and Financial Accounting; The role of Cost Accounting; Methods and Techniques of Cost Accounting; Characteristics of an Ideal Cost Accounting System	TL 01, TL 05	CA 01, SA 01	1
2	Cost Concepts, Classifications and Statements: Cost Object; Expenditures, Cost, Expense and Loss; Cost Classifications; Cost Data and Uses; The Chart of Accounts; Statement of Cost of Goods Manufactured and Sold; Cost Statement or Cost Sheet	TL 01, TL 05	CA 01, SA 01	1
3	Costing and Control of Materials: Classification of Materials; Accounting for Materials; Store ledger (FIFO & WAM) method; Inventory Planning; Ordering Cost, Holding Cost and EOQ; Effect of Quantity Discounts on EOQ; Safety Stock and Reorder Point; Material Control Methods; Materials Requirement Planning System. Practical problem.	TL 01, TL 02	CA 01, SA 01	1, 2
4	Costing and Control of Labour: Productivity and Labour Costs; Costs included in Labour; Accounting for Labour; Time Keeping, Computation of total payroll and Allocation of Payroll costs; Different incentive plan; Labour cost Control, Labour Turnover and Control of Labour Turnover; Learning Curve Theory. Practical problem & solution	TL 01, TL 02	CA 01, SA 01	2, 3
5	Costing and Control of Manufacturing Overhead: Manufacturing Overhead Costs; Actual Vs. Normal Costing of Manufacturing Overhead; Production Capacity, Predetermined Overhead Rates; Departmental vs. Plant-wise Overhead Rates; Separating Mixed Costs. Scatter-graph; High-low Method and Regression Analysis; Accounting for Manufacturing Overhead; Analysis and Disposition of Under-applied-and Over-applied Overhead	TL 01, TL 02	CA 01, SA 01	3
6	Contract Costing: Determination of profit of completed and incomplete contracts.	TL 01, TL 02	CA 01, SA 01	2, 3
7	Introduction of Management Accounting : Definition-process of Management Accounting, characteristics of Management Accounting, scope of Management Accounting, purpose and objectives of Management Accounting, Comparison of Management Accounting and Financial Accounting	TL 01, TL 02	CA 01, SA 01	4
8	Cost Terms, Concepts and Classifications: Cost Behaviour (Analysis and Use): General cost classifications- product costs versus period costs-	TL 01, TL 02, TL05	CA 02, CA 03, SA 01	5, 6

	cost classifications on Financial Statements. Types of cost behaviour patterns- the Analysis of Mixed Costs, High-low method			
9	Cost-Volume-Profit Relationships: The basics of CVP analysis- Break -even analysis- Break-even chart- Sales Mix. Business application and mathematical problem of CVP analysis	TL 01, TL 02, TL05	CA 02, CA 03, SA 01	5, 6
10	Budget: Define Budget, Types of Budget, Cash budget, purchase budget, sales budget, flexible budget and Related problems	TL 01, TL 02	CA 02, CA 04, SA 01	5, 7
11	Standard Costing: Meaning and Objectives- Types of ratios. Standard Costing and its uses for making business decision. Variance calculation, Decision making process from these calculation.	TL 01, TL 02	CA 02, CA 04, SA 01	6, 7
14	Assessment and review			

vi) Learning Materials:

a. Recommended Readings:

i. Cost Accounting by Matz and Usry

ii. Managerial Accounting by Garrison and Noreen

b. Supplementary Readings:

Theory and Practice of Costing- Volume 1 by Basu & Das

Course Code: MAT 0541 1204C	Credit: 03	Year: 1st	Semester: 2nd
Course Title: Integral Calculus and Ordinary Differential Equations		Course Status: Theory	

i) Rationale of the Course:

The combination of integral calculus and differential equations is a basic requirement to solve various integrals and differential equations for science and engineering students. It will provide the students with a solid foundation for further study in engineering.

ii) Course Content:

Integral Calculus: Definition of integration; integration by the method of substitution; integration by parts; standard integrals; method of successive reduction; definite integrals - its properties and use in summing series; Walli's formulae; improper integrals; Beta and Gamma functions; area under a plane curve in Cartesian and polar coordinates; area of the region enclosed by two curves in Cartesian and polar coordinates; trapezoidal rule; Simpson's rule; arc length of curves in Cartesian and polar coordinates; parametric and pedal equations; intrinsic equation; volumes of solid of revolution; volumes of hollow solid of revolution by shell method; area of surface of revolution.
Differential Equations: Ordinary differential equation and formation of differential equations; solution of first order differential equations with various methods; solutions of general linear equations of second and higher order with constant coefficients; solutions of homogeneous linear equations and applications; solution of differential equations of the higher order when the dependent and independent variables are absent; solutions of differential equations by the method based on factorization of the operators.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate the indefinite, definite, and improper integrals.
2) Solve ordinary differential equations of first and second order using different methods.
3) Apply the ideas of accumulation to calculate areas and volumes.
4) Create differential equations in different areas of science and engineering.
5) Apply the concepts of ordinary differential equations for solving engineering problems by choosing the most suitable method.

iv) **Mapping Course Learning Outcomes (COs) with POs:**

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	3											
CO3	1	3										
CO4		2			2							
CO5	3				1							

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lecture using board/projectors	Quiz, Short answer, Midterm Exam 1, and Semester-end Exam
CO2	Lecture using board/projectors	Assignment and Semester-end Exam
CO3	Lecture using board/projectors, Group work	Problem solving task cards, Assignment, Midterm Exam 1, and Semester-end Exam
CO4	Lecture using board/projectors, audio-visual tutorial	Quiz, Midterm Exam 2, and Semester-end Exam
CO5	Lecture using board/projectors	Quiz, Midterm Exam 2 and Semester-end Exam

Recommended Books:

1. Mohammed and Bhattacharjee: Integral Calculus
2. Ayres, F.: Differential equation
3. Edward, J.: Integral Calculus
4. Das and Mukherjee: Integral Calculus

Course Code: SCW 0923 1203C	Credit: 03	Year: 1st	Semester: 2nd
Course Title: Social Science for Engineers		Course Status: Theory	

i) Rationale of the Course:

This course provides students with an understanding of the society and its institutional and organizational processes and systems that affects the practice of engineers. The course examines different social systems, culture, power and civilization that are effective in designing, planning, working, and implementation at different levels of construction in engineering sciences.

ii) Course Objectives:

The objectives of this course are:

- To help the students develop understanding the need for social science knowledge in the practice field of engineers
- To make them able to examine how to utilize the formal and informal systems of the society in human function.
- To make them understand about organizational culture and its impact on productivity

- To assist them develop different frameworks and strategies to assess and address different social issues in the planned change.

iii) Course Contents

Some Basic Concept: Family, society, civilization, power structure, class, caste, gender and sex, culture, role and status, association.

Social Psychology: Personality, perception, attitude, motivation, memory and forgetting.

Community Participation: Understanding community through PRA tools, role of the community in environmental project, community participation and its challenges.

Organization: Organization culture, technology and organization culture, social change and technology, professionalism, work distribution, value of work, work and productivity, organizational theories and human resource management.

Industrialization and Urbanization: nature, causes and social and environmental impacts of industrialization and urbanization, industrial democracy.

iv) Course Learning Outcomes (COs):

After successful completion of the course students will be able to

CO1: Understand the society, culture and civilization

CO2: Identify the dimensions of human development, cognitive setting and their needs at different levels.

CO3: Analyze human psychology and behavior, and community participation for successful implementation of the industrial project

CO4: Demonstrate an ability to design social and environment friendly policy and its implementation

CO5: Apply professional norms and ethics in the service delivery systems

v) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				2	1						3
CO2			1			1		1	2		1	3
CO3						2		1	1		2	3
CO4					1					2		
CO5					1	1	1		2			

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning & Assessment Strategy

Week	Content / Topic	Teaching-Learning Strategy	Assessment Strategy	COs
1	Some Basic Concept: Family, society, civilization, power structure, class.	Lecture using board/LCD projectors	Quiz, Oral Exam	CO 1 CO 2
2	Some Basic Concept: Caste, gender and sex, culture, role and status, association.	Lecture using board/LCD projectors	Quiz, Oral Exam	CO 1 CO 2
3	Social Psychology: Personality, perception, attitude	Lecture using board/LCD projectors	Midterm Exam 1, and Semester-end Exam	CO 3 CO 5
4	Social Psychology: motivation, memory and forgetting.	Lecture using board/LCD projectors Tutorial, Assignment	Midterm Exam 1, Oral and Semester-end Exam	CO 3 CO 5
5	Community Participation: Understanding community through PRA tools, role of the community in environmental project,	Lecture using board/LCD projectors Tutorial, Assignment	Midterm Exam 1, and Semester-end Exam	CO 3
6	Community Participation: community participation and its challenges.	Lecture using board/LCD projectors, Tutorial, Assignment	Quiz, Oral, and Semester-end Exam	CO 3
7	Organization: Organization culture,	Lecture using board/LCD	Oral, Semester-end Exam	CO 4

	technology and organization culture,	projectors		CO 3 CO 5
8	Organization: social change and technology, professionalism,	Lecture using board/LCD projectors, Tutorial, Assignment	Quiz, Oral Exam	CO 4 CO 3 CO 5
9	Organization: work distribution, value of work, work and productivity,	Lecture using board/LCD projectors, Tutorial, Assignment	Quiz, Oral Exam	CO 4 CO 3 CO 5
10	Organization: organizational theories and human resource management.	Lecture using board/LCD projectors, research articles	Midterm Exam 2, Semester-end Exam	CO 4 CO 3 CO 5
11	Industrialization: nature, causes and social and environmental impacts of industrialization	Lecture using board/LCD projectors, Self-learning using reference books	Midterm Exam 2, and Semester-end Exam	CO 1 CO 3 CO 5
12	Urbanization: nature, causes and social and environmental impacts of urbanization	Lecture using board/LCD projectors, Self-learning using reference books	Midterm Exam 2, Quiz, Oral and Semester-end Exam	CO 1 CO 4 CO 5
13	Industrial democracy	Lecture using board/LCD projectors	Quiz, Oral Exam	CO 4 CO 5

Recommended Books
Khan. F. R. (2000). Principles of Sociology. Shirin Publication.
Maciver, R. M. and Page, C. H. (2001). Society: An introductory Analysis. New Delhi: Macmillan.
Richard, T. Schaefler, R. and Lamm, P. (1995). Sociology. USA: McGrew Hill Inc.
Kalat, J. W. (2016). *Introduction to psychology*. Nelson Education.
Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2006). Introduction to Psychology (7th eds.). New Delhi: Tata Mac-Graw Hill Publishing Co. Ltd.

Course Code: CEE 0732 1230	Credit: 0.5	Year: 1st	Semester: 2nd
Course Title: Year Final Viva I		Course Status: Viva	

i) Rationale of the Course:

By this course students will learn how to present themselves in an official forum for viva voce and they may be evaluated based upon the knowledge they achieved from their 1st year theory and laboratory course.

ii) Course Content:

All theory and laboratory courses of first year first semester and second semester

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain and answer the intellectual and technical questions in front of an examination board,
2) Communicate with examiner and express their knowledge in a satisfactory way,
3) Aply the skills developed from the courses of first year first semester and second semester.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2				3
CO2								3	1		1	3
CO3	2										2	3

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02
CO2	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02
CO3	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02

Course Code: CEE 0732 1234	Credit: 1.0	Year: 1st	Semester: 2nd
Course Title: Engineering Graphics II		Course Status: Sessional	

i) Rationale of the Course:

This course will familiarize the students with the building plan and its different components as well. They will also understand different environmental control elements. This practical drawing will help the students to understand the plan of structure designed by an Architect for structural design purposes. This understanding is essential for the execution of the structural design.

ii) Course Content:

Fundamentals of complete building drawing and computer applications This chapter presents the Complete Building Drawing and Computer applications (Sweet home 3D). Different parts of the building are described and taught to draw. The drawing of a building on a computer is also presented.
Fundamentals of drawing for environment control elements This chapter presents Drawing for environment control elements i.e. Septic tank, Soak-well, Inspection pits, Sewerage line, Underground water reservoir, Overhead water reservoir, Internal water and sewerage line, Soil and rainwater pipe from the building, Drainage, etc. and their application also described.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Build architectural plan of building
2) Create drawing of different structural components of building
3) Illustrate the different environment control elements of building.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3									
CO2	2											
CO3	2											

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL07, TL08	CA03, CA04, SA01, SA02
CO2	TL 01, TL 02, TL07	CA03, SA01, SA02
CO3	TL 01, TL 02, TL07	CA03, SA01, SA02

Course Code: CHE 0531 1202C	Credit: 1.5	Year: 1st	Semester: 2nd
Course Title: Chemistry Practical		Course Status: Practical	

i) Course Rationale:

This course is aimed to make the student practically skilled in handling chemical compounds and focus on understanding their properties.

ii) Course Objectives:

The objectives of this course are:

- Qualitative identification of cations and anions, and functional groups containing the inorganic and organic compounds, respectively.
- Demonstrate and analyze the recorded data in the report obtained from the laboratory.

iii) Course Content:

Qualitative analysis of inorganic salts:

- Separation and identification of group I cations
- Separation and identification of group II cations
- Separation and identification of group IIIA and IIIB cations
- Separation and identification of group IV cations
- Separation and identification of group V cations
- Identification of anions

Qualitative analysis of organic salts:

- Analysis of the functional groups of organic compounds

Quantitative analysis:

- Standardization of NaOH solution with the standard oxalic acid solution

iv) Course Learning Outcomes:

After the successful completion of the course, students will be able to:

CO1 Prepare and use the aqueous solution of inorganic compounds accurately for the identification of cations and anions using necessary reagents

CO2 Identify and understand the properties of various functional groups contained in the organic compounds

CO3 Determine and acquire knowledge on the concentration of solution using titrimetric analysis.

CO4 Demonstrate and analyze the recorded data in the report, and draw appropriate conclusions from the laboratory

CO5 Handle the chemicals and apparatus safely individually as well as work in a group

v) Mapping of Course Learning Outcomes (COs) with POs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1		3								
CO2		1		3								
CO3				3								
CO4		1						3				

CO5							3			1		

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning & Assessment Strategy

COs	Teaching-Learning Strategies	Assessment Strategies
CO1	Apparatus demonstration and presenting MSDS	Lab Performance (group)
CO2	Lectures, experiment demonstration	Lab Reports, Viva Voce
CO3	Lectures and experiment demonstration	Lab Performance, Viva Voce
CO4	Lectures and experiment demonstration	Lab Performance (individual), Written Examination

Books Recommended:

1. Vogel, *Qualitative Inorganic Analysis*
2. A.I. Vogel, *A Text Book of Practical Organic Chemistry*
3. A.I. Vogel, *Elementary Practical Organic Chemistry* (Part 1)
4. Vogel, *Textbook of Quantitative Analysis.*

Course Code: EEE 0713 1228C	Credit: 1.5	Year: 1st	Semester: 2nd
Course Title: Electrical Services Design		Course Status: Lab	

i) Rationale:

Electrical services are a vital component in any building, so it is necessary for architects to understand the basic principle of services design. This Course content includes the concepts of circuit theory, wiring system design, various lighting schemes, design of substation layout of equipment and design of security systems. This course will help students of architecture to trouble shoot a design problem on a single/multi-storied building/structure.

ii) Course objectives are:

1) To familiarize the students with electrical circuit theory.
2) To train and equip architects with appropriate knowledge and skills required for the lighting design, power supply design and their installations.
3) To familiarize the students with electrical design process.
4) Provide enough knowledge to the students of architecture so that they can interpret various components of the service design of the building.

iii) Course Contents:

1) Electrical units and standards, Ohm's law, KVL and KCL, Basics of AC circuits.
2) Wiring system design, Fitting and Fixture layout, Conduit layout, drafting, and estimation.
3) Design for illumination and lighting.
4) Electrical installations system design: substation, BBT and protection, heating and lifts.
5) Design for intercom, public address systems, telephone system and LAN.
6) Design of security systems including CCTV, fire alarm, smoke detector, burglar alarm, and sprinkler system.
7) A design problem on a single/multi-storied building/structure.

iv) Course Learning Outcomes:

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

1) Explain the basic concept of circuits and utilize those concepts in real-world problems,
2) Identify Electrical installations system such as power substation, protection, communication devices and security measures,

3) Predict and calculate the power demand according to the consumer's requirement,

4) Construct an efficient electrical design for a particular structure/arrangement.

v) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				1								
CO2	2	2			2							
CO3			1									
CO4										1		

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lectures	Quiz, viva
CO2	Lectures	Quiz, viva
CO3	Lectures	Quiz, viva
CO4	Lectures, demonstration	Lab Assignment, viva

Recommended Books

1. Electrical Wiring Estimating and Costing by S.L. Uppal and G.C. Garg

2. Lab Manual

Course Code: IPE 0715 1204C	Credit: 1.0	Year: 1st	Semester: 2nd
Course Title: Workshop Practice		Course Status: Sessional	

i) Rationale of the Course:

To have a balanced overall development of CEE graduates, it is necessary to integrate theory with practice. Workshop practice includes basic knowledge about manufacturing that is essential for further study of the engineers. It provides practical knowledge about different hand tools and machine tools. Overall, students can use the gathered knowledge to develop a product.

ii) Course Objectives:

The objectives of this course are to:

- inform student about different types of hand tools and their uses
- accumulate basic knowledge about different types of machine tools including their components and functions
- provide the opportunity to use gathered knowledge practically
- encourage students performing teamwork.

iii) Course Content:

Introduction to hand tools; Study and operation of an Engine Lathe; Study and operation of a milling machine; Study and operation of a drilling machine; Study and operation of a surface grinding machine; Preparation of a hexagonal nut.

iv) Course Learning Outcomes, COs:

After the successful completion of the course, students will be able to:

CLO1: identify different types of hand tools and their purposes
CLO2: specify and differentiate different types of machine tools used in manufacturing industries
CLO3: identify different components of engine lathe, milling machine, bench drilling machine and surface grinding machine and know about their respective functions
CLO4: perform different operations on the selected machine
CLO5: develop a product in team based on the design specifications.

v) Mapping of COs with POs

According to the POs of CEE department.

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning & Assessment Strategy

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lecture using board and Instruction materials, Practical demonstration, Hands on practice	Quiz, Report evaluation, Oral examination
CO2	Lecture using board and Instruction materials, Practical demonstration, Hands on practice	Quiz, Report evaluation, Oral examination
CO3	Lecture using board and Instruction materials, Practical demonstration, Hands on practice	Quiz, Report evaluation, Oral examination
CO4	Instruction materials, Practical demonstration, Hands on practice	Quiz, Report evaluation
CO5	Instruction materials, Practical demonstration, Hands on practice	Quiz, Report evaluation

Books Recommended:

1. James Anderson, Shop Theory.
2. Rajender Singh, Introduction to Basic Manufacturing and Workshop Technology
3. U.K. Singh and Manish Dwivedi, Manufacturing Processes
4. H.N. Gupta, R.C. Gupta, and Arun Mittal, Manufacturing Processes

Course No: PHY 0533 1204C	Credit:1.5	Year: 1st	Semester: 2nd
Course Title: Basic Physics Sessional		Course Type: Laboratory	

i) Rationale of the Course: Ability to acquire knowledge of physics to determine the various physical quantities by collecting and analyzing data in laboratory

ii) Course Objectives
The objective of this course is to enable the student to carry out some fundamental experiments for finding out the numerical values of some physical parameters based on various laws, principle and theorem of physics.

iii) Course Content
Mechanics:
1. Determination of moment of inertia of a flywheel
2. Determination of "g" by and moment of inertia of a compound pendulum
Properties of matter:
3. Determination of Young's Modulus by the method of bending
4. Determination of Rigidity Modulus by Static method

5. Using a flat spiral spring: a) Verification of Hooke's Law and determination of stiffness constant; b) Determination of "g" and the effective mass of the spring; c) Determination of modulus of rigidity of the material of the spring.

Electricity:

6. Determination of galvanometer resistance by half deflection method

iv) Course Learning Outcomes (COs):

After the successful completion of the course, students will be able to:

1) Measure the moment of inertia of a rotating bodies using conservation of energy and measure the acceleration due to gravity by at any place by exploiting simple harmonic oscillation.
2) Determine the various elastic moduli of different solid materials employing elastic properties i. e., (Hooke's law) of that materials and the surface tension as characteristic property of liquid from various method.
3) Measure the different electrical quantities (current, voltage and resistance) by building up basic circuits using Kirchhoff's and Ohm's law.
4) Reach to a conclusion by taking and analyzing data in collectively way through the discussion among the group members.
5) Present the experimental findings in a report and hence be competent to write a scientific report..

v) Mapping of the Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1			2					2	
CO2	3	3	1			2					2	
CO3	3	3	1			2					2	
CO4		3						3			2	
CO5		2		2		2					2	

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning& Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL03, TL 05	CA 03, CA 04, CA 05
CO2	TL 01, TL03, TL 05	CA 03, CA 04, CA 05
CO3	TL 01, TL03, TL 05	CA 03, CA 04, CA 05
CO4	TL 02, TL03, TL 05	CA 03, CA 04, CA 05
CO5	TL 02, TL03, TL 05	CA 03, CA 04, CA 05

Recommended Books:

1. Topping: *Errors of Observation and Their Treatment*
2. Worsnop, B.L. and Flint, H. T.: *Advanced Practical Physics*
3. Chowdhury, S. A. and Basak, A. K.: *Byaboharik Padartha Bidya*
4. Ahmed, G. and Uddin, M.S.: *Practical Physics*

19.3 Second Year First Sesemester

Course Code: CEE 0731 2123	Credit: 3.0	Year: 2nd	Semester: 1st
Course Title: Surveying		Course Status: Theory	

i) Rationale of the Course:

Surveying plays a vital role in the field of Geodesy, Photogrammetry, Cartography, GIS, Digital Mapping, Cadastral Surveying, etc. The planning and design of all Civil Engineering projects such as the construction of highways, bridges, tunnels, dams, state boundaries, coastlines, navigable streams, etc. are based on surveying measurements. Thus, surveying is a basic requirement for all Engineering projects.

ii) Course Content:

Introduction: This chapter presents a brief discussion on the significance of surveying, the scope of this course for civil and environmental engineers, and a basic introduction to some surveying terms. Classification of surveying and the importance of Surveying is also described concisely in this section. Importance of Surveying.
Errors in Surveying: Sources of Errors, Types of Errors, Precision and accuracy, Probability, and Calculation of error.
Calculation areas and volumes: This chapter mainly focuses on calculating earthwork (cutting and filling) by different methods.
Chain Surveying: This chapter presents an overview of types of chain surveying, elements of chain surveying, selection criteria for a survey station, types of errors that occur in chain surveying, and how to solve the error in the practical field have been discussed in this part.
Traverse Surveying: Introduction to traverse, Types of the traverse, Various types of the meridian and bearing systems, Measurement of angles with compass and theodolite, Procedure of traversing, plotting of the traverse, closing error, Traverse computation.
Plane Table Surveying: This chapter presents a concise description of plane table surveying, its advantages and disadvantages over other surveying methods, the instruments used in this survey, the working procedure in the field, and finally different methods for different geographical situations have been discussed.
Leveling: Definitions of terms used in leveling, Leveling instruments, Adjustments of a level, Field procedure of leveling, Methods of calculating R.L. (rise and fall, line of collimation), Curvature and Refraction, Errors in leveling, Contouring, Contour interval, Characteristics of contours, Method of locating contour, Uses of contour maps.
Tacheometry or Stadia Surveying: This chapter deals with the theory of stadia surveying, the description of instruments, formula derivation for horizontal and vertical distance, determination of tacheometric constant, and finally horizontal distance, inclined distance, and vertical height-based problems are discussed in this section
Curve and Curve Ranging: Classification of curves, simple circular curve, elements of a simple circular curve, degree of curve, and fundamentals of the geometry of simple circular curve, Method of curve ranging (Linear and instrumental method), Field procedure for setting out the curve, Workout examples of the simple circular curve. Introduction to transition curve, Characteristics, and function of transition curve, Combined curve, Setting out a combined curve, Workout examples of the combined curve, Introduction to vertical curve, Vertical curves by the equation of the parabola.
Photogrammetry Surveying: This chapter presents an overview of photogrammetry surveying, types of photogrammetry surveying, advantages, and disadvantages over other survey methods, and how many photographs are required for an aerial survey have been solved.
Project Surveying: Introduction to various project surveying, House setting work.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the basic principles of surveying and advanced tools/instruments used in various civil engineering projects.
2) Apply the suitable surveying method (chain surveying, traverse surveying, tacheometry or stadia surveying, plane table surveying, etc.) to prepare different types of maps i.e., topographic map, cadastral map, etc.
3) Apply the knowledge for calculating earthwork for different civil engineering projects (cutting and filling) to minimize project cost by different methods
4) Set out curve for the route project by using the basic theory of curve.
5) Apply photogrammetry surveying in the practical field.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						2					
CO2		3										1
CO3				2						3		2
CO4				2			2					
CO5	3						2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0732 2131	Credit: 2.0	Year: 2nd	Semester: 1st
Course Title: Mechanics of Solids I		Course Status: Theory	

i) Rationale of the Course:

This course will introduce students to the fundamentals of stress and strain, as well as their applications. Different types of joints, such as riveted joints and welded joints, and their failure mechanisms will be discussed in this course. It also teaches them how to calculate and draw the axial force, shear force, bending moment, and qualitative deflection diagram, as well as shear and bending stresses, in various shapes of determinate beams. This knowledge is essential to solving structural engineering problems.

Course Content:

Stress analysis of axially loaded members: Introduction, Analysis of internal forces, Simple stress, Shearing stress, Bearing stress
Strain analysis of axially loaded members: Simple strain, Stress-strain diagram, Hokes's law, Strain analysis of statically indeterminate members, Poisson's ratio: Biaxial and triaxial deformations
Stresses in thin and thick-walled cylinders and spheres: Stresses calculation in thin and thick-walled cylinders and spheres
Riveted and Welded Connections: Rivet, Types of riveted joints, Failure of the riveted joints, Introduction to welded connections
Axial force, Shear force, bending moment and qualitative deflection diagrams: Definition, Shear force and bending moment for determinate beams

Bending stress and shear stress in beams: Definition, Shear stress and bending stress for determinate beams of different shapes

ii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Describe the basics of stress and strain, and explain stress-strain diagram for brittle and ductile materials,
2) Calculate stresses and strains in a structural component due to axial load and determine the stresses in thin and thick-walled cylinders and spheres,
3) Identify different types of Riveted and Welded connections and calculate stresses on connections and plates,
4) Determine the shear force and bending moment for determinate beams and
5) Determine the shear stress and bending stress of determinate beams of different shapes.

iii) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		2	2									1
CO3	3											2
CO4	3	2										2
CO5	3											1

Correlation: 3-High, 2-Medium, 1-Low

iv) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05	CA 04, SA 01
CO2	TL 01, TL 05, TL 07	CA 01, CA 03, CA 04, SA 01
CO3	TL 01, TL 07	CA 05, SA 01
CO4	TL 01, TL 02, TL 06, TL 07	CA 01, CA 03, CA 04, CA 05, SA 01
CO5	TL 01, TL 02, TL 06, TL 07	CA 01, CA 03, CA 04, CA 05, SA 01

Course Code: CEE 0732 2135	Credit: 3.0	Year: 2nd	Semester: 1st
Course Title: Fluid Mechanics		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the knowledge of fundamental fluid mechanics based on a sound background in engineering mechanics. This knowledge is essential for the execution of water-related projects (such as pipe flow, sewer flow, open channel flow) and hydraulic engineering works.

ii) Course Content:

Fluid statics: This chapter introduces Fluid properties related to environmental phenomena, Ideal fluid, Real fluid, Viscosity, Surface tension, Capillarity, Manometry, Forces on the submerged planes and curved surfaces, Buoyancy and Floatation, Energy consideration in steady flow, Cavitation, EGL, HGL and Stagnation point.
Dynamics: This chapter describes Flow characteristics of fluid; Dimensional flow; Equation of continuity; Momentum and forces in fluid flow, Stationary vane, Moving vane.

Flow of fluid in pipes: Bernoulli's equation; Flow through venturimeter; Frictional losses in pipes and fittings, Laminar flow, Turbulent flow, Reynold's number, Pipes in series, parallel and pipe network will be explained in this chapter.
Types of fluid machinery: The final chapter deals with Impulse and reaction turbines; Centrifugal and axial flow pumps.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply the governing principles of fluid mechanics to solve fluid flow problems
2) Analyze and draw the free-body diagrams of fluid elements to show the magnitude and direction of forces acting on submerged surfaces
3) Explain how different fluid machineries (such as turbines and pumps) work.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3											
CO2			3										
CO3				2									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, SA 01
CO2	TL 01, TL 02	CA 02, CA 03, SA 01
CO3	TL 01, TL 02, TL 08	CA 05, SA 01

Course Code: CEE 0532 2137	Credit: 2.0	Year: 2nd	Semester: 1st
Course Title: Engineering Geology and Geomorphology		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the basics of engineering geology and geomorphology in the Bangladesh context which covers the earth and its materials, the structure of these materials, natural forces acting upon them, landform and water patterns, the assessment of landform changes, the impacts of development on the environment, the risks from surface processes, etc. As most of the civil engineering projects involve the earth and its features, the fundamental knowledge of geology and geomorphology is vital for understanding the stability of land to sustain the proposed project/structure.

ii) Course Content:

Introduction to engineering geology and geomorphology: The significance of studying engineering geology and geomorphology, the scope of this course for civil and environmental engineers, and basic introduction on geologic terms. Discussion on some historical failure events in the civil engineering field due to misinterpretation of geology.
Mineralogy: A concise description of various minerals, its formation, occurrence, properties, use, composition, classification, and identification. Introduction of real samples of some common rocks and minerals in class for identification and classification.

Geomorphology: This chapter will provided an overview of the characteristics, origin, and development of landforms of the earth. It also provides with the internal geologic processes of the earth's crust, such as tectonic activity and volcanism that constructs new landforms. This section seeks to understand landform history, its dynamics, and predict future changes by geologic processes like epigenic, endogenic, and extraterrestrial processes. This chapter also deals with a drainage basin, stream order (with example), channel morphology, water and wind erosion of soil, etc.
Geology and geomorphology of Bangladesh: This chapter mainly focuses on the geological and geomorphological features of Bangladesh. Different landscape maps, contour maps, and the physiographic map are shown in the class and a short observational study is made.
Structural geology: This chapter mainly focuses on the three-dimensional distribution of rock units with respect to their deformational histories and rock mechanics. Computation of strike-dip angle, tectonic plate boundary, structural defects, and fabrics, etc. are also covered in this part.
Geologic mapping: This chapter deals with the theory and practice of drawing different geologic maps like contour map, geologic cross-section map, etc. mainly focuses on the three-dimensional distribution of rock units with respect to their deformational histories. Computation of strike-dip angle, tectonic plate boundary, structural defects, and fabrics, etc. are also covered in this part.
Geology and earthquake: This chapter presents an overview of geologic features related to earthquake engineering. Different earthquake waves, their propagation, magnitude and epicenter determination, earthquake response of construction site geology, etc. are also covered in this section.
Introduction to Computational Geology: This chapter provides an preliminary idea on relationships between geological/ geotechnical parameters, such as mass, volume, unit weight, specific gravity, moisture content, void ratio, porsosity, total stress, effective stress, etc.
Application of geology in Civil & Environmental Engineering projects: This chapter presents the application scenario of site exploration techniques with different conventional and geophysical methods and different tools for geological measurement. Some case study on important civil and environmental engineering projects such as the Channel tunnel; Karnaphuli tunnel, Padma bridge, etc. are also covered in this chapter.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain the geological and geomorphological terms and parameters involved with civil and environmental engineering demand,
2) Assess the canges in different geological and geomorphological patterns and structures, seismic effects and energy release,
3) Apply knowledge on the selection of foundation for different structures within the setting of existing natural geology.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1					2						
CO2					2							
CO3			2		1							2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 02, TL 07	CA 02, CA 03, CA 04, SA 01
CO3	TL 01, TL 05, TL 07, TL 08	CA 04, SA 01

Course Code: CSE 0011 2103C	Credit: 2.0	Year: **2nd**	Semester: 1st
Course Title: Introduction to Computer Language		Course Status: Theory	

i) Rationale:
To familiarize the student with basic concepts of computer programming and developer tools. To present the syntax and semantics of the "C" language as well as data types offered by the language. To allow the students to write their own programs using standard language infrastructure regardless of the hardware or software platform.

ii) Objectives:
- To provide students a basic understanding of computer hardware and how a computer works
- To make students understand the basic terminology used in computer programming
- To facilitate with knowledge of how to write, compile and debug programs in the C language
- To help students write programs involving decision structures, loops, functions, and pointers
- To help students develop skills on standard programming practices and how to build up their own logic and how to implement them.

iii) Course Contents:
Computer Basics: Concept on Computer Hardware, Software, and its classification. **C-Language:** Preliminaries, Program constructs variables and data types in C. Input and output. Character and formatted I/O; Arithmetic Expressions and Assignment statements; Loops and Nested loops; Decision making; Arrays, Functions; Arguments and local variables, Calling Functions and arrays. Recursion and Recursive functions; Structures within a structure. Files; File functions for sequential and Random I/O. Pointers; Pointers and structures; Pointer and functions; Pointer and arrays; Operation and Pointer; Pointer and memory addresses; Operations on Bits; Bit Operation; Bit field; Advanced features; Standard and library.

iii) Course Learning Outcomes (COs): After the successful completion of the course, the student will be able to

By the end of this course, students will be able to:

1) Understand the concepts of computer hardware and how it works
2) Recall the basic terminology used in computer programming
3) Apply knowledge on the selection of foundation for different structures within the setting of existing natural geology
4) Apply control-flow tools such as loop, if-else, etc.
5) Understand the usage of pointers, structures, and some advanced topics.

iv) Mapping of Course Learning Outcomes to Program Learning Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3									
CO2						2	2				2	
CO3						2	2				2	
CO4						2	2				2	
CO5						2	2				2	

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lectures	Quiz, ClassTest,FinalExam
CO2	Lectures	Assignment, Quiz, Class Test, Final Exam
CO3	Lectures, Demonstration	Assignment, Quiz, ClassTest,FinalExam
CO4	Lectures,Demonstration	Assignment, ClassTest,FinalExam
CO5	Lectures,Demonstration	Assignment, Projects

Textbook

1. Schaum's Outline of Programming with C by Byron S. Gottfried
2. C: The Complete Reference by Herbert Schildt

Course Code: MAT 0541 2107C	Credit: 3.0	Year: 2nd	Semester: 1st
Course Title: Vector Calculus, Matrix, Laplace Transformation and Partial Differential Equations		Course Status: Theory	

i) Rationale of the Course:

This course is a complete introduction to the concepts and methods of vector analysis, matrix, Laplace transform and partial D.E. The applications for the related discipline will be discussed.

ii) Course Content:

Vector Calculus: Differentiation and integration of vectors together with elementary applications; line, surface and volume integrals; gradient of scalar functions; divergence and curl of vector functions; physical significance of gradient, divergence and curl; Stoke's theorem, Green's theorem and their applications.
Matrix: Types of matrices and algebraic properties; rank and elementary transformations of matrices; solution of system of linear equations by matrix methods; linear dependence and independence of vectors; matrix polynomials; determination of characteristic roots and vectors.
Laplace Transformation: Definition of Laplace transforms; elementary transformations and properties; convolution; solution of differential equations by Laplace transforms; evaluation of integrals by Laplace transforms.
Partial Differential Equation(PDE): Introduction; equation of the linear and non-linear first order standard forms; linear equations of higher order; equations of the second order with variable coefficients.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Find the length of a curve line, surface area and volume of some models,
2) Find the solution of a system of linear equations using matrix,
3) Apply Laplace transform to solve mathematical problems,
4) Create PDE from various type of engineering problems,
5) Solve engineering problems using PDE.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3											
CO2	3	2										
CO3	3	1	1									
CO4	2	2	1									
CO5	2	2	1									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Multimedia/ White board, group study	Assignment, term test, sem. exam
CO2	Multimedia/White board, group study	Assignment, term test, sem. exam
CO3	Multimedia/ White board, group study	Assignment, term test, sem. exam
CO4	Multimedia,/White board, group study	Assignment, term test, sem. exam
CO5	Multimedia/ White board, group study	Assignment, term test, sem. exam

Recommended Books:

1. Spiegel, M.R.: Advanced Calculus
2. Spiegel, M.R.: Vector Analysis and Introduction to Tensor Analysis
3. Lass, H.: Vector and Tensor Analysis
4. Ayres, F: Matrices
5. A G Hamilton: Linear Algebra
6. Spiegel, M. R.: Laplace Transform
7. Khanna, M. L.: Laplace Transforms
8. Khanna, M. L.: Partial Differential Equations

Course Code: CEE 0732 2122	Credit: 1.0	Year: **2nd**	Semester: 1st
Course Title: Details of Construction		Course Status: Sessional	

i) The rationale of the Course:

This course will familiarize the students with the knowledge of supervising a construction project's site, ensuring expected quality and specified compliances. The students will also be introduced to construction site safety and construction laws and regulations. This knowledge is essential for the execution of any civil structure and infrastructure projects.

ii) Course Content:

Pre-construction

Various methods, tools and techniques applied for site investigation, site survey, soil testing; checking design and detail working drawing from the constructability point of view; documentation and procedures for the approvals and permissions from different concerned departments for construction initiation.

Procurement

Different approaches of project delivery system including selection of consultants, contractors, project managers, and site engineers for a project; materials and equipment procurement methods and their impacts on construction performances.

Construction

Understanding and interpreting construction design documents, specification, and shop drawings, site preparation methods, setting-out the project on-site; comprehending various earthwork techniques; construction techniques of different types of foundation; formworks, fabrication of rebar for sub-structure and superstructure (column, beam, slab); brickworks; plastering; curing of different construction items (concrete, brickwork, plastering, etc.); tiles fittings, plumbing (water supply and sewerage) fittings and fixtures; primary concepts of electrical wiring and

fittings; and demonstrating the functions of different construction equipment including heavy equipment for complex infrastructure constructions; importance of various laboratory and field tests of materials and equipment and their appropriate schedule for ensuring construction quality; response to the request for inspection, giving feedback, and review the feedback for ensuring construction quality. Introducing construction codes and safety provisions mentioned in the Bangladesh National Building Code (BNBC).
Testing and commissioning The concepts and importance of testing and commissioning of a civil structure or infrastructure; testing of various structural and non-structural items, making the list of defective items during project handover/delivery, handover of spare materials and equipment; understanding liability period and functions of a consultant or contractor in this period.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Understand and analyze engineering drawings and specifications and implement them in-field.
2) Do various in-field tests of construction and building materials and their applications controlling construction quality.
3) Check construction formwork, examine steel fabrication, quality of concrete.
4) Synthesize the basic concept of site safety, time and cost management of a project
5) Understand the roles and responsibilities of a quality assurance engineer for onsite supervision.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3		3					3					
CO4		2								3		
CO5									2	3		

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 06	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 03, TL 06	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 03	CA 03, CA 04, SA 01, SA 02
CO5	TL 01, TL 03, TL 06	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 2134	Credit: 1.0	Year: 2nd	Semester: 1st
Course Title: AutoCAD for Civil and Environmental Engineers		Course Status: Sessional	

i) Rationale of the Course:

AutoCAD is the most widely used computer-aided design (CAD) software for producing architectural, engineering, and construction drawing. This course will able to make the students for sketching design projects and analyzing the sketches to find the best solution for the projects

ii) Course Content:

Introduction to AutoCAD for the Civil and Environmental Engineering profession: Getting started, Creating basic drawings, Manipulating objects, Drawing organization and inquiry commands, Using drawing aids, Editing entities, Controlling object visibility, Annotating the drawing, Dimensioning, Hatching objects, Creating additional drawing objects, plotting of drawings
Methods for a presentable drawing: Working with layout, Creating drawing template
Two-Dimensional drawings by using AutoCAD: Draw Plan, Elevation, Section of a Building using AutoCAD
Complete structural drawing of a five-storied residential building: Structural drawing using AutoCAD
Introduction to 3D model design: Getting to Know the 3D Modeling Workspace, Drawing in 3D Using Solids, Creating 3D Forms from 2D Shapes

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret and analyse civil engineering technical drawing,
2) Create two dimensional (2D) civil engineering technical drawings using AutoCAD,
3) Apply drawing skill in civil engineering project.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1					2	3					
CO2			2				2						2
CO3					2								

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 08	CA 03, SA 01
CO2	TL 01, TL 02, TL 07, TL 08	CA 03, SA 01, SA 02
CO3	TL 06, TL 08	CA 03, SA 01, SA 02

Course Code: CEE 0732 2138	Credit: 1.0	Year: 2nd	Semester: 1st
Course Title: Engineering Materials Sessional		Course Status: Sessional	

i) Rationale of the Course:

Students will determine different properties of engineering materials that will indicate the quality and strength of the materials.

ii) Course Content:

Determination of normal consistency of cement This experiment determines the amount of water needed for preparation cement mortar.
Determination of initial setting time of cement This experiment describes the beginning of setting time of cement paste i.e. the paste is rigid sufficiently to withstand a definite amount of pressure.

Determination of direct compressive strength of cement mortar The compressive strength of cement mortar at different ages can be determined by this experiment.
Sieve analysis of fine and coarse aggregate This experiment shows the index of coarseness or fineness of the material using sieve analysis.
Sampling and testing of bricks for compressive strength and absorption This test represents the load bearing capacity (compressive characteristics) of bricks and its water holding capacity.
Compressive strength of cylindrical concrete specimen and cubes The compressive strength of concrete (both cylindrical and cubes) at different ages can be determined by this experiment.
Specific gravity and absorption capacity of coarse and fine aggregate This test determines the water holding capacity (absorption) capacity of coarse and fine aggregates and their specific gravity.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Determine the normal consistency and setting time of cement,
2) Experiment of the compressive strength of cement mortar,
3) Determine the specific gravity and absorption capacity of fine and coarse aggregate,
4) Prepare the gradation curve and the index of coarseness or fineness of aggregate by using sieve analysis,
5) Determine the compressive strength of concrete at different ages.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1			2			3					
CO2			2	2			3					
CO3	1			2			3					
CO4				2			3					
CO5				2			3					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03	CA 03, SA 01, SA 02
CO2	TL 01, TL 03	CA 04, SA 01, SA 02
CO3	TL 01, TL 07, TL 03	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 07, TL 03	CA 03, CA 04, SA 01, SA 02
CO5	TL 01, TL 07, TL 03	CA 03, CA 04, SA 01, SA 02

Course Code: CSE 0011 2104C	Credit: 1.0	Year: 2nd	Semester: 1st
Course Title: Introduction to Computer Language Lab		Course Status: Sessional	

i) Rationale:

To familiarize the student with basic concepts of computer programming and developer tools. To present the syntax and semantics of the "C" language as well as data types offered by the language. To allow the students to write their own programs using standard language infrastructure regardless of the hardware or software platform.

ii) Objectives:

- To help to develop skills to work with C compilers and how to use run programs on the computer
- To foster the analytical and critical knowledge to build up logic and implement them using programming language C
- To facilitate necessary knowledge about how to design programs involving decision structures, loops, functions, and pointers
- To help to develop skills to debug codes by giving an in-depth idea about different syntax errors, exceptions and how to fix them
- To provide the knowledge of using basic searching and sorting algorithms.

iii) Course Contents:

Computer Basics: Concept on Computer Hardware, Software, and its classification. **C-Language:** Preliminaries, Program constructs variables and data types in C. Input and output. Character and formatted I/O; Arithmetic Expressions and Assignment statements; Loops and Nested loops; Decision making; Arrays, Functions; Arguments and local variables, Calling Functions and arrays. Recursion and Recursive functions; Structures within a structure. Files; File functions for sequential and Random I/O. Pointers; Pointers and structures; Pointer and functions; Pointer and arrays; Operation and Pointer; Pointer and memory addresses; Operations on Bits; Bit Operation; Bit field; Advanced features; Standard and library. **Problem Solving:** Basic Calculator, Odd/Even Test, Showing Letter Grade from Number, Drawing different shapes using Asterisks (*), GCD, Palindrome, Fibonacci Series, Geometric Mean, Quadratic Formula, Cumulative Sum, Cumulative Product, Weighted Average, Generating Prime Number using Sieve of Eratosthenes, Prime Factorization, Big Mod, SOD, NOD, Permutation, Combination, Finding Areas, Basic Geometry Problems, Factorial, Leap Year, Tower of Hanoi, String Manipulation: Vowel and Consonant Count, Reversing a Word, Matrix Multiplication, Piglatin Generator.

iv) Course Learning Outcomes (COs): After the successful completion of the course, the student will be able to:

1) Define the basic terminologies related to computer and explain the workflow of a computer and computer program
2) Implement the basic programming commands, control structures (if-else, loop), function, arrays, pointers, structures, unions, files and use them to write a computer program
3) Build a computer program o to solve a specific programming problem and determine the errors in programs written by other programmers
4) Apply best practices for code organization and maintainability in C programming languages
5) Be able to apply the knowledge and skills gained in this course to real-world programming tasks and projects.

v) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							3					
CO2			3			2						
CO3			3			2						
CO4			3			2						
CO5							2					

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lectures, Demonstration	Quiz, Assignments

CO2	Lectures, Demonstration	Quiz, Assignment, Lab Final
CO3	Lectures, Demonstration	Quiz, Assignment, Lab Final
CO4	Lectures, Demonstration	Quiz, Assignment, Lab Final
CO5	Lectures, Demonstration	Assignment, Projects

Textbook

1. Schaum's Outline of Programming with C by Byron S. Gottfried
2. C: The Complete Reference by Herbert Schildt

19.4 Second Year Second Semester

Course Code: CEE 0532 2221	Credit: 3.0	Year: 2nd	Semester: 2nd
Course Title: Hydrology		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the basics of engineering hydrology which covers the Hydrological cycle, Catchment, Losses, Hydrographs, Hyetographs, Precipitation, Streamflow, Runoff, Floods, and Flood Routing. Design topics such as flood frequency analysis, peak flow estimation, design hydrograph estimation, groundwater process and modeling, and Flood control/yield hydrology are also covered in this course. Knowledge of hydrology is vital for the sustainable management of water sources. This course acquainted students with different information on hydrology which helps them to solve practical problems efficiently.

ii) Course Content:

Introduction to hydrology The hydrologic cycle, Water budget equation, World water balance, History of hydrology, Importance and Role of Hydrology in Environmental Engineering.
Precipitation Forms of Precipitation, Weather Systems for Precipitation, Characteristics of Precipitation, Measurement of Precipitation, Rain gauge Network, Preparation of Data, Presentation of Rainfall Data, Mean Precipitation over an Area, Depth-Area-Duration Relationships, Intensity-Duration-Frequency-Relationship, Probable Maximum Precipitation.
Streamflow Measurement of Stage and Velocity, Area Velocity Method, Different Methods of Streamflow Measurement, Stage- Discharge Relationship, Extrapolation of Rating curve.
Abstractions from precipitation Evaporation Process, Evaporimeters, Empirical Evaporation Equations, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and methods for its Reduction, Transpiration, Evapotranspiration, Measurement of Evapotranspiration, Actual Evapotranspiration (AET), Interception. Infiltration and Soil Moistures, Infiltration Capacity, Modeling Infiltration Capacity, Classification of Infiltration Capacities, Infiltration Indices.
Runoff Runoff Characteristics of Stream, Yield or Annual Runoff, Flow Duration Curve and Flow Mass Curve, Surface Water Resources in Perspective of Bangladesh.
Hydrographs Construction of a Flood Hydrograph and Its Different components, Factors Affecting Flood Hydrograph, Effective Rainfall, Base Flow Separation, Unit Hydrograph of Different Durations, Derivation of Unit Hydrograph, Synthetic Unit Hydrograph, Instantaneous Unit Hydrograph, the Distribution graph.

Floods and flood routing
Introducing Different Method of Flood Peak Calculation and Their Practical Applications, Flood-Frequency Studies, Risk, Reliability and safety factor, Basic Equations of Flood Routing, Classification of flood routing, methods of flood routing, flood control, and flood forecasting.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain basic theories of the hydrologic cycle, global water balance, water budget equation, etc.
2) Explain the Hydrologic events like precipitation, runoff, streamflow, etc. in detail
3) Construct and analyze flood hydrograph, unit hydrograph, and apply the knowledge for the water resources projects
4) Apply methods of flood peak calculation and flood routing.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2				2
CO2								2				2
CO3		3										
CO4	3											

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 03, SA 01

Course Code: CEE 0732 2229	Credit: 3.0	Year: 2nd	Semester: 2nd
Course Title: Ground Water		Course Status: Theory	

i) Rationale of the Course:

This course will give an insight to the students about the groundwater sources, movement of ground water, ground water exploration techniques, and existing challenges related to ground water extraction. This knowledge is essential for execution of ground water resources management projects including pump and water well design and construction.

ii) Course Content:

Fundamentals of ground water
Introduction to water on earth; ground water in hydrological cycle; Occurrence of ground water: zone of aeration and zone of saturation; Groundwater sources: Artesian and non-artesian well, infiltration well, infiltration gallery, spring.

Basics of ground water storage and movement Ground water flow principle: Storage function, conduit function; Aquifer and its properties; Seepage and flow net; fundamentals of well hydraulics: tube well and open well.
Governing equations related to ground water Governing principles of groundwater flow; Movement of ground water (Darcy's Law) and appropriate continuity principles; Laplace equation for potential ground water flow; Equations related to the yield of wells; Applicability of the equations and related problems.
Ground water development in Bangladesh Types of well technologies used in Bangladesh including alternative technologies; Design of well (non-gravel pack and gravel pack); Sanitary protection and maintenance of well; Necessity of pumps and types of pumps; Design and installation of pumps.
Challenges of ground water resource Groundwater table depletion; Salt-water intrusion; Groundwater contamination; Modification of groundwater system.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply the governing principles of ground water flow, ground water movement, and appropriate continuity principles
2) Assess local subsurface geology by using the basic understanding of aquifer properties
3) Estimate hydraulic conductivity, permeability, velocity of ground water at field level and flow rate of confined and unconfined aquifers
4) Design the water well (non-gravel pack and gravel pack) and water pump.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3							3					
CO4			3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 03, SA 01

Course Code: CEE 0732 2233	Credit: 2.0	Year: 2nd	Semester: 2nd
Course Title: Mechanics of Solids II		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the basic knowledge of torsion, transformation of stress, deflection of beams, analysis of column etc. This knowledge is essential to analyze and design various components of a structure.

ii) Course Content:

Torsion: Torsional deformation of a circular shaft, The torsion formula, Power transmission, Angle of twist
Helical spring: Types of springs, Uses of helical springs, Stresses in helical spring
Stress Transformation and Principal stresses: Stress transformation, principal planes, principal stress, analytical and graphical methods for the stresses on an oblique section of a body, Mohr's circle
Deflection of beams Elastic deflections of a beam or cantilever using the method of double integration, the moment-area theorems and the conjugate-beam method
Columns Euler's formula to columns with different end conditions, Rankine's formula for long columns and effect of eccentric loading on the Rankine's and Euler's formula for long columns
Bending of curved beams Theory and problems related to bending of curved beams with small initial curvature and large initial curvature.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate the torsional stress in circular shafts and helical springs, design a circular shaft subjected to torsion, design a helical spring,
2) Calculate principal stress, maximum shear stress, the orientation of principal plane and plane of maximum shear stress both analytically and using Mohr's circle,
3) Determine the slope and deflection of beams under different types of loading,
4) Analyze both concentrically and eccentrically loaded columns; analyze curved beams.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2			2									
CO3				2								
CO4				2								

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL02, TL 05, TL 07	CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 02, CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0732 2271	Credit: 2.0	Year: 2nd	Semester: 2nd
Course Title: Water Supply Engineering		Course Status: Theory	

i) Rationale of the Course:

This course will give an insight to the students about the water quality, water collection, treatment, and distribution systems, and explain the role of a sustainable water supply system to meet the SDG6. This knowledge is essential for designing water demand, water collection system, water treatment processes, water distribution system, and covers the O & M of the water supply system.

ii) Course Content:

Introduction History and development of water supply system; Population prediction and water requirements; water sources and availability, water supply system in line with SDG6, JMP ladder for water supply and Bangladesh status.
Water source and quality Sources of water (surface, ground and rain water); Quality of water based on its source; Types of impurities; Effects of impurities on health and environment, drinking water requirements.
Collection system Design of collection system and water intake.
Water treatment processes and alternative water options Introduction to water treatment processes; Sedimentation; Coagulation; Filtration; Disinfection; Arsenic and Iron removal techniques; Rain water harventing.
Water distribution system Water pipes and pipe fittings including valves, washouts, hydrants, etc.; Fire hydrant; Overhead reservoir; Design, maintenance, monitoring and sanitary protection of water distribution systems, Leak detection and unaccounted water or system loss. Water supply system in rural and urban areas.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to

1) Explain the necessity of a sustainable water supply system in line with SDG6 and interprete the significance of water quality parameters on health and environment
2) Design of different water treatment units (sedimentation, coagulation, filtration, disinfection etc.)
3) Estimate water requirements and design the water collection and distribution systems.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2			3				2					
CO3			3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 08	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 03, TL 05, TL 07, TL 08	CA 01, CA 03, SA 01
CO3	TL 01, TL 02, TL 05, TL 07, TL 08	CA 02, CA 03, SA 01

Course Code: CEE 1021 2281	Credit: 2.0	Year: 2nd	Semester: 2nd
Course Title: Environmental Sanitation and Solid Waste Management		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the knowledge of sanitation and solid waste management based activities related to social and national level. This knowledge is essential for the execution of proper sanitation practice projects, improved solid waste management projects and improved personal and community-level hygiene practices. This course is closely correlated with wastewater treatment, industrial wastewater treatment, and proper disposal of solid waste in nature.

ii) Course Content:

General concepts of sanitation and its connection with SDG6 Definition of sanitation and its objectives; F-diagram and its significance; Sanitation systems and its classification; Connection of SDG6 with sanitation; JMP ladder for sanitation and Bangladesh status.
Sanitation technology Introduction to Sanitation Technology; Principles of excreta disposal; Different sanitation options; Sanitation practices in Bangladesh; Sanitation problems in the context of Bangladesh; Design of different types of latrine and septic tank; Sanitation of Community and Public Places; Duckweed treatment for waste and bio-gas plant technology.
Indoor sanitation Review of dwellers sanitation; Code of practice for adequate environmental facilities in an infrastructure; Housing and buildings: Space, lighting, air movement and circulation, temperature control, plumbing facilities, ventilation and air conditioning.
Environmental health Relation between water, waste and health; Water borne and water sanitation related diseases and their transmission routes; Control of communicable diseases: Important measures for prevention.
Hygiene promotion and community participation Hygiene promotion: Objectives, Scope and Motivation; Development of hygiene promotion program; Health education and hygiene promotion issues; Definition of community participation and its necessity; Forms of community participation.
General concepts of waste & solid waste Introduction to waste and solid waste.
Solid waste generation and solid waste collection Review of waste & solid waste generation: Formal practice to the general public; Techniques of solid waste generation and its impact on the environment; Review of the solid waste collection system.
Solid waste transfer, transport & treatment General concept of solid waste transfer, transport, volume reduction & treatment; Physical properties of solid waste.
Solid waste management Planning and socio-economic aspects of solid waste management; Community mobilization in solid waste management, hazardous and health-care waste management.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to

1) Explain the general concepts of sanitation, the significance of sustainable sanitation, the types of sanitation systems, available sanitation technologies and the necessity of hygiene promotion and community participation in sustainable sanitation
2) Identify diseases related to human excreta, different transmission routes of diseases, available preventive measures of communicable diseases and design the appropriate technology for safe sanitation
3) Apply concepts of solid waste management from the source of waste generation to waste disposal in a system of municipality organizational structure
4) Determine various technological applications for processing of waste and their disposals.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3				2							
CO2			3	3									
CO3		3											
CO4		3	2										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 08	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 05, TL 07, TL 08	CA 01, CA 03, SA 01
CO3	TL 01, TL 02, TL 05, TL 08	CA 02, CA 03, SA 01
CO4	TL 01, TL 02, TL 05, TL 08	CA 02, CA 03, SA 01

Course Code: STA 0542 2211C	Credit: 2.0	Year: 2nd	Semester: 2nd
Course Title: Statistics		Course Status: Theory	

i) Rationale of the course:

Acquiring knowledge to analyze civil and environmental engineering data.

ii) Course Objectives:

- Provide the basic knowledge of statistical tools,
- Equip the students for analyzing the data using the tools of descriptive and inferential statistics.

iii) Course Content:

Statistics: Definition, nature and scope. Nature of statistical data. Attributes and variables, population and sample, parameter and statistic, tabulation, frequency distribution, graphical representations.
Measures of central tendency: Mean, median, mode geometric mean, weighted mean and truncated mean.
Measures of dispersion: Range, standard deviation, variance, coefficient of variation, skewness and kurtosis.
Probability: Definition, statement and interpretation of laws of probability, Bayes' rule, random variables, mathematical expectations.
Probability distributions: Uses, applications and properties of Binomial, Poisson, negative Binolial, Exponential distribution, Normal distribution standard normal distribution. Brief discussion on sampling distributions- χ^2, t and F distributions.
Test of hypothesis: About mean, variance, proportion, test of independence, contingency tables, test of homogeneity, confidence intervals for mean, variance, proportions, sample size determination.
Correlation and regression: Definition, measure, interpretation and significance, curve fitting by least squares method and related tests, simple linear regression model with underlying assumptions, multiple linear regression.
Design of Experiments: Basic concepts, field layout and analysis of variance in completely randomized design, randomized block design and Latin square design. Analysis of covariance in a completely randomized design.

iv) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Perform exploratory data analysis,
2) Demonstrate a basic understanding on probability and probability distributions theory,

3) Perform bivariate analysis and interpret the results,
4) Perform test of hypothesis,
5) Design environmental experiments.

v) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		3		2					1	
CO2	1	2		3		2					1	
CO3	1	2		3		2					1	
CO4	1	2		3		2					1	
CO5	1	2		3		2					1	

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lecture using board/ Assignment	Assignment (Individual/group)/Semester-end examination
CO2	Lecture using board	Midterm Examination 1
CO3	Lecture using board	Quiz/ Semester-end examination
CO4	Lecture using board/Tutorial	Quiz/Semester-end examination
CO5	Lecture using board/Assignment	Assignment/ Midterm Examination 2

vii) Recommende books:

Main texts

1. Montgomery, D. C. and Runger, G. C. (2003) Applied Statistics and Probability for Engineers, 3rd Ed, John Wily and Sons.
2. Shill R.N. & Debnath S. C. (2001): An introduction to the theory of Statistics, Dhaka.

Reference Books

1. Mostafa, M. G., (1989) Methods of Statistics, Karim press and publication, Dhaka Bangladesh.
2. Gupta S. C. and Kapoor V. K., (2000) Fundamentals of Mathematical Statistics, 10th ed, Sultan Chand and Sons.
3. Hogg R V & Craig A T, (1995) Introduction to Mathematical Statistics, 5th Ed, Macmillan, London.
4. DeCoursey, W J. (2003) Statistics and Probability for Engineering Applications, Newnes, Elsiver Science (USA).

Course Code: CEE 0731 2224	Credit: 1.0	Year: 2nd	Semester: 2nd
Course Title: Quantity Surveying		Course Status: Sessional	

i) The rationale of the Course:

This course will familiarize the students with the quantity take-off or bill of quantity (BoQ) of different materials, equipment, and resources for a civil engineering project. This knowledge is essential for the budget preparation, material/resource scheduling, and time and cost management of any civil structure and infrastructure projects.

ii) Course Content:

Fundamentals of quantity surveying Basic theories and concepts of quantity surveying, different tools and techniques of estimation, and introduction of the relevant documents required to prepare estimation for a project.
Estimation of the building structure Measurement of materials and works, types of estimates, conceptual and detail estimates of a two-storied building. Estimation of quantities of steel & RCC elements of a multi-storied residential building. Estimation of plumbing and drainage (pipes, fittings, and fixtures) system of a building, water reservoir, and septic tank. Detail estimation of a one-story steel structure.
Estimation of roadway Computation of earth cutting and filling using various methods, basic estimation of materials required for the rigid and flexible pavements.
Estimation of a retaining wall and a culvert Introduction to various types of retaining walls and culverts. Estimation of materials required to construct a retaining wall and a culvert.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

6) Demonstrate skills for the budget preparation of a project
7) Prepare the bill of quantity for different work packages of a project
8) Evaluate the contractor's progress payment.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3											
CO2			3										
CO3					3			2			3		

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 06	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 03, TL 06	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0532 2226	Credit: 1.0	Year: 2nd	Semester: 2nd
Course Title: Remote Sensing and GIS Sessional		Course Status: Sessional	

i) Rationale of the Course:

This course will familiarize the students with the basics of remote sensing and GIS. This knowledge will be invariably important in analyzing remote data and to represent those data in graphical form.

ii) Course Content:

Fundamental of Remote Sensing Definition of remote sensing and its components; Types of data products, types of image interpretation, basic elements of image interpretation, visual interpretation keys, aerial photography, digital image processing , supervised and unsupervised classification of image, filtering process, integrated data analysis.

Application QGIS
GIS definition, development, application areas, Map-Definition, Elements of Maps, Types of maps, Advantages and disadvantages of analog/digital maps, Coordinate Systems- Geometric models of earth, Global/Local coordinate system, map projection, creating a basic map, interpolation.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain the basics of remote sensing and GIS
2) Apply the knowledge of GIS to create maps and images to represent spatial data.
3) Analyze the geo-spatial data using QGIS.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3											
CO2								2					
CO3								2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02	CA 03, SA 01, SA 02
CO2	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05
CO3	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05

Course Code: CEE 0731 2228	Credit: 1.0	Year: 2nd	Semester: 2nd
Course Title: Practical Surveying (Field Work)		Course Status: Field Work	

i) The rationale of the Course:

A field survey is a prerequisite task to be done before the planning and development of any civil engineering/mining project. Therefore, this course has great importance and will contribute to the development of qualified engineers. It is a fieldwork-based course through which students will learn about the tools/techniques of surveying and be able to execute the knowledge at the field level. This course will be helpful for the students to conduct the field survey and develop the skill to generate various maps and drawings relevant to engineering projects.

ii) Course Content:

Chain survey
• Identify the instruments for the chain survey • Select convenient stations • Conduct a chain survey in the field, record the observations in the field book and drawing paper • Conduct cross staff survey and find the area.
Plane table survey
• Identify the accessories of the plane table • Set up and orient the plane table • Conduct a survey in the field to plot the objects by radiation method and intersection method

Traverse/Route/Leveling and Contouring/ Height and Distance problem • Identify the leveling instrument • Perform temporary adjustments for taking observations • Conduct simple leveling and compound leveling • Take fly levels for establishing a benchmark
Tachometry and Stadia Surveying • In this type of surveying in which vertical and horizontal distances are computed from stadia, readings without using chains or tape. This is done with the help of a special type of transit theodolite known as tachometer and a staff known as stadia rod.
House setting • To mark the excavation lines, • To mark the centerlines of all the columns of the plan of a proposed building on the actual site of work as per plan of the building to facilitate earth cutting.
Curves and Curve settings. Use of Total Station and Global Position Station (GPS) • Setting out a simple circular curve in the field by a linear method and checking it by an angular method.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply surveying knowledge in real field projects
2) Design and conduct the fieldwork, and generate map/drawing for the respective Surveying
3) Use the engineering tools, techniques, and computational methods relevant to field survey.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2				2						
CO2			3	3		2				2		2
CO3	3	3					3					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 2230	Credit: 0.5	Year: 2nd	Semester: 2nd
Course Title: Year Final Viva II		Course Status: Viva	

i) Rationale of the Course:

By this course students will learn how to present themselves in an official forum for viva voce and they may be evaluated based upon the knowledge they achieved from their 2nd year theory and laboratory course.

ii) Course Content:

All theory and laboratory courses of second year first semester and second semester

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain and answer the intellectual and technical questions in front of an examination board,
2) Communicate with examiner and express their knowledge in a satisfactory way,
3) Aply the skills developed from the courses of second year first semester and second semester.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2				3
CO2									3	1		1	3
CO3		2										2	3

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02
CO2	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02
CO3	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02

Course Code: CEE 0732 2232	Credit: 1.0	Year: 2nd	Semester: 2nd
Course Title: Mechanics of Solids Sessional		Course Status: Sessional	

i) Rationale of the Course:

This course will make the students familiar with various methods to analyze material properties through experiments which will enhance their theoretical knowledge.

ii) Course Content:

Tension test of mild steel
Test of helical spring
Static bending test of timber beam
Impact test of metals
Hardness test of metals
Compressive strength test by concrete test hammer
Direct shear test of metal specimen
Buckling test of slender columns

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Perform tension, shear, torsion, impact, hardness tests for solid materials
2) Determine the impact and hardness of metals
3) Calculate the elastic constants through compression test on springs and deflection test on beams
4) Determine the strength of different materials

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						3					
CO2							3					
CO3							3					
CO4	3						3					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 02, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 02, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 2236	Credit: 1.0	Year: 2nd	Semester: 2nd
Course Title: Fluid Mechanics Sessional		Course Status: Sessional	

i) Rationale of the Course:

Theoretical equations and formula are applied to calculate the velocity and discharge of fluids. The applied techniques to find out the fluid velocity and discharge needs to be compared using laboratory scale measurement systems. Thereafter the theoretical parameters need to be calibrated.

ii) Course Content:

Determination of center of pressure: Center of pressure on partially and fully merged surface has been identified using a toroidal quadrant of rectangular section with an adjustable counter balance.
Application of Bernoulli's theorem: The energy equation according to Bernoulli's theorem for a horizontal conduit has been introduced. The experimental unit is constructed as a single Perspex fabrication consisting of two cylindrical reservoirs interconnected by a venture of rectangular cross section.
Determination of flow through venturimeter: Water flow determination using a venturimeter, which has different inner diameter for which water pressure would differ to each other has been introduced. Bernoulli's theorem is applied here basically.
Determination of flow over a V-notch: A right angled V-shape weir has been introduced through which upstream water is allowed to be flowed, and the volumetric water flow rate is calculated. Theoretical water flow rate is then compared to the actual one to evaluate the coefficient of discharge.
Determination of flow through an orifice: To measure and control the water flow from a reservoir, an orifice is generally applied as it is simply an opening in the wall of a water reservoir. The actual flow is calculated considering the horizontal and vertical distances of the flow from the orifice. Theoretical water flow rate is then compared to the actual one to evaluate the coefficient of discharge.
Determination of flow through an external cylindrical mouthpiece: An external cylindrical mouthpiece is introduced instead of orifice to calculate the actual flow by considering the horizontal and vertical distances of the flow from the mouthpiece. In general, the length of the mouthpiece is considered to be 3 times its inner diameter. Theoretical water flow rate is then compared to the actual one to evaluate the coefficient of discharge.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Conduct the experiments related to flow measurement techniques,
2) Compare between theoretical and actual discharges.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2			3			2					
CO2			3					3					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 02, TL 03, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: STA 0542 2212C	Credit: 1.0	Year: 2nd	Semester: 2nd
Course Title: Practical Statistics		Course Status: Sessional	

i) Rationale of the Course:

Acquire practical knowledge to analyze applied data.

ii) Objectives of the Course:

Provide skills of using statistical tools to analyze data in the field of civil and environmental engineering.

iii) Course Content:

Graphical representation, Measures of central tendency and dispersion, Correlation and Regression.
Test of hypothesis: test for population proportion, mean, variance, and test for independence of attributes.
Analyze and graphical representation of the data using Excel/ SPSS/ R programs.

iv) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply the statistical tools and make design of the studies,
2) Analyze data with proper interpretation.

v) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2		3		2					1	
CO2		2	2		3		2					1	

Correlation: 3-High, 2-Medium, 1-Low

vi) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Lecture using board/ Assignment	Assignment (Individual/group)/Semester-end examination
CO2	Lecture using board/Assignment using software	Assignment (Individual/group)/Semester-end examination

vii) Recommended Books:

Main texts

1. Montgomery, D. C. and Runger, G. C. (2003) Applied Statistics and Probability for Engineers, 3rd Ed, John Wily and Sons.
2. Shill R.N. & Debnath S. C. (2001): An introduction to the theory of Statistics, Dhaka.
3. DeCoursey, W J. (2003) Statistics and Probability for Engineering Applications, Newnes, Elsiver Science (USA).
4. Landau, S. and Everitt, B.S. (2004) A handbook of statistical analysis using SPSS, Chapman & Hall/CRC.

Reference Books

1. Mostafa, M. G., (1989) Methods of Statistics, Karim press and publication, Dhaka Bangladesh.
2. Gupta S. C. and Kapoor V. K., (2000) Fundamentals of Mathematical Statistics, 10th ed, Sultan Chand and Sons.
3. Hogg R V & Craig A T, (1995) Introduction to Mathematical Statistics, 5th Ed, Macmillan, London.

Third Year First Semester

Course Code: CEE 0732 3141	Credit: 3.0	Year: 3rd	Semester: 1st
Course Title: Structural Analysis I		Course Status: Theory	

i) Rationale of the Course:

This course aims to provide students with a thorough understanding of structural analysis of statically determinate structures by various methods, influence lines and moving concentrated loads, earthquake and wind loads, and structural analysis of statically indeterminate structures by approximate method.

ii) Course Content:

Analysis of statically determinate beams, frames and trusses: This chapter presents a review of internal forces acting on typical structural members and calculate the stability and determinacy of structures, Sign convention and notations for internal forces. It also includes determination of reaction, Axial force, Shear force and Bending moment, obtaining internal forces diagrams in a system
Analysis of portal frames, mill bent, bridge portal and braced trusses: Introduction to portal frame, analysis of portal frame, bridge portal, mill bent and braced trusses
Analysis of building frame for vertical and lateral load: Vertical load and Lateral load analysis analysis of statically indeterminate multistoried building frames by approximate method
Lateral load (Earthquake and wind effect) calculation as per Bangladesh National Building Code: Earthquake and wind load calculation as per BNBC
Influence line (beam, frame, floor beam, truss) analysis: Introduction to influence line, generation of influence lines for reaction, shear and moment by using Muller-

Breslau Principle

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Determine stability of a structure and analyze statically determinate and indereminate beams, frames and building and bridge trusses,
2) Apply the concepts and methodologies of influence line on different structures (beam, frame, floor beam, and truss) to solve real world problems involving structures of different nature,
3) Apply the concepts and methodologies of moving load on structural analysis to solve real world problems,
4) Analyze multistoried building frame for vertical and lateral loads by approximate method.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2								
CO2	2							1		2		
CO3			2				1					
CO4			2				1					3

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 02, TL 05, TL 07	CA 02, CA 03, SA 01
CO3	TL 01, TL 02, TL 05, TL 07	CA 03, SA 01
CO4	TL 01, TL 05, TL 07, TL 08	CA 03, SA 01

Course Code: CEE 0732 3145	Credit: 3.0	Year: 3rd	Semester: 1st
Course Title: Reinforced Concrete Design I		Course Status: Theory	

i) Rationale of the Course:

The aim of this course is to provide students with a thorough understanding of thedesign of reinforced concrete structures. This knowledge is essential to realize,understand and design reinforced concrete elements, such as beams and slabs underspecific loading and environmental conditions.

ii) Course Content:

Fundamentals of reinforced concrete members: This chapter presents a review of the properties, selection, performance and codified requirements of concrete andsteel. It also shows how strength criteria and fundamental principles of the materials can be applied to reinforcedconcrete members subjected to axial loading.
Flexural Analysis and Design of singly and doubly reinforced rectangular beams and T- beams according to WSD and USD methods: This chapter shows the flexural behavior and flexural strength of a beam under gradually increasing load on it. Itintroduces the WSD and USD methods and shows how to design singly and doubly reinforced rectangular beamsand T- beams according to WSD and USD methods. Also describes the practical considerations of beam design.

Shear and diagonal tension in beams: This chapter describes the shear and diagonal tension in beams, diagonal failure of beams and design of web reinforcement etc.
Bond and anchorage: This chapter describes the bond force and bond strength in reinforced concrete elements. It also introducesanchorage and development length of reinforcing bars, bar cutoff and bend points in beams, bar splices etc.
Analysis and Design of one-way and two-way slabs: This chapter describes different types of slabs, analysis and design of one way slab, analysis and design of two wayedge supported slabs by Coefficient method.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply the understanding of fundamental theory and principles for design of reinforced concrete members,

2) Analyze and design reinforced concrete structures (beams and slabs) for flexure in WSD and USD methods,

3) Analyze and design reinforced concrete beam for shear,

4) Develop bond and anchorage system for reinforced concrete structures.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2			3									1
CO3			3									1
CO4			3									1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping CourseLearning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, SA 01
CO2	TL 01, TL 02, TL 04,TL 07	CA 02, CA 05, SA 01
CO3	TL 01, TL 02, TL 07	CA 03, SA 01
CO4	TL 01, TL 02, TL 07	CA 03, SA 01

Course Code: CEE 0732 3151	Credit: 3.0	Year: 3rd	Semester: 1st
Course Title: Geotechnical Engineering I		Course Status: Theory	

i) Rationale of the Course:

This course will enable the students to understand basic geotechnical properties of soil, such as phase relationships, classification, gradation, and other index properties. The detailed analysis of engineering properties (strength parameters, consolidation, and stress) of geomaterials will provide knowledge on how to present and select strength parameters for designing a geotechnical structure. This course will also teach the effect of permeability, seepage, flow net, and lateral earth pressure on the analysis and design of different structures, such as building, embankment, storage facilities, roads, airport.

ii) Course Content:

Fundamentals of geotechnical engineering, formation and structures of soil: This chapter introduces the basics and history of geotechnical engineering along with different geotechnical issues, importance, and application. This also includes the origin, formation and structures of different soils with some uses.
Index properties and classification of soil: This chapter presents different index properties of soil, such as size and shape of soil particles, particle size distribution (sieve and hydrometer analyses), and Atterberg limits and related indexes. Different soil classification discusses how to arrange various types of soils in specific groups based on their properties with the objective of finding their engineering applications.
Phase relationships of soil: This chapter discusses the relationships among soil mass, weight, volume, dry mass, water, and air of a soil sample along with different practical and mathematical problems.
Permeability of soil: This chapter presents the determination process of the coefficient of permeability, seepage and soil suction. This chapter also describes the construction process of the flow net and its applications.
Compaction and consolidation of soil: This chapter differentiates between compaction and consolidation, and when these phenomena occur in the real field. The test procedure and analysis on compaction includes standard and modified proctor test. One-dimensional consolidation behavior and testing (using oedometer) of soil are included in this chapter with the view to analyze coefficient of consolidation, coefficient of volume compressibility, compression index, and induced settlement analysis. The time rate of consolidation discusses at which a soil consolidates and how long it requires to reach a certain degree of consolidation.
Shear strength of soil: This chapter presents the shear strength behavior of soil in both disturbed and undisturbed conditions. Determination of different shear strength parameters (i.e. angle of internal friction, cohesion, etc.) by various shear strength test methods such as direct, unconfined and triaxial shear strength apparatus are also delivered in this section. The selection of different triaxial test conditions, such as CD, CU, UU, based on field soil and loading conditions was also included in this chapter.
Lateral earth pressure of soil: This chapter presents different types of lateral earth pressure theories, such as Rankine's earth pressure theory, Culmann's active pressure, Coulomb's active pressure, and discusses their application in designing a structure.
Stress in soil mass and soil failure criteria: This chapter presents total and effective stress considering the water table. This chapter also includes soil failure criteria using the Mohr Circle theory.
Stress distribution in soil: This chapter presents vertical stress distribution on a vertical plane, due to line load, under a strip load, under a circular load, under the corner of a rectangular area and at any point of a rectangular area.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate the soil formation and structures, effect of permeability, seepage, flow net, lateral earth pressure of soil on the different structures,
2) Analyze optimum moisture content and maximum dry density, coefficient of consolidation, coefficient of volume compressibility, compression index, and induced settlement,
3) Interpret the values of shear strength and shear strength behavior, such as the angle of internal friction, cohesion in both drained and undrained conditions,
4) Examine total and effective stress, stress distribution and lateral eart pressure in soil.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										
CO2		2										
CO3				3								1
CO4				2								1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0732 3171	Credit: 3.0	Year: 3rd	Semester: 1st
Course Title: Open Channel Hydraulics		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the knowledge of free-surface fluid flow or open channel hydraulics based upon a sound background in fluid mechanics. This knowledge is essential for execution of water resources projects, hydraulic engineering works and hydraulic structures.

ii) Course Content:

Fundamental concepts of open channel flow: A review of fluid mechanics as applied to open-channel flow, The conservation laws are revisited, and the equations of continuity, momentum, and energy are derived, Kinds of Open Channel, Types of open channel flow, Channel geometry and section elements, Effects of viscosity and gravity, Velocity and pressure distribution and their coefficients.
Governing equations for Steady One-Dimensional Flow Continuity equation, Energy equation, Momentum equation, Applicability of the equations and related problems
Specific energy and critical flow Energy Depth Relationships, Specific energy curve, Discharge depth curve, Critical flow: computation of critical depth by analytical method, computation of critical depth by Trial and error method, computation critical depth by Numerical method, hydraulic exponent for critical flow computation, section factor for critical flow computation, Transition problems, Flow measurement,
Energy and momentum principles: The applications of the energy and momentum principles are discussed along with the problem of choking in steady flow. It is also demonstrated that the hydraulic behavior of open-channel flow can be very different under the subcritical and supercritical conditions. Also, the phenomenon of hydraulic jump is introduced.
Normal flow: A brief description of flow resistance formula is first provided in relation to the boundary layer theory, and then the normal flow calculations for uniform, grass-lined, riprap, composite, and compound channels are presented.
Design of open channels: This chapter is devoted to the hydraulic design of different types of open channels. Several charts are provided to facilitate the lengthy trial-and-error procedures we often need.

Gradually varied flow: This chapter deals with water surface profile calculations for gradually varied flow. An attempt is taken to emphasize how to identify the flow controls, predict the profile, and formulate a solution accordingly.
Rapidly varied flow: Hydraulic jump, Jumps in horizontal rectangular channels, Jumps in horizontal non-rectangular channels, Jumps in slopping channels, Stilling basins design

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Assess the basic principles of energy and momentum, continuity principle and critical flow condition theory for open channels,
2) Apply the governing equations for analyzing steady one-dimensional flow,
3) Design the unlined and lined open channels by using modern computational methods,
4) Calculate the surface profile for gradually varied flow and rapidly varied flow,
5) Apply the concept of hydraulic jump for designing of hydraulic structures and water resource project.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3			3				2					
CO4												2
CO5												2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05, TL 07, TL 08	CA 01, SA 01
CO2	TL 01, TL 05, TL 07	CA 01, SA 01
CO3	TL 01, TL 07, TL 08	CA 02, SA 01
CO4	TL 01, TL 05, TL 07	CA 02, SA 01
CO5	TL 01, TL 05, TL 07, TL 08	CA 02, SA 01

Course Code: CEE 0732 3181	Credit: 3.0	Year: 3rd	Semester: 1st
Course Title: Wastewater Engineering		Course Status: Theory	

i) Rationale of the Course:

This course will give an insight to the students about the wastewater source and characteristics, sewer material and appurtenances, conventional and decentralized wastewater systems, and different treatment units and disposal methods for industrial wastewater management. This knowledge is essential for selecting and designing the treatment units for the municipal and industrial wastewater treatment plant and covers the design, construction, and operation of the decentralized wastewater treatment system.

ii) Course Content:

Fundamentals of wastewater and its treatment: Definition and characteristics of wastewater; types of wastewater; sources of wastewater; quality and quantity of municipal and industrial wastewater, important contaminants in wastewater; objectives of wastewater treatment, level of wastewater treatment; unit operations and processes involved in wastewater treatment.
Wastewater plumbing: Description of sewage and wastewater plumbing; Conventional sewerage system; Small bore sewerage system; Simplified sewerage system; Sewer and sewer materials; Construction of sewer; Sewer and sewer appurtenances; Maintenance of sewer and sewer appurtenances; design of conventional sewearage system.
Principles of wastewater treatment processes: Preliminary or preparatory treatment: screening, comminutors, grit removal, floatation, neutralization, equalization, aeration, skimming tank; Primary treatment: sedimentation, Imhoff tank, septic tank, interceptor tank; Secondary treatment: waste stabilization ponds, trickling filter, activated sludge process, rotating biological contactors.
Fundamentals of decentralized wastewater treatment systems: Definition, characteristics and importance of decentralized wastewater treatment (DWWT) systems; Application of DWWT; Steps of treatment: septic tank/settler, anaerobic baffled reactor, anaerobic filter, planted gravel filter, polishing ponds; Recycle and reuse of treatment products.
Overview of industrial waste and wastewater treatment: Use of water in industries / water intensity; Source and characteristics of industrial wastewater; Consequences of industrial wastewater pollution; Waste reduction techniques; Industrial wastewater treatment: definition of effluent treatment plant (ETP), importance of ETP, treatment levels and mechanisms, overview on ETP process design and operation; Wastewater treatment and disposal methods of major industries - such as petroleum industries (gasoline kerosene treatment), textile industries, tannery; cement, fertilizer, paper and pulp, jute processing, dairy, drug and pharmaceutical, food and allied industry; Treatment and disposal of industrial waste sludge; Laws and regulations for industrial wastewater and waste treatment.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Describe wastewater characteristics, major contaminants, importance and level of wastewater/industrial wastewater treatment, different sewerage systems, sewer materials, and sewer appurtenances,
2) Identify different treatment units and disposal methods for various industrial wastewater management,
3) Design a conventional sewearage system using the fundamental concepts of wastewater plumbing,
4) Estimate wastewater quantity and design conventional and decentralized wastewater treatment systems.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3										
CO3			3									
CO4			3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 07	CA 02, CA 03, SA 01
CO3	TL 01, TL 02, TL 07, TL 08	CA 05, SA 01
CO4	TL 01, TL 02, TL 07	CA 03, SA 01

Course Code: CEE 0712 3183	Credit: 2.0	Year: 3rd	Semester: 1st
Course Title: Environmental Pollution Control Engineering		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the environmental pollution and its control technologies. Course content covers air pollution, noise pollution, thermal pollution, radioactive pollution, and advanced pollution control engineering. This knowledge is essential for the students to identify the extent of environmental pollution and formulate a sustainable engineering solution to cope with the challenges.

ii) Course Content:

General concepts of environmental pollution: Definition of environmental pollution; Sources and impacts of environmental pollution: atmospheric sub-systems, aquatic sub-systems and soil sub-systems.
Air pollution Air pollution and its classification; Air quality (physical and chemical fundamentals), Major air pollutants: characteristics and their effects on health and environment; Air quality index; Air quality model: indoor air quality model, dispersion model; Air pollution control mechanism and instrumentation; Laws and regulation of air pollution control.
Noise Pollution: Review of the human auditory system, noise pollution detection, noise pollution control mechanism, and acoustic design principle.
Thermal pollution: Definitation of thermal pollution; Source of thermal pollution; Effects of thermal pollution on environment; Control strategies of thermal pollution.
Radioactive pollution: Radioactive pollution, its sources and effects on health and environment; Control strategies of radioactive pollution.
Advanced pollution control engineering: Fundamental of environmental biotechnology, Phytoremediation and bioremediation techniques, Modern technologies in pollution detection, Monitoring and remediation, Application of biomimicry in pollution control engineering.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to

1) Explain the general concepts of different environmental pollution, their sources and impacts,
2) Interpret the available pollution control methods and choose the appropriate engineering solution,
3) Determine the pollution level and design the pollution control technology.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3			2							
CO3			3				2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy

CO1	TL 01, TL 02, TL 05, TL 08	CA 01, CA 02, CA 03, SA 01
CO2	TL 01, TL 02, TL 03, TL 05, TL 08	CA 01, CA 02, CA 03, SA 01
CO3	TL 01, TL 02, TL 05, TL 07, TL 08	CA 01, CA 02, CA 03, SA 01

Course Code: CEE 0732 3142	Credit: 1.0	Year: 3rd	Semester: 1st
Course Title: Structural Analysis and Design Sessional I		Course Status: Sessional	

i) Rationale of the Course:

The aim of this course is to provide students with a thorough understanding of the analysis and design of steel truss roof system considering wind load. This knowledge is essential for execution of engineering projects such as industrial infrastructures.

ii) Course Content:

Introduction Advantages and disadvantages of steel, Elastic and plastic design, Section modulus, Sections used as tension and compression members, section properties, Design philosophy (LRFD, ASD), Assumptions and classification of trusses, Industrial roof truss system.
Design of Industrial Roof Truss System- Purlin and Sag rod Analysis and design of purlins (dead load analysis, wind load analysis, load combination and design), Analysis and design of sag rod.
Analysis of Member Forces Dead load analysis, wind load analysis (left to right and right to left), combination of loads
Design of Truss members, Bracing System and Connections Design of truss members (top chord, bottom chord and web chord), Design of bracing system (vertical bracing, top chord bracing, bottom chord strut), Design of Welded Connections, Detailing of truss joints

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) demonstrate the theory and principles of design of steel structures,
2) analyze and design industrial steel roof truss system considering wind load,
3) analyze and design welded connections,
4) design the truss joints complying with the regulations set out in codes.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											2
CO2			3				2					2
CO3			3				2					2
CO4			3				2					2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05, TL 08	CA 03, CA 04,SA 01, SA 02
CO2	TL 01, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02

CO4	TL 01, TL 03, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 3146	Credit: 1.0	Year: 3rd	Semester: 1st
Course Title: Reinforced Concrete Design Sessional I		Course Status: Sessional	

i) Rationale of the Course:

This course aims to provide students with a thorough understanding of concrete structures' fundamental mechanics, the empirical assumptions, and how they relate to the design. Furthermore, this course focus on the analysis, design of the reinforced concrete beams, column and slabs, emphasizing the guiding principles of the serviceability limit state and the ultimate limit state concepts.

ii) Course Content:

Share of axial load by concrete and steel in a column.
Introduction of BNBC 2020.
Design of singly, doubly,T shaped reinforced concrete beams, one-way and two-way slabs both in WSD and USD and comparison.
Field visit: Visiting a construction site to show reinforcement of various components of a building, construction methods, etc.
Calculation of loads from balcony on a cantilever beam and design of the beam in USD.
Laboratory work: Construction of cylindrical molds and singly reinforced beams. Testing of molds for concrete strength; testing of the beam for design capacity and deflection. Comparison of results found from testing and theoretical calculation.
Laboratory work: Determination of concrete strength of an existing column with concrete hammer and reinforcement with ferro-scanner. Calculation of column's load bearing capacity, calculation of load on the column and comparison the results.
Design of a shear reinforcement of a beam by USD.
Laboratory work: Core Cutting from a concrete block and testing for compressing strength determination.
Design of a beam for torsion.
Design of masonry structure as per BNBC.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Calculate dead loads and live load on reinforced concrete beams and slabs as per BNBC 2020,

2) Analyze and design of reinforced concretebeams and slabs for flexure and sheartocomply with the regulations set out in BNBC,

3) Determine the capacity of existing beams, columns etc.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		3									
CO2	2		3									

CO3				3			2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping CourseLearning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 04, TL 07	CA 03, CA 04, CA 05, SA 01, SA 02
CO2	TL 01, TL 02, TL 04, TL 07	CA 03, CA 04, CA 05, SA 01, SA 02
CO3	TL 01, TL 02, TL 03	CA 03, CA 04, CA 05, SA 01, SA 02

Course Code: CEE 0732 3182	Credit: 1.0	Year: 3rd	Semester: 1st
Course Title: Plumbing for Water Supply and Drainage		Course Status: Sessional	

i) Rationale of the Course:

This course will demonstrate the design procedure of different components of a plumbing system using the knowledge of water supply engineering and fluid mechanics. This knowledge will be helpful for students to design and analyze the plumbing system of a building.

ii) Course Content:

Introduction: Introduction to design priniples associated with plumbing; plumbing fixtures, water pipe fittings including valves, and pumping machinery, hot and cold water system, fire fighting system; waste pipe, vent pipe and raindrop pipe.
System Design: Designing the plumbing system for water supply of a building; designing the waste water pipe, vent pipe and rainwater pipe of a building.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain the hydraulics and design principles associated with plumbing,
2) Apply the knowledge of hydraulics to design the plumbing system for water supply of a building,
3) Design the wastewater and rainwater plumbing system for a building.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3											
CO2				3									
CO3				3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02	CA 03, SA 01, SA 02
CO2	TL 01, TL 02, TL 07, TL 08	CA 03, CA 05
CO3	TL 01, TL 02, TL 07, TL 08	CA 03, CA 05

Course Code: CEE 0712 3184	Credit: 1.0	Year: 3rd	Semester: 1st
Course Title: Environmental Engineering Sessional		Course Status: Sessional	

i) Rationale of the Course:

This course will provide the students with hands-on experience in determining the optimum coagulant dose, solid removal efficiency through sedimentation, short-term biochemical oxygen demand (SBOD) in biodegradation processes, sludge volume index (SVI), self-cleansing velocity in sewer lines, bio-uptake coefficients of heavy metals, standard particulate matter (SPM) in air, basic weather forecasting parameters, dispersion coefficients of contaminants through soil, and sound level of different traffic environments. This knowledge and practice are very important to safely handle many environmental engineering issues.

ii) Course Content:

Optimum Coagulant Dose: This experiment deals with the determination of optimum coagulant dose in form of Al_2SO_4 for certain water sample to remove the turbidity of the sample using conventional jar test apparatus.
Settling column test for type II settling (flocculent part) This experiment deals with the determination of settling behavior of flocculent particles in a wastewater sample using settling column apparatus.
Short-term biochemical oxygen demand (SBOD) in biodegradation process: This experiment deals with the determination of total consumption of oxygen used by microorganism during short term biodegradation of organic waste using SBOD test apparatus.
Sludge volume index (SVI): This experiment deals with the determination of sludge volume index for industrial ETP generated sludge to assess the condition of sludge settleability using sludge volume index tester.
Self-cleansing velocity in sewer line: This experiment deals with the determination of self-cleansing velocity that should be maintained in municipal sewer line considering all types of sewer fittings like as elbow, tee etc.
Bio-uptake coefficient of heavy metal: This experiment deals with the determination of bio-uptake coefficient of heavy metals for different plants in aquatic environment to assess their phytoremediation capacity.
Standard particulate matter (SPM) in air: This experiment deals with the determination of standard particulate matter in form of $SP_{2.5}$ and SP_{10} using both vacuum filtration apparatus and air monitoring device in the open roadside environment.
Basic weather forecasting parameters: This experiment deals with the determination of basic weather forecasting parameters (air temperature, humidity, daylight intensity, wind velocity & direction, rainfall intensity) using mini portable weather station.
One-dimension dispersion coefficient of contaminants through soil media: This experiment deals with the determination of one-dimension dispersion coefficient of contaminants leached through soil media using leaching column apparatus.
Sound level in different traffic environment: This experiment deals with the determination of sound level for different traffic environment e.g. classroom, playground, canteen, bus stop, beside highway, congested busy intersection, industrial plant etc. using sound level meter.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Determine some important water/wastewater related parameters like as the optimum coagulant dose, solid removal efficiency through sedimentation, SBOD in biodegradation process, SVI for industrial effluent, self-cleansing velocity in sewer line,
2) Analyze phytoremediation related parameter like as bio-uptake coefficient of heavy metals,

3) Determine contaminant transport related parameter like as dispersion coefficient of contaminants through soil media,

4) Monitor standard particulate matter (SPM) in air, basic weather forecasting parameters, sound level of different traffic environment.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	2	3			2					
CO2		3	2	3			2					
CO3		3	2	3			2					
CO4		3	2	3			2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 02, TL 03, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 02, TL 03, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 02, TL 03, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 3186	Credit: 1.0	Year: 3rd	Semester: 1st
Course Title: Water Supply and Sewerage Engineering Sessional		Course Status: Sessional	

i) Rationale of the Course:

This course will familiarize the students with the general characteristics of water and sewage samples. This knowledge will be invariably important in analyzing any kind of water and sewage samples and helpful in designing water and sewage treatment units.

ii) Course Content:

Determination of pH, Color, Turbidity, Hardness, Solids, Total Alkalinity, Magnesium, Carbon dioxide, Chlorides, Iron, BOD, COD of water; Chemical Coagulation, Break Point Chlorination and Residual Chlorine determination; determination of Total and Fecal Coliform; OUR determination.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to

1) Explain the quality of water (surface water/groundwater/rainwater etc.) and identify the water-quality parameters that are significant for public health and the environment,

2) Determine the appropriate technique/method for testing the water and sewage/wastewater quality parameters,

3) Analyze the characteristics of water, wastewater, and sewage through conducting experiments.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2		3										
CO3				3			2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 02, TL 05, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03, TL 06	CA 05, SA 02

Third Year Second Semester

Course Code: CEE 0732 3243	Credit: 3.0	Year: 3rd	Semester: 2nd
Course Title: Structural Analysis II		Course Status: Theory	

i) Rationale of the Course:

This course provides students with the principles of elastic structural analysis and behaviour of indeterminate structures. Classical and modern analysis techniques are introduced to arm the students with the necessary tools to better appreciate the real behaviour of structures.

ii) Course Content:

Method of Analysis of Statically Indeterminate Structure: Methods of the analysis for indeterminate structures (Displacement method, Force method), Concept of static and kinematic indeterminacy
Deflection of Frames and Trusses: Virtual Work Method: Principle of Virtual Work Method. Conservation of energy principle, Deflection of trusses by Virtual Work Method, Deflection and slope of beams and frames by Virtual Work Method
Force Method of Analysis: Consistent Deformation Method: General principle and Definitions, Consistent deformation method for Beams, Consistent deformation method for Frames, Consistent deformation method for Trusses
Displacement Method of Analysis: Slope-Deflection Equation: Derivation of slope-deflection equation, Modified SDE for pin supported end span, Analysis of Beams, Analysis of frames without sidesway, Analysis of frames with sidesway
Displacement Method of Analysis: Moment Distribution: General principle and Definitions, Moment Distribution for Beams, Stiffness modification factor, Moment Distribution for Frames without sidesway, Moment Distribution for Frames with sidesway

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the basic concepts of structural indeterminacy,
2) Analyze indeterminate structures using displacement method,
3) Analyze indeterminate structures using force method,
4) Calculate deflections of determinate structures.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2			3									1
CO3			3									1
CO4	2											1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO2	TL 01, TL 05, TL 07	CA 01, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 03, SA 01
CO4	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01

Course Code: CEE 0732 3247	Credit: 3.0	Year: 3rd	Semester: 2nd
Course Title: Reinforced Concrete Design II		Course Status: Theory	

i) Rationale of the Course:

This course will enable the students with the analysis, design and detailing of reinforced concrete elements, such as slabs, columns, footings, stairs, and retaining walls, joint reinforcement. It also introduces them with serviceability design of the reinforced concrete structures.

ii) Course Content:

Analysis and design of two-way column supported slabs: This chapter describes the analysis and design procedure of two way column supported slabs by Direct design method and Equivalent frame method. It also covers the deflection calculation of slabs.
Analysis and design of columns: This chapter presents analysis and design of concentric, eccentric, short, long, sway and non-sway columns.
Analysis and design of foundations: This chapter discusses analysis and design of different types of footings and foundations, such as wall footings, column footings, combined footings, mat foundations, pile and pile caps etc.
Analysis and design of retaining walls: This chapter presents the types of retaining walls, loads on retaining wall, its analysis and design. Three types of retaining wall are considered here: gravity retaining wall, cantilever retaining wall and underground retaining wall.
Analysis and design of stairs: This chapter describes the types of stairs, their advantages and disadvantages, loading condition, analysis and design. Two types of stairs are considered here: cantilever stair and double flight stair.
Serviceability: This chapter includes cracking and deflection in members, crack control, control of deflection, moment vs. curvature of RC sections etc.
Analysis and design of reinforcement at joint: This chapter deals with design, detailing, analysis of Reinforcement at beam-column joint.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to

1) Apply the tools for critical understanding of the theory and principles of design and solution of reinforced concrete structures,
2) Perceive, analyze, and design reinforced concrete structures (slabs, columns, footings, stairs, retaining walls, joints) subjected to axial, flexure/bending and shear effects,
3) Analyze reinforced concrete member for serviceability response and calculate and evaluate deflections and crack control in accordance with the relevant codes,

4) Apply analysis and design skills to unfamiliar structural elements and applications.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2		2	3	2								
CO3			3									
CO4			2									2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping CourseLearning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01
CO5	TL 01, TL 07	CA 02, CA 05

Course Code: CEE 0732 3253	Credit: 3.0	Year: 3rd	Semester: 2nd
Course Title: Geotechnical Engineering II		Course Status: Theory	

i) Rationale of the Course:

This course will allow the students to perform the subsoil investigation and determine the bearing capacity of soil for the foundation of any structure. They will get the knowledge of how to design the shallow and deep foundations. This course will facilitate them to determine the settlement and possibilities of liquefaction hazards. They also get the fundamental knowledge on analysis of the safety factor of slope.

ii) Course Content:

Subsoil investigation: This chapter presents an elaborate discussion on different subsoil boring methods, e.g. auger, rotatory, percussion, wash boring, etc., disturbed and undisturbed sample collection. A detailed procedure of field tests, such as standard penetration test (SPT) including N-value corrections, cone penetration test (CPT), field vane shear test, non-destructive test, including water table monitoring are also discussed. Finally, a brief idea of preparing a subsoil investigation report is presented here.
Fundamentals of bearing capacities of shallow and deep foundations: This chapter presents bearing capacity determination of shallow foundation using Terzaghi's, Meyerhof's, Hansen's and Vesic's method in dry and submerged conditions. The bearing capacity of deep foundation (pile) in drained and undrained cases including single and group capacity are also determined.
Design of foundations: This chapter presents different types of foundation and their design procedure, such as footings (isolated and strip footing), mat (raft) foundations, pile foundations, caisson and coffer dams.
Compressibility and settlement of foundations: This chapter presents a different theoretical and mathematical analysis of the compression and settlement behavior of soil. Moreover, the estimation of gross and net settlement in case of both shallow and deep foundation is also discussed, including the permissible limit.
Slope stability analysis: This chapter presents different safety factors of the slope, types of slope failure and different methods, such as Swedish, Bishop's simplified method, etc. to identify the slope factors.

Fundamentals of soil liquefaction: This chapter presents a brief overview of soil liquefaction phenomena, its impact and mitigation technology. Theoretical and mathematical analysis of liquefaction hazard and some exercise problems in relation to liquefaction vulnerability assessment of underlying soil profile have also been discussed in this section.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Investigate the subsoil for geotechnical purposes,
2) Analyze and design the different types of shallow and deep foundation,
3) Calculate the settlement of foundations,
4) Evaluate the vulnerability of different natural and man-made slope and soil liquefaction hazards.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2										
CO2				3									2
CO3					2								
CO4					1	2							

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 07, TL 08	CA 04, SA 01
CO2	TL 01, TL 02, TL 07, TL 08	CA 01, CA 03, CA 04, SA 01
CO3	TL 01, TL 02, TL 07	CA 02, CA 03, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0732 3261	Credit: 3.0	Year: 3rd	Semester: 2nd
Course Title: Transportation Engineering I		Course Status: Theory	

i) Rationale of the Course:

This course will help the students to understand the basic principles of transportation engineering and to use modern techniques for the improvement of existing transport facilities. This course will also develop student's capacity to perform traffic analysis, designing of transport system components, and to identify the more appropriate techniques for transport related problem solving.

ii) Course Content:

Introduction: This chapter presents an overview of the basic tool and technique of the vast field of modern Transportation Engineering at an introductory level. This also includes the principles of transportations, transportation functionality, transportation in logistics, importance of transportation system, advantages and disadvantages of different mode of transportation, current problems in transportation sector and finally factors Influencing Transportation Costs and Pricing.
Transportation system status: Status of existing Transportation System, Systems Approach to Transport Planning, Interdependence of the Land

use and Traffic, Stages in Transportation Planning, Transport Systems and Planning Considerations.
Road Transportation System: This chapter presents a brief discussion on basic components of the road transport system and also describes roadway type according to different parameters i.e., geographical location, functional classification, standard wise classification, use wise and urban wise classification.
Transport & highway planning: Road classification, type of road patterns, road planning survey, master plan its phasing etc. are discussed in this chapter.
Highway alignment and Survey: Highway alignment and its various factors as well as considerations during construction are discussed in this chapter.
Traffic characteristics: This chapter presents a concise description of road users (physical, physiological, mental) and vehicular characteristics (static and dynamic), and their impacts on transportation system.
Traffic flow characteristics: This chapter discusses on fundamentals of Traffic Flow, Flow Parameters, Nature of traffic flow, Categories of Traffic Flow, Approaches to Traffic Flow – Spacing, Gap and Headway Characteristics. It also describes relationships among the three main characteristics -flow, density, and velocity for understanding better traffic flow.
Surveys and studies in traffic engineering: Conventional and Modern Methods of Traffic Survey and Studies – Volume and Capacity – Headway concepts and applications – Speed and Delay – Origin and Destination, Parking, Accident – Level of Services (LoS).
Design of transport infrastructure (Geometric Design): This chapter discusses in detail the geometric elements of highway i.e., cross-section, sight distance, horizontal alignment, vertical alignment. It also describes the factors influencing the geometry of highway and problems on the above discussion.
Intersection & Traffic Signal Design: This chapter presents an overview of the principles and type of at grade and grade-separated intersection; Types and features of channelizing Island and interchange, and basic elements that are considered for designing the intersection. Types and Design, Traffic Signal Control, Signal Co-ordination.
Traffic operation and management: Traffic Sign, Road Markings, Traffic Control Aids, Street furniture, Road Arboriculture - Traffic Regulation, Cost Effective Management Measures – Traffic Systems Management and Travel Demand Management - Congestion Management, Traffic Calming and Pricing.
Parking studies and Street Lighting: This chapter deals with the parking characteristics, parking types, parking demand and supply relation, survey techniques for parking studies, ill effects of parking on transportation systems, and design of parking. This chapter also presents an overview of the objectives, types, and design procedures of street lighting.
Intelligent transportation systems: A broad range of wireless and wireline communications-based information, control and electronics technologies systems are discussed in this chapter.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the basic principle of traffic and transportation engineering and use of modern tools and techniques in different transportation engineering projects,
2) Explain the characteristics of traffic and traffic flow that help to develop an efficient transport system,

3) Design roadway transport components such as the geometry of highway, signal design, parking design, etc. and to take realistic engineering decision based on the analysis,

4) Analyze the transport and traffic data for assessing the roadway performance (e.g., LOS), volume & capacity, speed & delay, and for designing necessary transport system elements.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						2					
CO2		2										
CO3			3									
CO4		3										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 05, TL 07	CA 02, CA 02, SA 01
CO3	TL 01, TL 02, TL 05, TL 07	CA 01, CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 05, TL 08	CA 02, SA 01

Course Code: CEE 0732 3273	Credit: 3.0	Year: 3rd	Semester: 2nd
Course Title: Hydraulics and Hydraulic Structure		Course Status: Theory	

i) Rationale of the Course:

Students will learn about sediment hydraulics and various types of hydraulic structures along with their design procedure and design consideration using knowledge of fluid mechanics and open channel hydraulics.

ii) Course Content:

Types of Hydraulic Structure: Introduction, Classification of Hydraulic Structure, their function and application. Common types of hydraulic structures in Bangladesh and their uses.
Theories of Seepage and Design of Weirs and Barrages: Failure of Hydraulic Structures Founded on Pervious Foundations, Bligh's Creep Theory for Seepage Flow, Lane's Weighted Creep Theory, Khoshla's Theory and Concept of Flow nets, Design of a Vertical Drop Weir on Bligh's Theory, Design of Modern Weirs and Barrages Founded on Permeable Foundations on The Basis of Khoshla's Theory
Dams and Types of Dam: Dams, Various kinds of dam, problems associated with dam construction, selection of the type of dam and their classification, factors governing selection of dams, selection of site for a dam.
Design of Gravity Dam: Forces acting on gravity dam, mode of failure and criteria for structural stability of gravity dam, stability analysis of gravity dam, design of gravity dam.
Spillways and Energy Dissipaters: Introduction, types of spillways, energy dissipation below spillways.

Diversion Head work: Components of diversion headwork and their function, weir and barrage, canal head regulator, design of canal head sluice.
Flood Control Reservoir: Definition and types of reservoir, types of flood control reservoir, Capacity-elevation and Area-Elevation curve of a reservoir site, computation of reservoir capacity, storage zones of reservoir, storage capacity and yield, computation of dependable catchment yield, calculation of reservoir capacity from mass inflow curve,
Cross drainage works: Types of cross drainage works, Aqueduct and Syphon Aqueduct, design considerations for cross drainage works
Sediment Transport and Calculation of Sediment Load: Sediment Transport Mechanism, Shield's Method for Non-scouring Channel Design, Regime Channel, Kennedy's Theory, Estimation Sediment Load by Empirical Formula
Rivers, Their Behaviour, Control and Training: Types of Rivers and Their Characteristics, Sub-continental Rivers and Their Classification, Behaviour of Rivers, Control and Training of Rivers, Design of Guide Bank

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Calculate and analyze sediment transport phenomenon and sediment load,
2) Design of non-scouring and non-silting canals considering sediment load,
3) Design different types of hydraulic structures considering their suitability and functions,
4) To analyze the impacts of hydraulic structures on river or canal regime.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2						1					
CO2			2	3				2					
CO3			3	2				2					
CO4						2							

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05, TL 07, TL 08	CA 01, SA 01
CO2	TL 01, TL 05, TL 07	CA 01, SA 01
CO3	TL 01, TL 07, TL 08	CA 02, SA 01
CO4	TL 01, TL 05, TL 07	CA 02, SA 01

Course Code: ARC 0731 3201C	Credit: 2.0	Year: 3rd	Semester: 2nd
Course Title: Urban and Regional Planning		Course Status: Theory	

i) Rationale of the Course:

The course aims to introduce the basic theory, concept and practices in physical planning through review and examination of city and regional structures since the beginning of the earliest human settlements to the contemporary, for the students of Civil and Environmental Engineering.

ii) Course Content:

Concepts of Urban Planning: This topic presents a brief discussion on the Definition, objective, scopes, trends, methods.
History of urbanization and planning: early to modern: This topic presents a brief narration of the world's planning history. From the bigging to the modern period.
Urban planning components: Introduction, framework, forms and type of Planning.
Urban planning methods: Introduction, Theories of zoning system, masterplan, housing, public buildings, transportations, parks and playground
Classical Models: The Concentric Zone Theory of Burgess, The Sector Theory of Hoyt, The Multiple Nuclei Theory of Harris and Ullmann
Planning Culture in Bangladesh: This chapter presents a brief narration of the Bangladesh's planning history. From the British period to the post-liberation.
Law and Governance & Problems and Possibilities: This chapter deals with the legislation system of Bangladesh. Also give a short view on the Problems and Possibilities in this field.
concept of contemporary planning tools and process: This chapter presents the overview on the Community planning, Public-Private partnership, Built-operate transfer, Transit-oriented Development.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) distinguish various human settlements and identify their planning process,
2) develop a solid conceptual framework on their origin and evolution throughout history,
3) relate various socio-cultural, political, environmental and technological impacts to the growth of the cities throughout the globe,
4) communicate concepts in urban history and theory through both verbal and written presentations,
5) identify the limitations of planning and land management system in Bangladesh,
6) apply critical thinking in a range of corresponding fields of history and theory in regional and urban planning.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3										
CO2		3										
CO3		3										
CO4							2					
CO5		2										
CO6										2		

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02	CA 01, CA 02, SA 01
CO2	TL 01, TL 02, TL 07, TL 08	CA 01, CA 02, SA 01
CO3	TL 01, TL 02	CA 01, CA 02, SA 01
CO4	TL 08	CA 01, CA 02

Course Code: CEE 0732 3230	Credit: 0.5	Year: 3rd	Semester: 2nd
Course Title: Year Final Viva III		Course Status: Viva	

i) Rationale of the Course:

By this course students will learn how to present themselves in an official forum for viva voce and they may be evaluated based upon the knowledge they achieved from their third year theory and laboratory course

ii) Course Content:

All theory and laboratory courses of third year first semester and second semester

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain and answer the intellectual and technical questions in front of an examination board,
2) Communicate with examiner and express their knowledge in a satisfactory way,
3) To aply the skills developed from the courses of third year first semester and second semester.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2				3
CO2									3	1		1	3
CO3		2										2	3

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02
CO2	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02
CO3	TL 01, TL 02, TL 03, TL 07, TL 08	SA 02

Course Code: CEE 0732 3232	Credit: 1.0	Year: 3rd	Semester: 2nd
Course Title: Scientific Research (Tools and Techniques)		Course Status: Sessional	

i) Rationale of the Course:

This course will provide necessary knowledge on basic tools and techniques used in scientific study and research. It will give a clear understanding of how to design and conduct scientific research, how to compile a research proposal

and dissertation, and how to publish and present them. It also gives an introduction to the process of compiling a patent document and its submission.

ii) Course Content:

Review on basic tools and techniques in scientific study and research: This module presents the brief review on different scientific study and management tools e.g. note taking, SQ3R reading system, mind mapping, flow charting, 5S system, PDCA, Kaizen theory, etc. Major innovations and scientific contributions specially in civil and environmental engineering field are also covered in this part.
Review on engineering research and its methods: This module presents a detailed overview on scientific and engineering research, their types, significance, methods of conduction etc.
Preparation of research proposal with budgeting: This module presents a complete description on how to prepare research proposal with budgeting.
Compilation of thesis paper: This module presents how to compile a thesis paper including introduction, literature review, materials and methods, data analysis and discussion, conclusion, references, contents, abstract, different annexures etc.
Writing and publishing scientific papers for journal and conference: This module presents how to write, submit and publish scientific papers in different peer reviewed international journals and conferences.
Preparation of theoretical and design patent application: This module presents how to write, submit and publish theoretical and design patent document for the sealing and protection of different novel intellectual property.
Delivering scientific talk and poster presentation: This module presents the way of delivering scientific talk in public gathering and how to prepare, display and present scientific poster in seminar or conferences.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Conduct innovative, structured scientific research,
2) Prepare and submit research proposal and patent documents,
3) Write and publish scientific articles in peer reviewed journals and conferences,
4) Deliver scientific talks and present different scientific posters.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2								3				
CO3								3	2			
CO4								3				

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 06, TL 08	CA 03, CA 04, CA 05, SA 01, SA 02
CO2	TL 01, TL 02, TL 05	CA 03, SA 01
CO3	TL 01, TL 02, TL 05	CA 04, SA 01
CO4	TL 01, TL 02, TL 08	CA 05, SA 01

Course Code: CEE 0732 3244	Credit: 1.0	Year: 3rd	Semester: 2nd
Course Title: Structural Analysis and Design Sessional II		Course Status: Sessional	

i) Rationale of the Course:

This course will enable the students to build-up the capacity in order to investigate the stability, strength and rigidity of different types of structures. This knowledge is essential for designing various structures (pile foundation, septic tank, underground reservoir, overhead water tank, shear wall etc.).

ii) Course Content:

Analysis and Design of Pile Foundation Introduction, design of pile cap, design of pile.
Analysis and Design of Septic Tank Introduction, volume of tank design (length, width and depth design), soak field and soak pit design.
Analysis and Design of Underground Reservoir Introduction, design of side wall, base slab and roof slab.
Analysis and Design of Overhead Water Tank Introduction, determination of tank dimension, design of side wall, and base slab.
Analysis and Design of Shear Wall Introduction, load calculation, design considering shear forces, design considering moment.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Structural design of pile foundation,
2) Design of eptic tank,
3) Design of underground reservoir and overhead water tank,
4) Design of shear wall.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3				2					2
CO2			3				2					2
CO3			3				2					2
CO4			3				2					2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 03, TL 05, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03, TL 05, TL 08	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 03, TL 05, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 3252	Credit: 1.0	Year: 3rd	Semester: 2nd
Course Title: Geotechnical Engineering Sessional I		Course Status: Sessional	

i) Rationale of the Course:

This course will provide the students with the hands on experience of testing different soil in standard laboratory and field test apparatus. The students will learn the geotechnical property, behavior and parameters of soil for applying them in designing different structures based on soil parameters and solving geotechnical issues.

ii) Course Content:

Visual classification of soils: This chapter presents the procedures for visually identifying the soil in terms of their color, size, shape and stiffness.
Specific gravity determination: This chapter discusses in detail the procedure of determining the specific gravity of soil using a pycnometer.
Grain size distribution: This chapter presents the procedure and analysis to determine the grain size determination of soil using different standard sieves and hydrometer.
Atterberg limits determination: This chapter deals with the liquid limit, plastic limit, shrinkage limit, and plasticity index of fine-grained soil. Atterberg limits are used to classify fine-grained soil according to the Unified Soil Classification System (USCS) or AASHTO system.
Field density determination: A brief description of the procedure for determining the field density of soil by using sand replacement method is discussed in this chapter. The field density of soil is used to determine various indexes and engineering properties of soil.
Compaction test (Proctor/ modified proctor): These laboratory tests will enable to determine the relationship between the moisture content and the dry density of soil under a specified compaction effort.
Unconfined compression test: This chapter deals with the theory and determination of unconfined compressive strength of clay soil. The undrained shear strength (su) of soil is necessary for the determination of the bearing capacity of foundations, dams etc.
Direct shear test: This chapter presents a concise description and determination of shear strength parameters (angle of internal friction and cohesion - most important geotechnical parameters of soil) of soil in a direct shear device.
Consolidation test: This chapter presents a brief description and procedure for determining the magnitude of consolidation settlement that a laterally confined soil specimen undergoes when subjected to different vertical stresses. The obtained data can be used to determine the compression index, recompression index, preconsolidation stress, coefficient of consolidation, and coefficient of secondary compression of the soil.
Vane shear test: The chapter discusses the procedure of a vane shear test on clay soil, which provides undrained shear strength of soft clays.
Permeability test: This chapter presents the procedure of permeability test to determine the coefficient of permeability.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the procedure of soil classification, atterberg limits, soil compaction, flow of water through soil, consolidation, and shear strength of soils,
2) Distinguish between fundamental behaviors of cohesive and cohesionless soil, including grain size distribution.

3) Explain and apply the knowledge of dry density, optimum moisture content, strength, compressibility, and permeability of soil in real geotechnical analysis and design,

4) Calculate the deformation and settlement of soil under any specific load.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1			2		2	1					
CO2			2				2						
CO3					3		1						2
CO4													2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 03, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 03, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02

Fourth Year First Semester

Course Code: CEE 0732 4121	Credit: 2.0	Year: 4th	Semester: 1st
Course Title: Project Planning and Management		Course Status: Theory	

i) Rationale of the Course:

This course will guide the students to discover new and established project management tools and techniques and help them gain an understanding of a project life cycle. Students will learn how to handle more projects with budget constraints effectively, efficiently, and timely.

ii) Course Content:

Introduction: This chapter presents an overview of the need for project management, the construction of the project, the project scope and goals, the project life cycle, and the major types of construction projects.
Contract strategy: This chapter discusses in detail the contract, selection of contract type, project delivery methods, types of contracts, contract administration, and problems on the above topic.
Project planning: This chapter presents a concise description of project planning steps, work breakdown structure, activities relationships, and drawing project network. It describes in detail the duration of the activity, the direct cost of the project, and the problem above.
Project scheduling: This chapter discusses on critical path method, calculations for the critical path method, Program Evaluation and Review Technique (PERT), time-scaled diagrams, and criticisms of network techniques.
Resources management: This chapter deals with resource management, resource allocation, resource aggregation (loading), resource leveling (smoothing), and scheduling with limited resources. It also includes a case study and problems on the above topic.
Project finance and evaluation:

This chapter presents a brief description of contract cash flow, project cash flow, discounted cash flow, finalizing a tender price, pricing policy, and the problem above. The payback period and feasibility study of the project are described in this section.
Project control: This chapter presents an overview of problems that may arise during construction, schedule updating, delays analysis, and earned value management.
Simplex method: This chapter focuses mainly on capital budgeting, establishing optimum transfer prices, and cost volume profit analysis (product planning decision, profit planning decision, pricing decision, etc.)

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret project management (i.e., project planning, scheduling, and resource allocations), construction of the project, the project scope and goals, and the project life cycle.
2) Explain various construction contract types, construction operations (i.e., project documentation, measurement, and progress payments), and project delivery methods.
3) Develop an effective plan for selecting the project through the feasibility study.
4) Apply appropriate tools/techniques/methods for designing construction scheduling (e.g., Bar Chart, CPM, PERT), and project performance monitoring and control (EVM, time-cost tradeoff) simultaneously with a limited resource.
5) Analysis of the cost, volume, and profit for decision-making in the areas of product planning, profit planning, and pricing.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2											
CO3			3									
CO4			2				1					
CO5		2										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL05	CA 01, CA 03, SA 01
CO2	TL 01, TL 05	CA 03, CA 04, SA 01
CO3	TL 01, TL 02, TL 07	CA 04, SA 01
CO4	TL 01, TL 02, TL 05, TL 07	CA 03, CA 04, SA 01
CO5	TL 01, TL 02, TL 07	CA 02, SA 01

Course Code: CEE 0532 4133	Credit: 3.0	Year: 4th	Semester: 1st
Course Title: Earthquake and Disaster Management		Course Status: Theory	

i) Rationale of the Course:

This course familiarizes the students with fundamental knowledge of disaster management and earthquake engineering. This knowledge is essential for the students to understand common natural disasters in Bangladesh and the strategy/policy/national plan of the Bangladesh government for disaster management. Besides, this course will enable the students to understand the seismic behavior of structures and apply current codified requirements and

design specifications for seismic-resistant buildings.

ii) Course Content:

Disaster Management: Basic concepts Definition and basic components of disaster management; Important terminologies, their significance and inter-relation: disaster, hazard, vulnerability, risk, preparedness, prevention, mitigation, rehabilitation, retrofitting etc.; History of natural disasters; Classification of natural disasters; Impact of disasters on SDGs; Natural disasters in Bangladesh.
Sources of disasters, their effects and probable remedial measures: Bangladesh perspective Sources, effects on public health and environment, and probable remedial measures: Flood, Cyclone, Tsumani, River bank erosion, Structural collapse, Arsenic contamination etc.
Disaster Management System in Bangladesh: Conceptualizing disaster management in Bangladesh; Disaster management system in Bangladesh: National level, Sub-national levels, Disaster Management Institutions in Bangladesh; Disaster management regulatory framework: Disaster management act, National disaster management policy, Disaster management plans, Standing orders on disaster, Guidelines for government at all levels; Disaster management plans: National plan for disaster management, District disaster management plan, Upazila disaster management plan, Union disaster management plan, Paurashava/City Corporation disaster management plan, Sectoral development plans incorporating disaster risk reduction, Hazard specific multi-sectoral disaster management plans etc.
Earthquake Engineering: Basic concepts Earthquake – definition; Causes of EQ, Intraplate EQ & Volcanic EQ; Foreshock & Aftershock; EQ terminology; Determination of EQ focus, EQ intensity & magnitude, Intensity scale, Iso-seismal lines, Magnitude scale, EQ Energy, Magnitude vs. Intensity.
Causes of EQ and Theory of Plate Tectonics Layers of earth, Causes of EQ, Sequence of EQ events, Continental drift, Theory of plate tectonics, Plate boundaries and their formation.
Seismic Waves and Faults Types of seismic waves, Wave motion and propagation, Movement of earth, Wave Parameters, Detection of Seismic Waves, Nature of Seismic Waves, Locating EQ Epicenter by Three-Circle Method, Classification of Faults, Fault Terminology, Elastic Rebound Theory.
Seismicity in Bangladesh Seismic Sources, Status of EQ, EQ History, Major EQ in Bangladesh, Seismic Zones, Damage Potentialities in Major Cities, etc.
Effect of EQ Primary and Secondary Effects, Shaking Hazard on Structures, Inertia Force and deformation in Structural Components, Horizontal and Vertical Shaking, Liquefaction and Its Physical Consequences, Landslides, Tsunamis, Sand blow, etc.
Seismic Vulnerability Reduction: Architectural and Structural Measures Code and Specifications, Set-back Rule, Size of Buildings, Horizontal and Vertical Irregularity of Buildings, Adjacency of Buildings and Seismic separation Gap, Twisting of Buildings and Effect of Torsion, Soft Story Effect and Design Considerations, Short-Column Effect and Its Solution, etc.
Seismic Design of Buildings Seismic Design Philosophies, Earthquake Ground Motion and Response Spectra, EQ-Resistant Buildings and Construction Details.
Loss Estimation Loss estimation due to damage of buildings (by RVS method: FEMA 154), Estimation of Human Casualty and Injury, Estimation of Economic Loss.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to

1) Describe the fundamentals of disasters in Bangladesh; their sources, types, effects, and relevant strategy/policy/national plan of the Bangladesh Government for disaster management
2) Identify probable remedial measures that comply with the disaster management system of Bangladesh
3) Identify favorable and unfavorable design features of building structures and apply building codes for earthquake resistant building design
4) Estimate the probable loss due to an earthquake in terms of human casualty and injury and monetary value.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3				2						
CO3	3	3	2									
CO4							3					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 07	CA 01, SA 01
CO2	TL 01, TL 02, TL 07	CA 03, SA 01
CO3	TL 01, TL 03	CA 02, SA 01
CO4	TL 01, TL 02, TL 08	CA 03, SA 01

Course Code: CEE 0732 4141	Credit: 2.0	Year: 4th	Semester: 1st
Course Title: Reinforced Concrete Design III		Course Status: Theory	

i) Rationale of the Course:

In the race of modern science and technology, to make things stronger, cheaper, lighter, more functional, and more sustainable, prestressed concrete is used extensively in bridges, multistory buildings, and many other important parts of modern infrastructure. This course provides students with an opportunity to enhance their skills in prestressed concrete design and applications.

ii) Course Content:

Introduction: This chapter presents an overview of prestressed concrete principles, the Classification, and types of prestressing, comparison between normal reinforced concrete and prestressed concrete. Finally, beam stresses are determined by considering different concepts.
Prestressing system and end anchorages: A concise description of different methods for pretensioning and posttensioning, end anchorages for posttensioning and pretensioning, comparison between posttensioning and pretensioning is discussed in this chapter.
Analysis of sections for flexure: This chapter discusses in detail about analysis of prestressed flexural members, stresses in concrete due to prestress and load, stresses in steel due to load, Cracking moment, Ultimate moment for bonded and un-bonded tendons.
Design of sections for flexure and shear: This chapter focuses on the design of prestressed concrete sections for flexure and shear under different load scenarios, including working load, cracking load, and ultimate load.

Loss of pre-stress: This chapter deals with the loss of pre-stress due to Friction, Elastic shortening, Creep, Shrinkage, relaxation, bending, etc.
Analysis and design of pre-stressed compression member and slab: This chapter discusses in detail about analysis and design of prestressed compression members and slab.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the basic principles of prestressed concrete, different methods of prestressing, advanced construction technology for prestressing systems, and their applications in civil infrastructure.
2) Determine beam stresses using different concepts, and losses of prestress due to various causes i.e., friction, elastic shortening, creep, shrinkage, relaxation, and bending, etc.
3) Analysis of prestressed beam section considering flexure.
4) Design prestressed beam and slab considering flexure.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3						1					
CO2		2											
CO3			3										
CO4				3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05	CA 03, CA 04, SA 01
CO2	TL 01, TL 02, TL 05, TL 07	CA 01, SA 01
CO3	TL 01, TL 02, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 07	CA 02, SA 01

Course Code: CEE 0732 4143	Credit: 2.0	Year: 4th	Semester: 1st
Course Title: Steel Structure		Course Status: Theory	

i) Rationale of the Course:

This course will enable students to the behavior and design of structural elements in steel structures using current codified requirements and design specifications. This course will enable the students to realize, understand and design basic elements of simple steel structures.

ii) Course Content:

Introduction: This chapter introduces the design philosophy, limit states, design considerations, elastic and plastic design, overview of LRFD and ASD methods, Sections used as tension and compression members, section properties, etc..

Design of tension members: this chapter presents design strength of tension member, gross yield strength, net section fracture strength, shear lag, effective net area of the tension members, block shear rupture strength, design of tension member using the AISC-LRFD and ASD manual.
Connections: This chapter discusses the introductory concepts, classification of connections based onthe connecting medium, type of internal forces and type of members joining, riveted connection, riveting process and limitations.
Design of bolted connections: This chapter presents the structural bolting, ASTM bolt types, bolt sizes, bolt assembly, bolted joint types, failure mechanism of bolted connections, code requirements, shear strength, bearing strength, and minimum edge distance and spacing requirements for bolted connection, design of bolted connection and gusset plate for given design forces, behavior of a slip-critical connection and slip-strength of fully tensioned bolted connection, design of slip-critical bolted splice connection for tension member.
Design of welded connections: this chapter presents structural welding, different types of welding procedures, types of weld based on shape, method of deposition and welding position, welded joints, minimum and maximum weld size, nomenclature of weld, standard welding symbols, stresses in weld, specifications for welded connections, strength of weld, balanced welded connection, design of fillet welded connection in AISC-ASD and LRFD methods..
Design of steel beam, steel column: This chapter presents the ASD and LRFD design method of steel beam, steel column.
Design of steel base plate and composite structures: This chapter presents the ASD and LRFD design method of steel base plate and composite structures.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply critical understanding of the theory and principles of design and solution of steel structures,
2) Perceive, design and analyze basic elements of steel structures like tension members,
3) Analyze and design simple welded and bolted connections,
4) Design steel beam, steel column, steel base plate and composite structures.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2										
CO3				3								1
CO4				2								1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 02, TL 08	CA 01, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0732 4149	Credit: 3.0	Year: 4th	Semester: 1st
Course Title: Structural Analysis III		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the knowledge of analyzing both structural and nonstructural problems. This knowledge is essential for computing the displacements, stresses and strains in discrete structures involving complicated geometries, loadings and material properties.

ii) Course Content:

Introduction to Finite Elements: Explanation of finite elements, one dimensional stress and strain deformation, time depended flow problems, equation solutions by finite elements.
Method of Analysis of Statically Indeterminate Structures: Brief review on Concept of Static and Kinematic Indeterminacy, Degree of Freedom, Methods of the Analysis for Indeterminate structures (Displacement method, Force method) etc.
Displacement Method of Analysis: Stiffness Matrix Method: General principle and definitions, Member stiffness, Stiffness transformations, Assembly of stiffness matrices and Solution for trusses, beams and frames.
Force Method of Analysis: Fundamentals of Flexibility Matrix Method: General principle and definitions, Flexibility matrices and Solution for beams, frames and trusses.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate the concepts and methodologies of finite element methods on different structures (beam, frame and truss) to solve real world problems involving structures of different nature
2) Identify indeterminate structures and suitable method(s) for analysis
3) Apply the stiffness matrix method to solve indeterminate beams, frames and trusses
4) Apply the flexibility matrix method to solve indeterminate beams, frames and trusses.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										1
CO2		3										
CO3			3									1
CO4			3									1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping CourseLearning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, SA 01
CO2	TL 01, TL 08	CA 03, CA 04, SA 01
CO3	TL 01, TL 02, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 07	CA 02, CA 03, SA 01

Course Code: CEE 0732 4151	Credit: 2.0	Year: 4th	Semester: 1st
Course Title: Geotechnical Engineering III		Course Status: Theory	

i) Rationale of the Course:

This course will enable the students with the knowledge on how to perform geotechnical analysis and design of different structures such as sheet pile, retaining wall, machine foundation and piles subjected to lateral load. This course will also offer knowledge of different soil improvement and dewatering techniques to make them able to work in different adverse soil conditions to design a sustainable structure.

ii) Course Content:

Analysis and design of sheet pile: This chapter presents the analysis and design of different sheet piles and their design for both cohesive and cohesionless soil.
Analysis and design of retaining wall: This chapter introduces different types of retaining walls, application of lateral earth pressure theories to design, stability of gravity retaining walls, and with metal, geotextile and geogrid reinforcement, and slurry wall construction.
Fundamentals of soil stabilization: A brief description of soil stabilization methods, such as lime stabilization, cement stabilization, fly ash stabilization and deep mixing method along with their applications have been included in this chapter.
Soil improvement techniques: This chapter presents the specifications and design of field compaction, dynamic compaction, vibroflotation, stone column, precompression, sand drain, and prefabricated vertical drains..
Fundamentals of machine foundation: This chapter presents different types of machine foundations, and relevant design issues due to vibration, especially from the machines..
Pile subjected to lateral load: This cahapter includes analysis and design of pile due to lateral load using the elastic solution and Brom's method.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Design of sheet piles, machine foundations and subjected to lateral load,
2) Analyze and design of retaining wall,
3) Apply different soil stabilization techniques to solve soft soil issues for construction purposes,
4) Apply different ground improvement methods to improve the bearing capacity, strength and stiffness of soil.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										
CO2		2	2									1
CO3				2	1							
CO4				3	2							2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 01, CA 03, CA 04, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0732 4161	Credit: 3.0	Year: 4th	Semester: 1st
Course Title: Transportation Engineering II		Course Status: Theory	

i) Rationale of the Course:

This course will introduce students to the basics of transportation modeling which are important for long-term transport planning and policy recommendation. This course will also develop the student's capacity for scientific investigation of road traffic accidents, and design, construction, and maintenance techniques of both rigid and flexible pavement.

ii) Course Content:

Highway materials: This chapter presents an overview of the basic properties of subgrade soil, aggregate, bituminous materials, cement concrete. It also describes various methods of testing the highway materials to confirm its specification.
Fundamentals of flexible pavement: This chapter discusses in detail traffic volume calculation, factors affecting the design and performance of flexible pavement, flexible pavement design by AASHTO method, CBR method, RHD method. It also includes the whole procedure of bituminous mix design using Marshall mix method and the problem on the above topic.
Fundamental of rigid pavement: This chapter presents a concise description of the types of rigid pavement, factors affecting the design and performance of rigid pavement, types of rigid pavement stresses, factors affecting the concrete stresses, determination process of stresses at different positions of rigid pavement using Wasstard method. It describes in detail the design method of rigid pavement by AASHTO method and the problem above.
Highway construction: This chapter discusses on construction procedures of earth roads, gravel roads, water-bound macadam roads, bituminous pavement, cement concrete pavement, and soil-stabilized roads. Different types of joints in cement concrete pavements, joint filler, sealer, and reinforced and prestressed concrete are described in this section.
Highway maintenance and Drainage: This chapter deals with pavement failure, methods of measurement of skid resistance, unevenness, ruts, and cracks. Pavement surface condition evaluation by physical measurement methods and strengthening of the existing pavement is discussed in this part. This chapter also describes highway maintenance, the importance of highway drainage, surface & sub-surface drainage, drainage of slopes, erosion control, and road construction in waterlogged areas.
Accident and Traffic Congestion: Causes of accidents – Human factors – Vehicles – Road and its condition – Environmental Studies, types of accidents, remedies of an accident; hazardous road location identification, road safety strategies, different index of traffic congestion measurement, remedies of traffic congestion.
Transportation modeling: Definition of transportation modeling, Advanced travel demand forecasting methods, Four step transport demand modeling – trip generation, trip distribution, modal split, trip assessment, Transportation Management System.
Transport system management: Technics for transport demand management and transport supply management.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Design of roadway pavement (flexible and rigid) using different methods.
2) Evaluate the optimum asphalt content for flexible pavement construction by Marshal Mix design.
3) Develop a four-step transport demand model for transport planning.
4) Apply appropriate strategy for road safety, roadway maintenance and transport system management.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				3									
CO2					3								
CO3				2				2					
CO4		2	3										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 07	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 03, TL 06	CA 03, CA 04, SA 01
CO3	TL 01, TL 02, TL 05, TL 06, TL 07	CA 02, CA 03, SA 01
CO4	TL 01, TL 02, TL 04, TL 05	CA 03, CA 04, SA 01

Course Code: CEE 0732 4130	Credit: 1.0	Year: 4th	Semester: 1st
Course Title: Thesis		Course Status: Thesis	

i) Rationale of the Course:

Thesis in undergraduate level will enable a student to learn how to conduct a research by problem identification, objective determination and methodology development, conduct experiments and analysis and finally interpret the result.

ii) Course Content:

Thesis is an individual inquiry conducted by the students under the general guidance of an academic advisor. This inquiry can take one of the following forms in any branches of civil engineering (structure, geotechnical, water, environment and transportation):
(a) An original theoretical and/or experimental investigation;
(b) Design of an engineering product or development of computer program;
(c) Compilation and critical analysis of information on a specific engineering topic; or
(d) Investigation of a substantive engineering problem for an external sponsor.
The thesis work will be carried out throughout the whole period of the final year.

In 4th year 1st semester:

- Selection of thesis topic
- Preparation of project proposal comprising an overview, aims of the project/thesis, methodology, timeline and expected outcomes.
- Setting of experimental set-up (if needed).
- Preparation of proposal defense

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Identify a research hypothesis or research question, develop methodology to conduct the study, design an experiment process or system and after completion of all experiment and analysis, write the thesis,
2) Able to prepare research proposals for submission and presentation for various purposes,
3) Collect relevant data (primary or secondary) and by analyzing the collected data reach to an acceptable solution,
4) Understand of the research work conducted and applied it as the theoretical framework to the research process,
5) Prepare a supervised and defended research project as a thesis to the department.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		2				2		1	2	1
CO2								1			3	
CO3		2				1		2				
CO4	2										2	1
CO5										2	1	

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Conducting regular meeting with thesis group students	Thesis proposal evaluation by supervisor
CO2	Showing relevant videos	Thesis proposal evaluation by co supervisor if any
CO3	Arranging training for laboratory experiments and analyzing data critically/Hands on practice	Thesis proposal evaluation by external members
CO4	Group discussion among students and supervisors	Thesis proposal presentation
CO5	Self study by students using reference book/research article/case study/other online materials/ Taking dummi presentation before proposal presentation	Oral examination infront of presentation board

Course Code: CEE 0732 4132	Credit: 1.0	Year: 4th	Semester: 1st
Course Title: Field Work For Engineers		Course Status: Field Work	

i) Rationale of the Course:

By doing this course students can be benefited more, since engineering courses are taught relating both academic and practical experience. This approach may motivate students, enable them to relate what was learned in the class with the real world, and allow them to start developing their own engineering judgment, which is essential for the successful practice of civil and environmental engineering.

ii) Course Content:

Field Work in Civil Engineering Projects
Trip to different construction sites such as, bridge site, flyover and underpass sites, river protection sites, dam sites, road construction sites etc.
Trip to the surface water treatment plants, iron and arsenic removal plants, rain water harvesting plants, industrial waste treatment plants etc.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply the skills developed from various engineering projects to real field,
2) Relate theoretical knowledge with the practical work,
3) Supervise construction projects and use this knowledge in job life,
4) Use the professional and ethical issues and the importance of lifelong learning in civil engineering,
5) Communicate effectively orally and written,
6) Carry out and finalize a civil engineering project by showing professional ethics.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											2
CO2		1					1					
CO3	2						2					
CO4									2	2	3	
CO5								3				
CO6									3	2		

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Group discussion among students and instructors	Assessment, quiz, oral examination
CO2	Guest lectures/industrial visit/field visit	Assessment, quiz, oral examination
CO3	Self study by students using reference book/research article/case study/other online materials	Assessment, quiz, oral examination
CO4	Hands on practice/ simulation/ field demonstration	Assessment, quiz, oral examination
CO5	Group discussion among students and instructors	Assessment, quiz, oral examination
CO6	Hands on practice/ simulation/ field demonstration	Assessment, quiz, oral examination

Course Code: CEE 0732 4142	Credit: 1.0	Year: 4th	Semester: 1st
Course Title: Computer-Aided Structural Analysis and Design		Course Status: Sessional	

i) Rationale of the Course:

This course will make the students familiar with various industry-standard software for structural analysis and make them able to apply this knowledge in the professional field.

ii) Course Content:

Application of the civil engineering software such as GEAR, GRASP to analyze and design different structural components like beam, frame, truss etc.
Application of civil engineering software STAAD.Pro/ ETABS/ SAP2000/ SAFE to analyze and design of multi-storied building frames.
Application of the software ANSYS/ Abaqus FEA to simulate the stress distribution pattern in the beam.
Development of Excel sheets for the design of structural components.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Design structural components using software,

2) Develop 3D models of building structures using civil engineering software,

3) Evaluate analysis results using various softwares.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1		2	2			3					2
CO2				2				3					2
CO3								3					2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 06, TL 07, TL 08	CA 03,SA 01, SA 02
CO2	TL 01, TL 02, TL 05, TL 06	CA 03, SA 01, SA 02
CO3	TL 01, TL 02, TL 08	CA 03, CA 05

Course Code: CEE 0732 4146	Credit: 1.0	Year: 4th	Semester: 1st
Course Title: Reinforced Concrete Design Sessional II		Course Status: Sessional	

i) Rationale of the Course:

This course will enable the students to understand structural design and analysis of multistoried buildings considering wind and earthquake loads. It also gives student introductory idea to understand building design as per BNBC-2020, BOQ preparation, etc.

ii) Course Content:

Calculation of Environmental Loads (wind and earthquake): This chapter introduces the basics of wind and earthquake load calculation as per the existing guidelines, Codes, etc.
Calculation of slab and beam load: This chapter presents the process of load calculation for slabs and beams of a building. In that case guidelinelines of existing codes is followed.
Load analysis using software: This chapter discusses the load analysis using the design/ analysis softwares (2D/3D).
Design of slab, beam and column: This chapter presents the design of slab, beam and columns considering the results in software analysis. It also introduces how to present the design in printed form to the report. All the process in accomplished following the Code guilines.
Design of footing, stair, septic tank, etc: This chapter introduces the other important parts of a building, footing, stair, septic tank etc, design, as per requirement.
Plumbing design, Finishing works, Power supply: This chapter presents the the Plumbing desing and finishing works. Also gives an idea related to Power supply.
Preparation of design reports and Bill of Quality (BOQ): This chapter presents the process of design reports and BOQ for future references.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate the necessary knowledge about BNBC-2020
2) Analyze the knowledge on design and analysis of multistoried buildings
3) Interpret the basic process in the analysis of building frames by both lateral (wind and earthquake) and vertical loads
4) Examine software for design, related power and plumbing systems, Design report, BOQ, finishing works etc.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										
CO2		2										
CO3				3								1
CO4				2								1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 07	CA 03, CA 05, SA 01
CO2	TL 01, TL 07, TL 08	CA 04, SA 02
CO3	TL 01, TL 07	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 05, SA 01

Course Code: CEE 0732 4162	Credit: 1.0	Year: 4th	Semester: 1st
Course Title: Transportation Engineering Sessional I		Course Status: Sessional	

i) Rationale of the Course:

This course will provide the students with the practical experience of testing aggregate, asphalt, and soil in a standard laboratory. The students will learn the basic property, behavior and ensure the quality of these materials by conducting various tests.

ii) Course Content:

Aggregate test:
This chapter discusses in detail the procedures, standard methods of testing, significance, and applications of different aggregate parameters i.e., the specific gravity and water absorption, Aggregate-Crushing Value, Aggregate Impact Value, Ten Percent Fine Value, Elongation index, Flakiness of Coarse Aggregate, Los Angeles abrasion test, and Angularity number of aggregates. This test plays an important role in the behavior of the pavement structure because the composition, shape, and size of the aggregate all have a significant impact on the workability, durability, strength, weight, and shrinkage of the concrete.

Asphalt test:
This chapter presents an overview of the procedures, standard methods of testing, significance, and applications of different asphalt parameters. To ensure the quality of asphalt several tests are conducted which are Specific Gravity, Standard penetration, Ductility Value of Bitumen, Solubility of Bitumen, Loss on Heating, Softening Point, Flash & Fire Point, Marshall Test, and Viscosity of asphalt. The primary use (70%) of asphalt is in road construction, where it is used as glue or binder mixed with aggregate particles to create asphalt concrete. Asphalt has low initial costs, lasts longer, and due to its recyclability, has a residual value greater than other pavements.

Marshal Mix Design:
This chapter presents a concise description of Marshal Mix design to find out the optimum bitumen content and also identifies the key factors that affect the stability, flow, and specific gravity of asphalt concrete.

Californian Bearing Ratio (CBR):
A brief description of the procedure for determining the Californian Bearing Ratio (CBR) of soil is discussed in this chapter. The Californian Bearing Ratio (CBR) test is a penetration test used to evaluate the subgrade strength of roads and pavements. The results of this test are used with the curves to determine the thickness of pavement and its component layers.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Interpret the physical and engineering properties of pavement materials i.e., Aggregate, Asphalt.
2) Evaluate the strength of pavement layers (subgrade, sub-base, and base) based on Californian Bearing Ratio (CBR) value.
3) Design the mix ratio of asphalt concrete to find out the optimum bitumen content by using the Marshal method.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2						1					
CO3				3			1					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05, TL 06	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 03, TL 05, TL 06	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 05, TL 06	CA 03, CA 04, SA 01, SA 02

Fourth Year Second Semester

Course Code: CEE 0732 4263	Credit: 3.0	Year: 4th	Semester: 2nd
Course Title: Transportation Engineering III		Course Status: Theory	

i) Rationale of the Course:

This course will provide comprehensive coverage of the main features of the airport and railway engineering with an understanding of the principles and practices relating to the design and operations. This knowledge is essential to combine theoretical analysis with practical applications to allow students to understand the distinctive features of engineering in the airport and railway context.

ii) Course Content:

Airport
Airport classification, Planning of airfield components – Runway, Taxiway, Apron, Hanger, Passenger Terminals, Configuration of runway, Design of taxiway, Design of flexible pavement by FAA method and CBR method, Design of rigid pavement by FAA method,Airport marking, signaling, Airport drainage, Airport planning.

Railway
Different components and alignment of railways,Geometric design of railway, Signaling, Maintenance,Stations and yard, Capacity analysis of locomotives.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Evaluate airport classification, details of airfield components, airport planning, airport marking, lighting, and drainage.
2) Design several airport components (i.e. runway, taxiway)
3) Evaluate railway elements (i.e. rails, sleeper, ballast, station, fastening, points and crossings), maintenance, signalling, and resistance.
4) Develop geometric design and alignment of railway.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2			3									
CO3	2	1										
CO4			3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO2	TL 01, TL 02, TL 07, TL 08	CA 01, CA 03, SA 01
CO3	TL 01, TL 02, TL 04	CA 03, SA 01
CO4	TL 01, TL 02, TL 07, TL 08	CA 02, SA 01

Course Code: CEE 0732 4271	Credit: 3.0	Year: 4th	Semester: 2nd
Course Title: Irrigation and River Engineering		Course Status: Theory	

i) Rationale of the Course:

The aim of this course is to learn basic concepts of irrigation and water requirements for plants growth. This course will enable the students to know the different methods of irrigation and their suitabilities, drainage, details of canals used or irrigation and their design with cost benefit analysis.

ii) Course Content:

Fundamentals of irrigation engineering: This chapter represents idea about basic concepts on irrigation importance and demerits of irrigation and its types, advantages, disadvantages and ill effects of irrigation, techniques of water distribution in the farms, quality of irrigation water.
Water requirements of crops: Cropperiod, base period, duty and delta of a crop, optimumutilisation of irrigation water, irrigation efficiencies, soil-moisture-irrigation relationship, different terminologies used for irrigation, estimating depth and frequency of irrigation on the basis of soil-moisture-irrigation relationship.
Canal irrigation system: Alluial and non-alluvial canals, alignment of canals, description of the irrigation channel network system, irrigation channel design, design of branch channel, determination of required canal capacity, canal losses.

Lining of irrigation canals and economics of lining: Advantages of lining, justification for lining the existing canals and canals on a new project, canal cross sections and velocities in lined canals, types of lining their construction and uses.
Reclamation of water logged and saline soil for agricultural purpose: Definition f salinity and water logging, causes and control of water logging, reclamation of saline and alkaline lands, surface and sub surface drainage.
River Engineering: Ideas about river types, characteristics, uses of river, river morphology, river sediment transportation capacity, control of a river, control of flood and its management.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Design of an irrigation canal,
2) Calculate the water requirements of a crop, irrigation frequency and consumptive use,
3) Estimate the sediment transport capacity of a river,
4) Analyze and design river training works,
5) Select Flood control methods and flood control management.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2		3									2	
CO3			3				2				2	
CO4												2
CO5			3									2

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 05, TL 07, TL 08	CA 01, CA 02, CA 03, SA 01
CO2	TL 01, TL 07, TL 08	CA 02, CA 03, SA 01
CO3	TL 01, TL 05, TL 08	CA 04, SA 01
CO4	TL 01, TL 02, TL 07	CA 04, SA 01
CO5	TL 01, TL 02, TL 07, TL 08	CA 01, CA 02, CA 03, SA 01

Course Code: CEE 0712 4281	Credit: 2.0	Year: 4th	Semester: 2nd
Course Title: Environmental Impact Assessment		Course Status: Theory	

i) Rationale of the Course:

This course presents the methodology of environmental impact assessment (EIA) as an important tool for sustainable environmental management and decision-making. The course covers a gist of the concepts, methods, issues, and various forms and stages of the EIA process. It analyzes the advancement of EIA abroad and in Bangladesh. It mainly focuses on case studies of EIA in Bangladesh but also keens on the EIA process of other countries, including developing countries. Distinctive levels and frameworks of EIA are inspected to highlight the differences of approach and affect of the EIA process.

ii) Course Content:

Definition, guidelines of GIS, scoping, TOR EIA - important terms in environmental impact assessment; Aims and objectives of EIA; Role of EIA in Environmental Management.
EIA methodology This chapter presents EIA Methodology: Different methods of EIA- checklist, matrix Lepoid methods;
Base line survey, IEE This chapter discusses initial environmental examination, Baselines studies; Rapid environmental impact assessment, scoring procedure, participatory rural appraisal (PRA), rapid rural appraisal(RRA), participatory tools for community participation, advocacy, mobilization, gender approach, participatory management and planning in development sector, institutional aspects, implementing intervention in project cycles, people participation.
Economic evaluation method This chapter presents EIA of development schemes; Economical evaluation of EIA; Cost and Cost/benefit analysis of EIA..
Case Studies This chapter discusses EIA (State of art) in water resources and industrial projects; Application of EIA in energy and agricultural development; EIA for embankment flood protection measures; EIA of irrigation activities: EIA of the infrastructure development project; Environmental impact of flood in rainy season; EIA of draught in dry season; EIA in solid waste management; EIA of gas field and tea garden; EIA in JMB project; EIA of transport system; EIA procedure in the private sector, EIA procedure in govt. sector; Different EIA index calculation.
Environmental Auditing This chapter presents Introduction to Environmental Auditing.; Environmental management and ISO 14000.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Explain the major principles, guidelines, rules, and different steps of environmental impact assessment,
2) Communicate both orally and in written form the key aspects of environmental impact assessment,
3) Analyze different case studies/examples of EIA in practice and apply the knowledge in practical cases,
4) Evaluate an environmental impact assessment case with necessary professional skills and provide an environmental management plan to some extent.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2										
CO2			3										
CO3													1
CO4				3	2								1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 07	CA 01, CA 03, SA 01
CO2	TL 01, TL 07	CA 02, CA 03, CA 04, SA 01
CO3	TL 01, TL 07, TL 08	CA 04, SA 01
CO4	TL 01, TL 07, TL 08	CA 04, SA 01

Course Code: CEE 0721 4255	Credit: 2.0	Year: 4th	Semester: 2nd
Course Title: Geoenvironmental Engineering		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the basics of geoenvironmental engineering. It teaches them how to create contaminant transport models for various geoenvironmental profiles. This knowledge is essential to design and implement various contaminated land management techniques.

ii) Course Content:

Introduction to Geoenvironmental Engineering: This chapter presents a brief discussion on significance and scope of geoenvironmetal engineering
Soil Structure: This chapter focuses on the structure of soil media, their properties, texture etc.
Soil-Water: This chapter presents water interaction with soil media. Permeability, Darcy's theory etc. are discussed here with some practical example
Contaminants and Their Transport Method: This chapter consists of brief discussion on different contaminants and their transport methods such as advection, diffusion; hydrodynamic dispersion etc. It also covers determination of tortuosity of different natural and artificial flow medium.
Tools and Techniques in Geoenvironmental Engineering: This chapter focuses on the monitoring and determination tools and techniques involved in Geoenvironmental Engineering like as tensiometer, lysimeter etc. tools for soil leaching study and corresponding breakthrough curve preparation are also reviewed in this section
Contaminants Transport Models: This chapter presents a basic introduction on different geoenvironmetal contaminant transport models. Some mathematical problems are practiced which are based on convective-diffusive transport modeling
Contaminated Land Management Techniques: This chapter presents different techniques for the management of contaminated land. Different physic-chemical and biological approach such as bioventing, bio injecting, biosparging, phytoremediation etc. are reviewed in this part

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Find out the sources and causes of potential geoenvironmetal contamination
2) Conduct leaching experiment and other field and laboratory test for studying the contaminants transport phenomena
3) Develop contaminant migration models for different geoenvironmetal profiles
4) Design and implement different management techniques for recovery of contaminated lands

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2			2							
CO2		2	3	3			3					
CO3		2	2	3			2					
CO4	1	2	2	3			2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05	CA 01, CA 03, SA 01
CO2	TL 01, TL 02, TL 06, TL 07	CA 01, CA 03, CA 04, SA 01

CO3	TL 01, TL 06, TL 07	CA 01, CA 03, CA 04, SA 01
CO4	TL 01, TL 06, TL 07	CA 01, CA 03, CA 04, SA 01

Course Code: CEE 0732 4230	Credit: 3.0	Year: 4th	Semester: 2nd
Course Title: Thesis		Course Status: Thesis	

i) Rationale of the Course:

Thesis in undergraduate level will enable a student to learn how to conduct a research by problem identification, objective determination and methodology development, conduct experiments and analysis and finally interpret the result.

ii) Course Content:

Thesis is an individual inquiry conducted by the students under the general guidance of an academic advisor. This inquiry can take one of the following forms in any branches of civil engineering (structure, geotechnical, water, environment and transportation):

(a) An original theoretical and/or experimental investigation;

(b) Design of an engineering product or development of computer program;

(c) Compilation and critical analysis of information on a specific engineering topic; or

(d) Investigation of a substantive engineering problem for an external sponsor.

The thesis work will be carried out throughout the whole period of the final year.

In 4th year 2nd semester:

- Conduction of laboratory experiments/ software based analysis
- Data analysis from the outcomes of the experiment/software
- Formulation of research findings and thesis paper writing
- Preparation for final thesis defense

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Identify a research hypothesis or research question, develop methodology to conduct the study, design an experiment process or system and after completion of all experiment and analysis, write the thesis.
2) Able to prepare research proposals for submission and presentation for various purposes.
3) Collect relevant data (primary or secondary) and by analyzing the collected data reach to an acceptable solution.
4) Critically explain the research work conducted and applied it as the theoretical framework to the research process.
5) Prepare a supervised and defended research project as a thesis to the department.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		2				2		1	2	1
CO2								1			3	
CO3		2				1		2				
CO4	2										2	1
CO5										2	1	

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment

Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	Conducting regular meeting with thesis group students	Thesis evaluation by supervisor
CO2	Showing relevant videos	Thesis evaluation by co supervisor if any
CO3	Arranging training for laboratory experiments and analyzing data critically/Hands on practice	Thesis evaluation by external members
CO4	Group discussion among students and supervisors	Thesis presentation/Final defence
CO5	Self study by students using reference book/research article/case study/other online materials/ Taking dummi presentation before final defence/ presentation	Oral examination infront of presentation board

Course Code: CEE 0732 4244	Credit: 1.0	Year: 4th	Semester: 2nd
Course Title: Bridge Design Sessional		Course Status: Sessional	

i) Rationale of the Course:

The aim of this course is to equip the students with a thorough understanding of the behavior and design of bridges. The knowledge is essential to realizeand understand how different types of loads act on bridges and to analyze and design the elements accordingly.

ii) Course Content:

Introduction to bridges: This chapter discusses on Historical evolution of bridges, Importance of Bridges, Different types of bridges with their distinctive features, Choice of appropriate bridge type, Components of bridges etc.
Bridge Loadings: This chapter describe the loading standards (AASHTO, Bridge Design Standards for Roads & Highways Department of Bangladesh), Types and Application of loadings, Distribution of loads on slabs, stringers, Materials properties etc.
Analysis and design of bridge superstructure: This chapter deals with Analysis and design of Concrete Slab bridge, Concrete Deck- Girder bridge and Concrete Balanced Cantilever bridge.
Introduction to bridge sub-structure: This chapter introduces with Piers, Abutments, Foundations of bridges, their General features, Materials, Types, Forces, Stability, Design, etc.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Identify bridge components, different bridge types and appropriate uses for each,
2) Determine the appropriate structural system to be used for bridges according to the site topography,
3) Perceive, analyze and design reinforced concrete bridge superstructures and foundations.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2	2									
CO3		2	3	3			2					1

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 03, TL 04	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 04	CA 03, CA 05, SA 01, SA 02
CO3	TL 01, TL 02, TL 03, TL 07	CA 03, CA 04, CA 05, SA 01, SA 02

Course Code: CEE 0732 4252	Credit: 1.0	Year: 4th	Semester: 2nd
Course Title: Geotechnical Engineering Sessional II		Course Status: Sessional	

i) Rationale of the Course:

This course will provide the students hands on experience of unconsolidated undrained (UU), consolidated undrained (CU), consolidated drained (CD) shear tests, dilatancy test, SPT, CPT and field van shear test. They also learn to prepare the Sub-soil investigation report. In addition, they will acquaint the procedure of the Pile load test and Pile integrity test.

ii) Course Content:

UU, CU and CD shear strength test: This chapter presents the whole testing process of UU, CU and CD shear strength test in Tri-axial machine.
Dilatancy test: This chapter presents dilatancy test of soil (granular) for soil investigation.
Cone penetration test (CPT): This chapter provides details on CPT test procedure and analysis for soil investigation.
Standard penetration test (SPT): This chapter provides details on SPT test procedure and analysis for soil investigation.
Field vane shear test: This chapter provides details on field vane shear test procedure and analysis for soil investigation.
Establishment of sub-soil profile: This chapter presents establishment of sub-soil profile from bore log.
Interpretation of soil test result: This chapter presents interpretation of soil test result for better understanding of criteria.
Preparation of soil report: This chapter presents analysis of soil and preparation of a report in professional standard.
Design of foundation: This chapter presents design of both shallow and deep foundation for building structure from subsoil investigation report.
Pile load test: This chapter presents pile load test for building structure.
Pile integrity test: This chapter presents pile integrity test for building structure.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Assess the geotechnical parameters of soil from the laboratory test results using UU, CU and CD shear tests, and dilatancy test,

2) Interpret SPT, CPT and field van shear test results to use them in design,

3) Analyze the soil parameters to determine the bearing capacity of a foundation based on the soil investigation report,

4) Interpret the procedure and test results of the pile load test and pile integrity test.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2					1					
CO2					3			1					
CO3				3									2
CO4				3									

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 03, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 03, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02
CO4	TL 01, TL 05, TL 06, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 4246	Credit: 1.0	Year: 4th	Semester: 2nd
Course Title: Transportation Engineering Sessional II		Course Status: Sessional	

i) Rationale of the Course:

The course will demonstrate road traffic studies based on the field data and in this process students will learn to conduct a traffic survey work. Students will also learn to design rigid and flexible highway and airfield pavements.

ii) Course Content:

.***Traffic studies***
Traffic volume study and Traffic speed study (Spot Speed, Time mean speed, Space mean speed) Pavement

Geometric design od roadway
Design of signal system
Assessment of road geometric condition

- Geometric layout of roadway (road length, width, number of lanes, median height, width, shoulder height, width, etc.)
- Determination of road width at curve section,
- Highway drainage system

Assessment of roadway surface condition

- Identification of cracks in rigid and flexible pavement
- Evaluation of PCI value by skid resistance tester or sand-patch method in several locations (near high speed location, zebra crossing, intersection)
- Qualitative observation of potholes, elevated/depressed manholes, speed breakers etc.

Structural design of roadway • Design of rigid pavement for highways- pavement thickness, joint spacing & reinforcement details by AASHTO method. • Design of flexible pavement - by AASHTO, IRC and RHD method.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Analyze traffic data such as roadway capacity analysis, traffic volume calculation, speed data analysis, etc.

2) Design of structural components (flexible and rigid pavement) and geometric components of roadway,

3) Evaluation of roadway surface condition (e.g. PCI value).

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1	2										
CO2				3									
CO3			3										

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 04, TL 07, TL 08	CA 03, SA 01, , SA 02
CO2	TL 01, TL 02, TL05, TL 06, TL 07	CA 03, SA 01, SA 02
CO3	TL 01, TL 04, TL 06	CA 03, SA02

Course Code: CEE 0732 4272	Credit: 1.0	Year: 4th	Semester: 2nd
Course Title: Design of Hydraulic Structures		Course Status: Sessional	

i) Rationale of the Course:

In order to have a balanced overall development of engineering graduates, it is necessary to integrate theory with practice. This course will let the students to do a hand on design example for a hydraulic structure so that they will know the basic assumption and consideration for designing a hydraulic structure.

ii) Course Content:

Design of a three vent regulator (Hydraulic calculation) Finding of glacis height, determination of transition length, Determination of distance of baffle pier and end sill from the foot of the glacis
Design of a three vent regulator (Hydraulic calculation) Design of cutoff wall depth, Design of total floor length, selection of crest width
Design of a three vent regulator (Hydraulic calculation) Design of safe exit gradient, Design of chute block, Design of baffle pier, design of end sill
Design of a three vent regulator (Hydraulic calculation) Design of inverted filter and launching apron, Check of floor thickness

Design of a three vent regulator (Structural calculation) Load calculation, Check of factor of safety, Design of distributed load on top slab, Moment distribution, Design of top slab, Design of bottom slab
Design of a three vent regulator (Structural calculation) Design of abutment, Foundation design for box part, Check for settlement

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Calculate glacis height, transition length, distance of baffle pier and end sill from the foot of the glacis, design of cutoff wall depth, design of total floor length, selection of crest width,
2) Design of safe exit gradient, design of chute block, design of baffle pier, design of end sill, design of inverted filter and launching apron, check of floor thickness,
3) Calculate structural load, check factor of safety, moment distribution, design of top slab, design of bottom slab, design of abutment, foundation design for box part, check for settlement.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	1	2				3					
CO2		2	2	3									
CO3		1	1	3				3					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO2	TL 01, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02
CO3	TL 01, TL 05, TL 07, TL 08	CA 03, CA 04, SA 01, SA 02

Course Code: CEE 0732 4282	Credit: 1.0	Year: 4th	Semester: 2nd
Course Title: Environmental Design Sessional		Course Status: Sessional	

i) Rationale of the Course:

This course will demonstrate the design procedure of different environmental components (such as deep tube well, and septic tank) and environmental systems (such as water distribution system, drainage system and groundwater system) using the knowledge of environmental engineering. This knowledge will be helpful for students to design and analyze those environmental systems and components by using different open-source softwares.

ii) Course Content:

Design of deep tube well; environmental design of septic tank; Design of water distribution system using EPANET; design and analyze the storm drainage system using SWMM; developing groundwater models using PMWIN;.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Design different environmental components such as deep tube well and septic tank,

2) Design a water distribution network and a simple storm drainage network using EPANET and SWMM, repectively,

3) Create groundwater models to differentiate the influence of different boundary conditions and examine the effect of hydraulic conductivity on head and drawdown contours using PMWIN.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				3									
CO2								3					
CO3								2					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 03, CA 05, SA 01, SA 02
CO2	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05, SA 01, SA 02
CO3	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05, SA 01, SA 02

Assessment or Evaluation Procedure for theory courses/sessional courses/industrial tour and training/field visit/seminars/thesis

i) Theory courses

1) Assessment Strategy

Distribution of numerical scores	
Class attendance	10%
Quiz/Assignment/Class assessment	10%
Midterm	20%
Final Exam	60%
Total	100%

2) Marks distribution:
   i. Continuous Assessment: 40%
   ii. Summative (Final exam): 60%

ii) Sessional courses

1) Assessment Strategy

Distribution of numerical scores	
Class attendance	10%
Report submission	20%
Assignment/Class assessment/Presentation/Inerim Quiz	20%
Viva	10%
Final Quiz	40%
Total	100%

2) Marks distribution:
   i. Continuous Assessment: 60%

ii. Summative (Final quiz): 40%

iii) Iindustrial tour and training/field visit

Course instructor will fix the assessment strategy.

iv) Thesis

Thesis defence will be held at the completion of students thesis work. Marking strategy of the thesis defence is shwown in following table.

Distribution of numerical scores	
Supervisor and/or Co-supervisor(s)	30%
Externals (2)	30%
Viva board members (4 including externals)	40%
Total	100%

Part D

20. Grading/Evaluation

1) Grading Scale

Grade-Point for a course will be awarded from the roundup marks of individual courses as follows:

Numerical Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	C-	2.00
Less than 40%	F	0.00

2) Grades:

Different grades of a course will be awarded according to the grading scale shown in above table.

3) Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

GPA: Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses completed by a student in a semester.

CGPA: Cumulative Grade Point Average (CGPA) of only major and both major and second major degree will be calculated by the weighted average of every course of previous semesters along with the present semester. For clearing graduates if the roundup value of the third digit after decimal is nonzero the second digit will be incremented by one. A student will also receive a separate CGPA for his second major courses.

4) Course Withdrawal

A student can withdraw a course by a written application to the Controller of Examinations through the Head of the discipline on or before the last day of instruction. The Controller of Examinations will send the revised registration list to the disciplines before the examination. There will be no record of the course in transcript if the course is withdrawn.

5) Incomplete (I) courses

A student to register his/her incomplete courses, if offered, from proceeding semesters before s/he can register courses from current or successive semester, otherwise s/he takes the courses when the desired course is offered next time. A student will not be allowed to take 100 and 300 level and 200 and 400 level courses simultaneously. 100 level courses mean courses of 1st and 2nd semesters, 200 level courses mean courses of 3rd and 4th semesters and so on.

6) Retake

If a student has to repeat a failed or incomplete course and that course is not offered any more, the discipline may allow him/her to take an equivalent course from the current syllabus. For clearing graduates if any incomplete course is not offered in the running semester, the discipline may suggest a suitable course to complete the credit requirement.

7) Grade Improvement

If a student gets pass mark (or pass grade) in any course, there is no opportunity of grade improvement later. Only a student can sit for examination for a course again in next available semester, if he/she gets F grade in that course.

8) Dropout

If a student can not complete his/her degree according to the academic year specified in Section 17(f), the student will dropout from the program.

FACULTY LIST of CEE Dept., SUST.

SL.No.	Full Name	Cell Phone
Professors		
01.	Dr. Mohammod Aktarul Islam Chowdhury	01558304361
02.	Dr. Md Jahir Bin Alam	01712091181
03.	Dr. Mushtaq Ahmed	01711161075
04.	Dr. Muhammad Azizul Hoque	01707075369
05.	Dr. Md Misbah Uddin	01939671364
06.	Dr. Mohammad Shahidur Rahman	01982283070
07.	Dr. Bijit Kumar Banik	01798599471
08.	Dr. Muhammad Saiful Islam	01889170438
09.	Dr. H M A Mahzuz	01929983057
10.	Dr. Md Imran Kabir	01711143363
11.	Dr. Md Bashirul Hauqe	01973409490
Associate Professors		
12.	Dr. Gulam Md Munna	01712509851
13.	Dr. Tajmunnaher	01919813027
14.	Ms Shilpy Rani Basak	01712806038
15.	Dr. Ahmed Hasan Nury	01756380455
16.	Dr. Shriful Islam	01716687869
17.	Mr. Sourav Ray	01716563200
18.	Mr. Mohammad Rafiqul Islam (On leave)	-
Assistant Professors		
19.	Mr. Mohaiminul Haque	01719351375
20.	Mr. Md Aminul Islam	01717762464
21.	Mr. Khairul Hasan (On leave)	-
22.	Mr. Nur Md Robiul Hoque	01920819986
23.	Ms. Khayrun Nahar Mitu (On leave)	01866451509
24.	Ms. Sabrin Ara (On leave)	01791652951
25.	Ms. Ayesha Ferdous Mita (on leave)	01614333046
Lecturers		
26.	Md. Nazmul Islam Rafi	01705820034
27.	Nusrat Jahan Ekra	01614333045

Profile for non-major courses offered by CEE department

Course Code: CEE 0541 2101A	Credit: 2.0	Year: 2nd	Semester: 1st
Course Title: Structure I - Basic Mechanics		Course Status: Theory	

i) Rationale of the Course:

This course facilities for gathering the basic knowledge about the effects of force on solid mass and to develop student's ability to visualize the distribution of forces on a solid body. This course will also offer knowledge of centroids, friction, moment of inertia and flexible chords. This knowledge is a prerequisite for many engineering courses offered in the subsequent semesters that capture the detailed analysis and design of engineering structures or structural components.

ii) Course Content:

Statics of particles: This chapter is devoted to the study of forces contained in a single plane. The analysis of forces in three-dimensional space is also analyzed here.
Rigid bodies- Equivalent systems of forces: In this chapter, the effect of forces exerted on a rigid body, and how to replace a given system of forces with a simpler equivalent system is shown.
Centroids: Definitions, Center of gravity, Mass center and Centroid, Centroids of Areas, Principle of Symmetry, Integrating for Centroids (Arc of a Circle, Plane Triangle, Sector of Circle, Area without an axis of symmetry, Right circular cone), and Composite figures are discussed and determined in this chapter.
Moment of inertia of area: Introduction, Rectangular moment of inertia, Polar moment of inertia, Radius of gyration, Determination of moment of inertia (Rectangle, Triangle, Circle), Transfer formula-parallel axes, Choice of the differential element, Composite areas, and Product of inertia are discussed and determined in this chapter.
Structural analysis: The forces in the members of a simple truss using the method of joints and the method of sections are determined in this chapter.
Fundamentals of friction: This chapter presents frictional force, limiting frictional force, coefficient of kinetic friction, laws of friction, angle of friction, and belt friction.
Fundamentals of flexible cords: This chapter shows how to solve and analyze the parabolic chord and the catenary.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Draw complete free-body diagrams and write appropriate equilibrium equations from the free-body diagram, including the support reactions on a structure,
2) Analyze various statically determinate systems such as beams, trusses,
3) Locate the centroid of an area, center of mass, center of volume effectively for different shapes of objects,
4) Calculate the moment of inertia of areas for different geometric configurations,
5) Determine the frictional force and coefficient, and the resultant tension of flexible chord.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9

CO1	2								
CO2	2	3				2			
CO3	2	3				2			
CO4	2	3				2			
CO5	2								

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 01, CA 04, SA 01
CO2	TL 01, TL 02, TL 07, TL08	CA 02, CA 03, CA 04, SA 01
CO3	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 07, TL 08	CA 03, CA 04, SA 01
CO5	TL 01, TL 02, TL 07	CA 03, CA 04, SA 01

Course Code: CEE 0732 2203A	Credit: 3.0	Year: 2nd	Semester: 2nd
Course Title: Structure II - Mechanics of Solids		Course Status: Theory	

i) Rationale of the Course:

This course will develop basic knowledge and use the relevant physical properties and fundamental laws governing materials and structures' behavior. Students will learn how to solve various problems of interest in Structural Analysis. In this course, the emphasis is on the physical understanding of mechanisms underlying materials' mechanical and structural behavior.

ii) Course Content:

Fundamental concepts of stress and strain This chapter presents a review of the fundamental concepts of stress and strain. A brief discussion on axial stress, axial strain, shearing stress, shearing strain, and bearing stress, bearing strain. Stress calculation of thin-walled pressure vessels.
Mechanical properties of materials This chapter deals with analyzing mechanical properties of materials, stress-strain diagram, Hook's law for axial and shearing deformation, and Poisson's ratio.
Calculate the stress and strain of different members Calculate stresses and strains in members subjected to tension, compression, shear, and temperature changes. Calculate stresses and strains of statically indeterminate members.
Joints- welded and riveted Introduction, Types of riveted and welded joints, Strength of a simple Lap Joint: Bearing type connection, Strength of a complex Butt joint: Bearing type connection, Friction type connection, welded connection.
Shear force and bending moment diagrams for statically determinate beams and frames Definition, determination of Shear force and bending moment for determinate beams and frames, Relation among load, shear and moment, Shear force, and bending moment diagram.
Flexural and shearing stresses in beams; Principal stresses Introduction, Derivation of flexure formula, Economic section, Shearing stress at a loaded beam, Distribution of shearing stress, principal stress and strain.
Slopes and deflections in statically determinate beams Introduction, Double integration method, Theorem of area moment method, conjugate beam method.

Indeterminate beam analyses Introduction to statically indeterminate structure, Analysis of statically indeterminate beam using moment area and conjugate beam method.
Buckling of columns Introduction, Types of end conditions of the column, Euler's formula to columns with different end conditions, Rankine's formula for long columns, and effect of eccentric loading on the Rankine's and Euler's formula for long columns are also discussed here.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Apply the theory of solid mechanics to analyze a wide variety of structural members subjected to tension, compression, shear, and temperature changes to solve real world problems,
2) Apply the concepts and methodologies of materials' mechanical properties to solve practical problems related to civil engineering structures,
3) Design of a riveted joint, as well as welded joints
4) Present graphical variation of shear force and bending moment diagrams along the member's axis could be shown.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2				1	2		2	
CO2	2				1	2		2	
CO3	2				1	2		2	
CO4	2				1	2		2	
CO5	2				1	2		2	

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 01, CA 04, SA 01
CO2	TL 01, TL 02, TL 07, TL08	CA 02, CA 03, CA 04, SA 01
CO3	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 07, TL 08	CA 03, CA 04, SA 01
CO5	TL 01, TL 02, TL 07	CA 03, CA 04, SA 01

Course Code: CEE 0732 3101A	Credit: 3.0	Year: 3rd	Semester: 1st
Course Title: Structure III Building Structures		Course Status: Theory	

i) Rationale of the Course:

This course familiarizes students to the vertical load calculation for the components of a frame building. It also introduces students with deferent types of structures such as truss, arch, dome, shell, folded plate and shear wall. This course also deals with the fundamental design process of RCC and steel structures.

ii) Course Content:

Vertical load calculation for the components of a building: Calculation of the load of wall, slab, beam, column, live load.

Approximate analysis of multistoried buildings for vertical and lateral loads: Portal method and cantilever method.
Introducing deferent types of structures: Truss, arch, dome, shell, folded plate, shear wall etc.
Fundamental design process of RCC structures: Design of beam and slab in WSD and USD considering flexure, shear, torsion and deflection.
Fundamentals and design process of steel structures Design of tension member, beam and column in ASD and LRFD.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Analyze horizontal and vertical loads on building,
2) Identify the load of different components of building,
3) Analyze and design RCC beam and slab
4) Apply critical understanding of the theory and principles of design and solution of basic elements of steel structures.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2					2		2	
CO2	2					2		2	
CO3	2					2		2	
CO4	2					2		2	
CO5	2					2		2	

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 01, CA 04, SA 01
CO2	TL 01, TL 02, TL 07	CA 02, CA 03, CA 04, SA 01
CO3	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 07, TL 08	CA 03, CA 04, SA 01
CO5	TL 01, TL 02, TL 07	CA 03, CA 04, SA 01

Course Code: CEE 0732 3202A	Credit: 3.0	Year: 3rd	Semester: 2nd
Course Title: Construction Workshop and Material Sessional		Course Status: Sessional	

i) Rationale of the Course:

Students will determine different properties of engineering materials indicating the quality and strength of the materials.

ii) Course Content:

Determination of normal consistency of cement: This experiment determines the amount of water needed for preparation cement mortar.

Determination of initial setting time of cement: This experiment describes the beginning of setting time of cement paste i.e. the paste is rigid sufficiently to withstand a definite amount of pressure.
Determination of direct compressive strength of cement mortar: The compressive strength of cement mortar at different ages can be determined by this experiment.
Sieve analysis of fine and coarse aggregate: This experiment shows the index of coarseness or fineness of the material using sieve analysis.
Sampling and testing of bricks for compressive strength and absorption: This test represents the load bearing capacity (compressive characteristics) of bricks and its water holding capacity.
Compressive strength of cylindrical concrete specimen and cubes : The compressive strength of concrete (both cylindrical and cubes) at different ages can be determined by this experiment.
Specific gravity and absorption capacity of coarse and fine aggregate : This test determines the water holding capacity (absorption) capacity of coarse and fine aggregates and their specific gravity.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Determine the normal consistency and setting time of cement,
2) Experiment the compressive strength of cement mortar,
3) Determine the specific gravity and absorption capacity of fine and coarse aggregate,
4) Prepare the gradation curve and the index of coarseness or fineness of aggregate by using sieve analysis.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1		1					
CO2	2	1		1					
CO3	2	1		1					
CO4	2	1		1					
CO5	2	1		1					

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 03, CA 05, SA 01, SA 02
CO2	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05, SA 01, SA 02
CO3	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05, SA 01, SA 02
CO4	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05, SA 01, SA 02
CO5	TL 01, TL 02, TL 06, TL 08	CA 03, CA 05, SA 01, SA 02

Course Code: CEE 0732 4101A	Credit: 2.0	Year: 4th	Semester: 1st
Course Title: Project Management		Course Status: Theory	

i) Rationale of the Course:

This course will familiarize the students with the basic knowledge of developing skills of understanding basic project management principles and practices. This knowledge is essential to manage projects from initiation to commissioning achiving projects' basic objectives such as time, cost, quality, and safety.

ii) Course Content:

Introduction Principles of project management and contruction management, triple constraints (time-cost-quality) to achieve project goals, basic concepts of contract management, project safety and risk management.
Planning and Scheduling Work Breakdown Structure (WBS), Gantt Chart, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), comparision and applications of CPM and PERT in various projects.
Project Delivery System and Contract Management Basi concepts of project procurement, Project Delivery Methods: Design-Bid-Buid (DBB), Design and Build, Construction Management Contract (CMC), Alliancing, Public Private Partneship (PPP), Engineering Procurement and Contract (EPC), Build, Operate and Transfer (BOT); Contrat types: Lump Sum, Unit Price, Cost Plus or Cost Reimbursable, guaranteed Maximum Price (GMP).
ProjectSchedule and Cost Management Cash flow analysis, earn value management (EVM), S-curve, pay back period, cost-benefit ratio, internal rate of return (IRR).
Project Quality Management Deming's 14 points to achieve project quality, ISO 9000, Cost of Quality (CoQ), seven quality control tools, Total Quality Management (TQM), Quality Management in PMBoK.
Project Safety and Risk Management Safety management: Safety practices at construction site from BNBC, personal and site safety, Risk management: planning for risk management, risk register, risk evaluation, risk assessment, risk control, risk residual, planning for risk response, monitoring and control risks during project execution phases.

iii) Course Learning Outcomes (COs):

By the end of this course, students will be able to:

1) Develop a project's plan and schedule,
2) Prepare cosh flow and fininancial report,
3) Formulate quality assurance plan and risk response strategy,
4) Analyze project performance and report project status to the top management.

iv) Mapping Course Learning Outcomes (COs) with POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1					2		1	
CO2	1					1		1	
CO3	1					1		1	
CO4	1					2		1	
CO5	1					2		1	

Correlation: 3-High, 2-Medium, 1-Low

v) Mapping Course Learning Outcomes (COs) with the Teaching-Learning Strategy & Assessment Strategy:

COs	Teaching-Learning Strategy	Assessment Strategy
CO1	TL 01, TL 02, TL 08	CA 01, CA 04, SA 01
CO2	TL 01, TL 02, TL 07	CA 02, CA 03, CA 04, SA 01
CO3	TL 01, TL 05, TL 07	CA 03, CA 04, SA 01
CO4	TL 01, TL 02, TL 07, TL 08	CA 03, CA 04, SA 01
CO5	TL 01, TL 02, TL 07	CA 03, CA 04, SA 01

Appendix A: Code used for Teaching-Learning & Assessment Strategy

Code	Teaching-Learning Strategy	Code	Assessment Strategy
TL 01	Lecture using board/LCD projectors/OHP Projectors	Continuous Assessment:	
T L02	Assignment/project/seminar/workshop/tutorial	CA 01	Midterm Examination 1
TL 03	Laboratory/Other teaching aids (Audio-visual: film and documentaries, virtual classroom)	CA 02	Midterm Examination 2
TL 04	Guest lectures/industrial visit/field visit	CA 03	Assignment/ Report
TL 05	Self-learning using reference book/research article/case study/other online materials	CA 04	Quiz/ Sudden test
TL 06	Simulation/field demonstration/Hands on practice	CA 05	Presentation (Individual/group) /Interim viva voce
TL 07	Examples and in class problem solving	Summative Assessment (SA):	
TL 08	Self study, group discussion	SA 01	Final Exam (Semester-end examination)/ Final Quiz
		SA 02	Viva (Semester-end oral examination)
		SA 03	Seminar paper/ field/ thesis report evaluation