CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.E/B.TECH IN

CIVIL ENGINEERING

(3RD- 8TH SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY,

AGARTALA TRIPURA (WEST)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

CIVIL ENGINEERING DEPARTMENT

SYLLABUS FOR B.TECH

THIRD SEMESTER

Theory Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
01	UCE03B01	Surveying-I	03	01	×	04	04
02	UCE03B02	Engineering Geology	03	01	×	04	04
03	UCE03B03	Numerical Analysis and Computer Programming	03	01	×	04	04
04	UCE03C01	Mathematics-III	03	×	×	03	03
05	UCE03C02	Humanities-III	03	×	×	03	03

Practical/Sessional Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
06	UCE03P01	Engineering Geology lab	×	×	02	02	01
07	UCE03P02	Computer Lab- 1	×	×	02	02	01
08	UCE03P03	Civil Engineering Drawing	×	×	03	03	02
09	UCE03P04	Surveying Field works I	×	×	04	04	03

Total Contact Lectures per week= (18+11) =29 Total Credit =25

SYLLABUS FOR B.TECH

FOURTH SEMESTER

Theory Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
01	UCE04B01	Mechanics of Solid	03	01	×	04	04
02	UCE04B02	Surveying-II	03	01	×	04	04
03	UCE04B03	Hydraulics	03	01	×	04	04
04	UCE04B04	Engineering Materials, Construction and Services	03	01	×	04	04
05	UCE04E01	H.S.S Elective	03	×	×	03	03

Practical/Sessional Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
06	UCE04P01	Hydraulics Lab	×	×	02	02	01
07	UCE04P02	Solid Mechanics Lab	×	×	02	02	01
08	UCE04P03	Surveying Field works II	×	×	04	04	03
9	UCE04P04	Com Lab-II	×	×	02	02	01

Total Contact Lectures per week= (19+10) =29 Total Credit=25

SYLLABUS FOR B.TECH

FIFTH SEMESTER

Theory Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
01	UCE05B01	Structural Analysis-I	03	01	×	04	04
02	UCE05B02	Design of RC Structures-I	03	01	×	04	04
03	UCE05B03	Concrete Technology	03	×	×	03	03
04	UCE05B04	Geotechnical Engineering-I	03	01	×	04	04
05	UCE05B05	Transportation Engineering-I	03	01	×	04	04
06	UCE05B06	Environmental Engg-I	03	01	×	04	04

Practical/Sessional Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
07	UCE05P01	Cement & Concrete Lab	×	×	02	02	01
08	UCE05P02	Geotechnical Engineering Lab-I	×	×	02	02	01
09	UCE05P03	Transportation Engineering Lab-I	×	×	02	02	01
10	UCE05P04	Environmental Engineering Lab-I	×	×	02	02	01

Total Contact Lectures per week= (23+8) =31 Total Credit=27

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA CIVIL ENGINEERING DEPARTMENT

SYLLABUS FOR B.TECH SIXTH SEMESTER

Theory Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
01	UCE06B01	Structural Analysis-II	03	01	×	04	04
02	UCE06B02	Design of Steel Structure I	03	01	×	04	04
03	UCE06B03	Water Resources Engineering-I	03	01	×	04	04
04	UCE06B04	Geotechnical Engineering-II	03	01	×	04	04
05	UCE06B05	Transportation Engineering-II	03	01	×	04	04
06	UCE06B06	Environmental Engg.-II	03	01	×	04	04

Practical/Sessional Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
07	UCE06P01	Structural Engg Lab –I	×	×	02	02	01
08	UCE06P02	Geotechnical Engineering Lab-II	×	×	02	02	01
09	UCE06P03	Transportation Engineering Lab-II	×	×	02	02	01
10	UCE06P04	Environmental Engineering Lab-II	×	×	02	02	01

Total Contact Lectures per week= (24+08) = 32 Total Credit =28

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

CIVIL ENGINEERING DEPARTMENT

SYLLABUS FOR B.TECH SEVENTH SEMESTER

Theory Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
01	UCE07B01	Structural Analysis-III	03	01	×	04	04
02	UCE07B02	Design of RC Structure-II	03	01	×	04	04
03	UCE07B03	Water Resources Engg-II	03	01	×	04	04
04	UCE07B04	Transportation Engineering-III	03	01	×	04	04
05	UCE07E05 TO UCE07E12	Elective-I	03	01	×	04	04

Practical/Sessional Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
07	UCE07P01	Structural Engg Lab –II	×	×	02	02	01
08	UCE07P02	Water Resources Engg Lab.	×	×	02	02	01
09	UCE07P03	Project-I	×	×	04	04	03
10	UCE07P04	Seminar & Viva Voce	×	×	02	02	01

Total Contact Lectures per week=(20+10) = 30

Total Credit =26

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

CIVIL ENGINEERING DEPARTMENT

SYLLABUS FOR B.TECH

EIGHTH SEMESTER

Theory Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
01	UCE08B01	Design of Steel Structure -II	03	01	×	04	04
02	UCE08B02	Estimation, Costing and Valuation	03	01	×	04	04
03	UCE08B03	Geotechnical Engineering-III	03	01	×	04	04
04	UCE08E01- 04	Elective II	03	01	×	04	04
05	UCE08E01- 11	Elective-III	03	01	×	04	04

Practical/Sessional Subjects:

Sl. No	Subject Code	Name of the Subject	L	T	P	Total Periods/ week	Total Credit
06	UCE08P01	Structural Design & Drawing	×	×	03	03	02
07	UCE08P02	Civil Engineering Estimation & Costing	×	×	02	02	01
08	UCE08P03	Project: II	×	×	04	04	03
09	UCE08P04	Comprehensive Viva-voce	×	×	00	00	02

Total Contact Lectures per week= (20+9) = 29 Total Credit = 28

Total Credit (3rd to 8th Sem) = 159

ELECTIVE SUBJECTS

ELECTIVE I

Sl. No	Subject Code	Name of the Subject	L	T	P	Number of lecture/ Week	Total Credit
01	UCE07E01	Advanced Structural Analysis	03	01	×	04	04
02	UCE07E02	Advanced Structural Design	03	01	×	04	04
03	UCE07E03	Advanced Solid Mechanics	03	01	×	04	04
04	UCE07E04	Alternative Building Materials & Technology	03	01	×	04	04
05	UCE07E05	Design of Foundation & Retaining Structure	03	01	×	04	04
06	UCE07E06	Ground Improvement in Civil Engineering.	03	01	×	04	04
07	UCE07E07	Hill Roads	03	01	×	04	04
08	UCE07E08	Urban Transport Planning	03	01	×	04	04
09	UCE07E09	Water Resources Planning & Management	03	01	×	04	04
10	UCE07E10	River Engineering & Flood Control	03	01	×	04	04
11	UCE07E11	Industrial Pollution & Control	03	01	×	04	04
12	UCE07E12	Environmental Quality & Pollution Monitoring Techniques	03	01	×	04	04

ELECTIVE II

Sl. No	Subject Code	Name of the Subject	L	T	P	Number of lecture/Week	Total Credit
01	UCE08E01	Project Planning & Management	03	01	×	04	04
02	UCE08E02	Bridge Engineering	03	01	×	04	04
03	UCE08E03	Design of Hydraulic Structures	03	01	×	04	04
04	UCE08E04	Geometric Design of Transportation Facilities	03	01	×	04	04

ELECTIVE III

Sl. No	Subject Code	Name of the Subject	L	T	P	Number of lecture/ Week	Total Credit
05	UCE07E05	Experimental Stress Analysis.	03	01	×	04	04
06	UCE07E06	Finite Element Method of Structural Analysis	03	01	×	04	04
07	UCE07E07	Geotechnical Investigation & Practices	03	01	×	04	04
08	UCE07E08	Rock Engineering	03	01	×	04	04
09	UCE07E09	Pavement Engineering.	03	01	×	04	04
10	UCE07E10	Traffic Engineering	03	01	×	04	04
11	UCE07E11	Geographic Information System & its Application	03	01	×	04	04
12	UCE07E12	Computational Hydraulics	03	01	×	04	04
13	UCE07E13	Environmental impact assessment & auditing.	03	01	×	04	04
14	UCE07E14	Air pollution and control measures.	03	01	×	04	04
15	UCE07E15	Rural water supply and sanitation.	03	01	×	04	04

DETAIL

COURSE CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.E/B.TECH

IN

CIVIL ENGINEERING

(3RD SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

TRIPURA (WEST)

SURVEYING-I

(UCE03B01**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1) To understand the field information to be collected before starting any project work.

2) To study the earth surface condition.

3) To study the calculation of earth cutting and filling for any project.

4) To understand essentials related to field data collection etc.

Course content:

Unit- 1

Introduction and basic concepts: Introduction, classification of surveying, Principles, some basic terms, Scale, Precision, Accuracy and errors.

Unit 2

Linear Measurements: Different methods, Instruments, Ranging out Survey lines, Measurements of lengths by chain, tape, Error in chaining, Tape corrections.

Unit – 3

Chain Surveying: Principle, Definition of various terms, Instruments, offsets, basic problem in chaining, Obstacles in chaining**.**

Unit – 4

Compass Surveying: Principle, Prismatic compass, Bearings, Magnetic declination, Local attraction, Error in compass surveying, Precautions.

Unit – 5

Levelling: Introduction, definition basic terms, instruments, Method of Levelling, Reciprocal Levelling.

Unit – 6

Plane Table Surveying: Principle, instruments, Methods, Two and Three point problems.

Unit – 7

Area and Volumes: Area from field measurements, Area from plans, Planimeter. Area of cross-section, Measurement of volumes, Mass diagram.

Unit – 8

Theodolite Surveying – Introduction, Types of Theodolite, Definitions of Terms, Temporary adjustments, Measurement of various angels, Fundamental lines and desire relations, Sources of Error in theodolite work. Traversing, balancing of traverse, Calculation of traverse area.

Unit – 9

Minor Surveying Instruments: hand levels, clinometer, hypsometer, pantagraph, box sextant,

introduction to modern instruments (Total station, GPS etc.).

Course outcome:

1. Students will be able to understand parameters to be collected from field.
2. Students will be given a broad idea regarding different parameters related to field survey.
3. Students will be able to analyze data collected for levelling of earth surface.
4. Students will be able to how to fix alignment of any project.
5. Students will be able to understand various methods involved in earth cutting and filling.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE03B01.1	Students will be able to understand parameters to be collected from field.
UCE03B01.2	Students will be given a broad idea regarding different parameters related to field survey.
UCE03B01.3	Students will be able to analyze data collected for levelling of earth surface.
UCE03B01.4	Students will be able to how to fix alignment of any project.
UCE03B01.5	Students will be able to understand various methods involved in earth cutting and filling.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE03B01.1	2	2	1	1	-	-	-	-	2	-	-	1
UCE03B01.2	2	2	1	1	-	-	-	-	2	-	-	1
UCE03B01.3	2	2	1	1	-	-	-	-	2	-	-	1
UCE03B01.4	2	2	1	1	-	-	-	-	2	-	-	2
UCE03B01.5	2	1	1	1	-	-	-	-	2	-	-	1
Total	**10**	**9**	**5**	**5**	**-**	**-**	**-**	**-**	**10**	**-**	**-**	**6**
Average	**2**	**1.8**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1.2**
Eq. Av Attainment	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE03B01.1	3	3
UCE03B01.2	3	3
UCE03B01.3	3	3
UCE03B01.4	3	3
UCE03B01.5	3	3
Total	**15**	**15**
Average	**3**	**3**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Surveying Vol. I & II	Agor, R.	Khanna publications
2	Surveying Vol. I & II	Arora, K.R	Standard Book House
3	Solving Problems in Surveying	Bannister	Longman Scientific Technical
4	Engineering Surveying Technology	A. and Baker, R Bannister A., and Baker, R	Khanna publications
5	Surveying Vol. I & II	Punmia, B.C	Laxmi publications Delhi,
6	Surveying I, II	Kanetkar, T.P.	Pune Vidyarthi Griha Prakashan.

ENGINEERING GEOLOGY

(UCE03B02**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. Origin, internal and surface structures of the earth.
2. Identification of the minerals types of clay minerals, their properties and effects on engineering project.
3. Types of rock (Igneous, Sedimentary, and Metamorphic), Civil engineering importance of rock forming minerals. Sedimentary processes (Weathering, erosion, deposition), Metamorphism and volcanic eruptions.
4. Geological structures (Joint, veins, crack, faults, and fold), reasons of formation for each type and their side effects on the engineering projects.
5. Types of Dams and Tunnels. Types of maps, how we can draw the topographic map by using computer programming.
6. Types of Mass wasting, factors increasing instability and methods of stabilization.
7. Study ground water, factors affecting on the variation of water table depth. Methods of searching for ground water.

Course content:

Unit-1

Introduction to Geology –Different branches of Geology, Geological time scale and time-stratigraphic conception, relevance of Geology in Civil Engineering.

Unit-2

Exploration and testing of Rock, RQD, Borehole problems.

Unit-3

Elementary concepts of mineralogy, petrology, structural geology with special emphasis on structures igneous, metamorphic and sedimentary rocks.

Unit-4

Engineering Geological/geotechnical problems and particular relevance of geology to civil engineering projects, Geotechnical properties of rock. Geotechnical considerations of groundwater, environment, natural resources and Energy. Geological structures and their significance in Civil Engineering projects folds, faults, joints and unconformities.

Unit-5

Geology of Dam and reservoir sites, tunnels, hill slope

Unit-6

Weathering and erosion of rocks including rapid mass wasting movements.

Unit-7

Fundamentals of Geophysical Prospecting, Importance of Seismic method and electrical resistivity method to civil engineering projects, Brief description of Seismic and Electrical resistivity prospecting for civil engineering purposes.

Unit-8

Engineering seismology (causes of earthquakes; seismic waves; magnitude, intensity and energy release; characteristics of strong earthquake ground motions), Earthquake occurrence in the world, Plate tectonics, Faults, Related Hazards, Volcanoes, Landslides.

Unit-9

Geo-informatics and Engineering Geology Remote sensing: Basic principles role of remote sensing in Civil Engineering various interpretation techniques in remote sensing Geographical Information Systems. Applications of geological knowledge in Civil Engineering projects.

Course outcome:

On completion of the course, the students will be able to:

1. Student will be able to learn the most common igneous, sedimentary and metamorphic rocks and also learn the different branches of geology.
2. Student will be able to describe and interpret the geological structures in the geological maps and cross sections and also learn the geotechnical considerations of ground water movement.
3. Students will be able to learn the different testing methods of rocks, Weathering and erosion of rocks, RQD and Borehole problems.
4. Students will be able to learn the various geological considerations for the construction of Dam, Reservoir and Tunnels.
5. Student will be able to learn the importance of Seismic method and electrical resistivity method to civil engineering projects.
6. Student will be able to learn the engineering seismology i.e. causes of earthquakes; seismic waves; magnitude, intensity and energy release; characteristics of strong earthquake ground motions etc.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	**Course Outcome**
UCE03B02.1	Student will be able to learn the most common igneous, sedimentary and metamorphic rocks and also learn the different branches of geology.

UCE03B02.2	Student will be able to describe and interpret the geological structures in the geological maps and cross sections and also learn the geotechnical considerations of ground water movement.
UCE03B02.3	Student will be able to learn the different testing methods of rocks, Weathering and erosion of rocks ,RQD and Borehole problems
UCE03B02.4	Student will be able to learn the various geological considerations for the construction of Dam, Reservoir and Tunnels.
UCE03B02.5	Student will be able to learn the importance of Seismic method and electrical resistivity method to civil engineering projects and also learn the engineering seismology.
UCE03B02.6	Student will be able to learn the engineering seismology i.e. causes of earthquakes; seismic waves; magnitude, intensity and energy release; characteristics of strong earthquake ground motions etc

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE03B02.1	3	2	1	2	1	2	1	1	2	1	2	3
UCE03B02.2	3	2	1	2	1	2	1	1	2	1	2	3
UCE03B02.3	3	2	1	2	1	2	1	1	2	1	2	3
UCE03B02.3	3	2	1	2	1	2	1	1	2	1	2	3
UCE03B02.5	3	2	1	2	2	2	2	2	1	1	2	3
UCE03B02.6	3	2	2	2	2	2	2	2	2	1	2	3
Total	18	12	6	12	8	12	8	8	11	6	10	18
Average	3	2	1	2	1.33	2	1.33	1.33	1.83	1	1.67	3
Equivalent Avg. attainment	3	2	1	2	1	2	1	1	2	1	2	3

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE03B02.1	3	2
UCE03B02.2	3	3

UCE03B02.3	3	4
UCE03B02.3	2	4
UCE03B02.5	2	4
UCE03B02.6	3	3
TOTAL	**18**	**23**
AVERAGE	**3**	**3.83**
Equivalent Avg. Attainment	**3**	**4**

References:

Sl. No.	Name of Book	Author	Publisher
1	A text book of Engg. Geology.	N. Chennakesavulu	Macmillan India Limited, 1996
2	General Geology For Engineers.	A.E.Kehew.	-
3	Engineering Geology. An Environmental Approach.	Perry H. Rahu.	-
4	Engineering And General	Prabin Singh.	S K Kataria & Sons (2010)
5	Geology and Engineering.	Leggot, R.F.	McGraw-Hill College; Subsequent edition (March 1, 1988)
6	A Geology for Engineers	Bhyth, F.G.M.	-
7	Geology of India and Barma	M.S.Krishnan	-
8	Stuctural Geology.	Marland P. Billing	-
9	Geology for Civil Engineers.	A.C.Mclean, C.D.Gribble	-
10	A text Book of Geology.	P.K.Mukherjee.	-
11	Geology of India.	D.N.Wadia.	South Asia Books (1994)

NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING

(UCE03B03**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Course objectives:

1. To obtain basic understanding of computer programming in either of C or C++ or FORTRAN languages.
2. To understand errors in numerical processes.
3. To obtain an understanding of different methods for solving polynomials, trigonometric, linear simultaneous and transcendental equations.
4. To obtain concept of curve fitting techniques.
5. To obtain an understanding on the different methods of numerical differentiation and integration.
6. To acquire knowledge for writing computer programming for the above numerical methods.

Course content:

Computer Programming:

Unit- 1

Programming Languages: Introduction to computer programming in either of C or C++ or FORTRAN languages. Constants and variables, Arithmetic expressions, Input/ Output statements, Simple programs. Control statements, Concepts of loops, Structure and Unions, One dimensional arrays, 2 dimensional arrays, and matrix computations. Concept of Sub-programming, functions, File I/O. Programming for the numerical methods mentioned in the units below using either of C or C++ or FORTRAN languages.

Numerical Analysis:

Unit 2

Approximations and round off errors, Truncation errors, Determination of roots of polynomials and transcendental equations by Newton-Rapson, Bisection Method, Secant method, Bairstow's method.

Unit – 3

Solutions of simultaneous linear algebraic equations by Gauss Elimination, and Gauss-Siedel iteration methods.

Unit – 4

Curve fitting- linear and nonlinear regression analysis.

Unit – 5

Backward, Forward and Central difference relations and their uses in Numerical differentiation and integration.

Unit – 6

Numerical solution of ordinary differential equations by Euler, Modified Euler, Runge-Kutta and

Predictor-Corrector method.

Unit – 7

Numerical integration: Trapezoidal and Simpson rule.

Course outcome:

1. Students will be able to use different tools required for writing a complete computer program in C or C++ or FORTRAN languages.
2. Students will be able find out errors in numerical methods.
3. Students will be able to solve polynomials, trigonometric, transcendental equations and simultaneous linear algebraic equations by various methods.
4. Students will be able to fit data points into different types of curve.
5. Students will be able to solve differential equations and perform integration numerically using different methods.
6. Students will be able to write complete computer programs corresponding to different numerical techniques learned in the course and represent the resulting data in a comprehensive manner.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE03B03.1	Students will be able to use different tools required for writing a complete computer program in C or C++ or FORTRAN languages.
UCE03B03.2	Students will be able find out errors in numerical methods.
UCE03B03.3	Students will be able to solve polynomials, trigonometric, transcendental equations and simultaneous linear algebraic equations by various methods.
UCE03B03.4	Students will be able to fit data points into different types of curve.
UCE03B03.5	Students will be able to solve differential equations and perform integration numerically using different methods.
UCE03B03.6	Students will be able to write complete computer programs corresponding to different numerical techniques learned in the course and represent the resulting data in a comprehensive manner.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE03B03.1	1	1	-	1	3	1	-	-	1	-	-	1
UCE03B03.2	2	1	-	3	3	-	-	-	1	-	-	1
UCE03B03.3	3	2	-	2	3	1	-	-	1	-	-	1
UCE03B03.4	2	2	-	3	3	-	-	-	-	1	-	1
UCE03B03.5	3	2	-	2	3	-	-	-	-	-	-	1
UCE03B03.6	2	2	-	2	3	-	-	-	1	-	-	1
Total	**13**	**10**	**-**	**13**	**18**	**2**	**-**	**-**	**4**	**1**	**-**	**6**
Average	**2.17**	**1.67**	**-**	**2.17**	**3**	**0.33**	**-**	**-**	**0.67**	**0.17**	**-**	**1**
Equivalent Avg. Attainment	**2**	**2**	**-**	**2**	**3**	**0**	**-**	**-**	**1**	**0**	**-**	**1**

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE03B03.1	2	3
UCE03B03.2	2	3
UCE03B03.3	2	2
UCE03B03.4	3	2
UCE03B03.5	2	3
UCE03B03.6	3	3
Total	**14**	**16**
Average	**2.33**	**2.67**
Equivalent Avg. Attainment	**2**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Numerical Methods	Shastry S.S.	Prentice Hall Inc. India
2	Numerical Methods	Nobel Ben	New York International Publication
3	Numerical Methods for Engineering	Station Ralph G.	Englewood Cliffs N.J.,Prentice Hall Inc.
4	Numerical Methods	Buckingham R.A.	Sir Isaac Pitman Sons Ltd., London
5	Numerical Methods	Grewal B.S	Khanna Pub. New Delhi
6	Numerical Methods	Bakhvalov N.S.	Mir. Publications Moscow

7	The complete ANSI C	Sudhit Kaicker	BPB Publications, New Delhi
8	The C Programming Language	B.W. Kernighan and D.M. Ritchie	Prentice Hall of India
9	Programming with C	Byron S. Gottfreid	Tata McGraw-Hill, 2nd Edition
10	Numerical Methods	Balaguruswami	Tata McGraw-Hill

MATHEMATICS-II1

(UCE03C01**)**

Total Credit: 03 **Contact Periods: 03 (3L+0T)**

Courses objective:

The objectives of the course Engineering Mathematics-III are:

1. The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modelling, climate prediction and computer networks etc.
2. Apply probability theory via Bayes' Rule
3. Describe the properties of discrete and continuous distribution functions.
4. Use method of moments and moment generating functions.
5. Apply the Central Limit Theorem.
6. Use statistical tests in testing hypotheses on data.
7. Introduce students to partial differential equations, and to solve linear Partial Differential with different methods.
8. Introduce students to some physical problems in Engineering and Biological models that results in partial differential equations.
9. Introduce the Fourier series and its application to the solution of partial differential equations.

Course content:

Unit-1

Probability and Random Variable: Axioms of probability, Conditional probability, Independent events, Baye's Theorem, Random variables, Probability mass function, Probability density function - properties, Moments, Moment generating functions and their properties.

Unit-2

Standard Distributions: Binomial, Poisson Normal distribution and their properties, function of random variables.

Unit-3

Two-dimensional random variables: Joint distribution, Marginal and conditional distribution, covariance, correlation and regression, Transformation of random variables, Central limit theorem.

Unit-4

Testing of hypothesis: Sampling distribution, Testing of hypothesis of mean, variance,proportion and differences using Normal, t and Chi-square.

Unit- 5

Fourier Series: Periodic functions, Fourier series, Dirichlet's conditions, function defined in two or more sub-ranges, discontinuous functions, even function, odd function, half range series, change of interval.

Unit-6

Partial Differential Equations: Order, Method of forming Partial Differential Equations, Solution of Equation by Direct Integration, Lagrange's Linear equation, Method of Multipliers, Partial Differential equations non-linear in p,q, Charpits Method, Linear Homogeneous Partial Differential equation, Non-Homogeneous Linear Equations, Method of Separation of variables, Equation of vibrating string, Solution of wave equation by D'Alembert's method, One dimensional heat flow, Two dimensional Heat flow.

Course outcome:

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

1. Understand the basic concepts of probability, random variables, probability distribution, and moments and moment generating functions.
2. Define the basic discrete and continuous distributions such as normal, binomial, Poisson, and make be able to apply them and simulate them in simple cases.
3. Explain the concepts of two dimensional random variables, independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables. Also State the central limit theorem, and apply it.
4. Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions. Hypothesis testing and its application in real life problems.
5. Find the Fourier series representation of a function of one variable, and find the solution of the wave, diffusion and Laplace equations using the Fourier series.
6. Students familiarize with the fundamental concepts of Partial Differential Equations (PDE) which will be used as background knowledge for the understanding of specialized courses in Engineering. Students will master how solutions of PDEs are determined by conditions at the boundary of the spatial domain and initial conditions at time zero.

Table 1

To establish the correlation between Cos & POs

No. of Course Outcome (CO)	Course Outcome
UCE03C01.1	Understand the basic concepts of probability, random variables, probability distribution, and moments and moment generating functions.
UCE03C01.2	Define the basic discrete and continuous distributions such as normal, binomial, Poisson, and make be able to apply them and simulate them in simple cases.
UCE03C01.3	Explain the concepts of two dimensional random variable, independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables. Also State the central limit theorem, and apply it.
UCE03C01.4	Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions. Hypothesis testing and its application in real life problems.
UCE03C01.5	Find the Fourier series representation of a function of one variable, and find the solution of the wave, diffusion and Laplace equations using the Fourier series.
UCE03C01.6	Students familiarize with the fundamental concepts of Partial Differential Equations (PDE) which will be used as background knowledge for the understanding of specialized courses in Engineering. Students will master how solutions of PDEs are determined by conditions at the boundary of the spatial domain and initial conditions at time zero.

Table 2

(LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12
UCE03C01.1	3	3	2	1	-	-	-	-	-	1	1	2
UCE03C01.2	2	2	2	1	2	-	-	-	-	1	1	1
UCE03C01.3	3	2	3	2	1	1	-	-	-	-	1	1
UCE03C01.4	3	3	2	2	3	1	-	1	1	1	1	2
UCE03C01.5	2	2	2	1	1	1	-	-	-	1	1	1
UCE03C01.6	3	2	2	2	1	1	-	-	1	1	1	1
Total	**16**	**14**	**13**	**9**	**8**	**4**	**-**	**1**	**2**	**5**	**6**	**8**
Average	**2.67**	**2.33**	**2.17**	**1.5**	**1.33**	**0.67**	**-**	**0.17**	**0.33**	**0.83**	**1**	**1.33**

Eq. Av Attainment	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**0**	**0**	**1**	**1**	**1**

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE03C01.1	2	2
UCE03C01.2	1	1
UCE03C01.3	2	1
UCE03C01.4	1	2
UCE03C01.5	1	2
UCE03C01.6	2	2
Total	**9**	**10**
Average	**1.5**	**1.67**
Eq. Average Attainment	**2**	**2**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Advanced Engineering Mathematics.	1957.E.Kreyszig	5th Ed., Willey Eastern.
2.	Advanced Engineering	H.K. Das	S.Chand and Company.
3.	Higher Engineering Mathematics.	B.S. Grewal.	Khanna Publishers.
4	Schaum's Outline Series	Spiegel, Murrary R	McGraw Hill Book

HUMANITIES-III (ENGINEERING ECONOMICS AND COSTING)

(UCE03C02**)**

Total Credit: 03 **Contact Periods: 03 (3L+0T)**

Courses objective:

1. To make the Engineering student know about the basic concepts and law of Economics and their application to understand the behaviour of agents present in the market.The subject will address the requirement of evaluating the commercial viability of projects undertaken by graduate engineers
2. To make the Engineering student know about the basic concepts of cost and costing, Accounts and financial statements and their application to understand the issue of commercial viability of any projects.

Course content:

Unit- 1

Engineering Economics- meaning, nature, scope and subject matter

Unit 2

Utility- definition, total, marginal and average; cardinal utility theory; indifference curves theory; **Demand**- factors effecting demand, elasticity of demand- different types of elasticity, classification of goods based on various elasticity of demand

Unit – 3

Production- Production function; Iso-quant; returns to scale; Total, Average & Marginal Product; law of variable proportions; Cobb-Douglas production function; Iso-cost curve; Derivation of cost curve from production function; Production optimization; expansion path

Unit – 4

Cost- short run and long run cost (the 'Envelope Curve'); shape of different types of cost curves; **Revenue-** total revenue and marginal revenue, relation between marginal revenue and price elasticity of demand

Unit – 5

Firm- different types of firm and its characteristics; traditional theory of firm; objectives of firm

Unit – 6

Introduction to Accounting- Definition of Accounting and accountancy, objectives of accounting, users of accounting information, Double Entry system of Book-Keeping, Journal and Ledger, Cash book, Trial balance.

Unit – 7

Final Accounts- Basic concepts, uses and preparation of Trading account; Profit and Loss account;

and Balance Sheet. Issue and Forfeiture of Share and Re-Issue of Company.

Unit – 8

Introduction to Costing- Elements of Cost, Direct Materials, Direct Labour, Direct Expenses, Overheads, Production, Office and Administration, Selling and Distribution, Allocation of overhead, machine hour rate, labour hour rate, practical problems.

Course outcome:

1. Be able to identify and explain economic concepts and theories related to the behavior of economic agents present in market.
2. Be able to analyse the impact of various government policies in production and profitability of the company.
3. Be able to identify the basic features of alternative representations of human behavior in economics.
4. Be able to understand the impact various decisions or transactions will have on the company's statements and financial health.
5. Be able to comfortably communicate with senior financial and non-financial leaders about financial statement issues and the financial impact of business decisions.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE03C02.1	Be able to identify and explain economic concepts and theories related to the behavior of economic agents present in market.
UCE03C02.2	Be able to analyse the impact of various government policies in production and profitability of the company.
UCE03C02.3	Be able to identify the basic features of alternative representations of human behavior in economics.
UCE03C02.4	Able to understand the impact various decisions or transactions will have on the company's statements and financial health.
UCE03C02.5	Able to comfortably communicate with senior financial and non-financial leaders about financial statement issues and the financial impact of business decisions.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE03C02.1	-	2	1	-	-	3	-	-	1	-	-	-
UCE03C02.2	-	3	2	1	-	2	-	2	2	-	3	2
UCE03C02.3	-	-	-	2	-	2	-	--	2	-	-	-
UCE03C02.4	-	3	2	1	-	-	-	1	-	-	3	-
UCE03C02.5	-	3	2	1	-	-	-	1	-	1	-	-
Total	**-**	**11**	**7**	**5**	**-**	**7**	**-**	**4**	**5**	**1**	**6**	**2**
Average	**-**	**2.2**	**1.4**	**1.0**	**-**	**1.4**	**-**	**0.8**	**1.0**	**0.2**	**1.2**	**0.4**
Eq Av Attainment	**-**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**0**	**1**	**0**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE03C02.1	2	3
UCE03C02.2	3	2
UCE03C02.3	3	2
UCE03C02.4	3	3
UCE03C02.5	3	3
Total	**14**	**13**
Average	**2.80**	**2.60**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Modern Economics	H. .L. Ahuja	S. Chand.
2	Ïndian Economics	K. K. Dewett and M.L .Sharma	S. Chand.
3	Modern Accountancy	Mukherjee & Hanif.	Tata Mc Graw Hill Publishing Co. Ltd. April.

4	Financial Accounting	Tulsian	Tata Mc Graw Hill Publishing Co. Ltd. April.
5	Financial Accounting	Larson	Tata Mc Graw Hill, Publishing Co. Ltd. April.
6	Cost Accounting	B. Banerjee	World Press.
7	Cost Accounting	Jawaharlal	Tata Mc Graw Hill, Publishing Co. Ltd. April.

ENGINEERING GEOLOGY-LAB

(UCE03P01**)**

Total **Credit: 01** **Contact Periods: 02**

Courses objective:

1. Types of rock (Igneous, Sedimentary, and Metamorphic), Civil engineering importance of rock forming minerals. Sedimentary processes (Weathering, erosion, deposition), Metamorphism and volcanic eruptions.
2. Types of Mass wasting, factors increasing instability and methods of stabilization.
3. Study ground water, factors affecting on the variation of water table depth. Methods of searching for ground water
4. To acquire practical knowledge on geology and on various types of rocks and minerals.

Course content:

Unit-1

Megascopic Identification of minerals and rocks

Unit-2

Microscopic identification of some related minerals and rocks.

Unit-3

Interpretation of geological maps

(i) Drawing the geological selection of geological maps

(ii) Inter relation of geological maps and section with respect to subsurface structure

Unit-4

Problems of locating sites of dams, tunnels, highways.

Course outcome:

On completion of the course, the students will be able to:

1. Identify the main and most common igneous, sedimentary and metamorphic rocks encountered by foundations and construction.
2. To describe and interpret the geological structures in the geological maps and cross sections.
3. This course provides students the opportunity to expand their understanding of the application of geology by focusing the use of geological principles in the investigation of engineering project.
4. This course provides students with an insight into the role of engineering geology in major engineering projects, and as such, it also highlights the importance of such projects to society.
5. Students will also examine the role of a risk management approach to engineering projects and appreciate their legal and ethical responsibility in providing advice of such projects.
6. To distinguish the characteristics of the most important geological formations and problems that may arise in the various public works.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE03P01.1	Identify the main and most common igneous, sedimentary and metamorphic rocks encountered by foundations and construction.
UCE03P01.2	To describe and interpret the geological structures in the geological maps and cross sections.
UCE03P01.3	This course provides students the opportunity to expand their understanding of the application of geology by focusing the use of geological principles in the investigation of engineering project.
UCE03P01.4	This course provides students with an insight into the role of engineering geology in major engineering projects, and as such, it also highlights the importance of such projects to society.
UCE03P01.5	Students will also examine the role of a risk management approach to engineering projects and appreciate their legal and ethical responsibility in providing advice of such projects.
UCE03P01.6	To distinguish the characteristics of the most important geological formations and problems that may arise in the various public works.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
UCE03P01.1	3	2	2	1	2	2	1	1	2	2	2	2
UCE03P01.2	2	2	2	2	2	2	2	2	2	2	2	2
UCE03P01.3	2	2	2	2	2	2	2	1	2	2	2	2
UCE03P01.4	3	2	2	2	1	2	1	1	2	2	2	3
UCE03P01.5	3	2	2	2	3	2	1	3	2	1	2	3
UCE03P01.6	3	3	2	2	2	3	1	2	2	1	3	2
Total	**16**	**13**	**12**	**11**	**12**	**16**	**7**	**10**	**12**	**10**	**13**	**14**
Average	**2.7**	**2.2**	**2.0**	**1.8**	**2.0**	**2.2**	**1.3**	**1.7**	**2.0**	**1.7**	**2.2**	**2.3**
Eq. Av Attainment	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE03P01.1	2	3
UCE03P01.2	2	2
UCE03P01.3	3	2
UCE03P01.4	1	3
UCE03P01.5	3	3
UCE03P01.6	1	2
Total	**12**	**15**
Average	**2**	**2.5**
Equivalent Avg. Attainment	**2**	**3**

COMPUTER LAB-1

(UCE03P02**)**

Total Credit: 01 Contact Periods: 02

Courses objective:

1. To know different rules of Numerical Methods.
2. To know programming software like C language.
3. To know how to get the output of different numerical method problems through programming software.
4. To compare the output of Numerical Method problems analytically and through programming.

Course content:

Unit-1

Numerical integration by Trapezoidal and Simpson's rule

Unit-2

Various matrix operation and their use

Unit-3

Uses of loops, arrays, pointers etc.

Unit-4

Various Numerical analysis related problem as per theory.

Course outcome:

1. Students will be able to understand the various Numerical analysis related problem as per theory.
2. Students will be able to get idea about various matrix operation and their use.
3. Students will be able to understand the uses of loops, arrays, pointers etc.
4. Students will be able to understand the Numerical differential equations by Euler, Runga kutta method etc.
5. Students will be able to understand the Numerical integration by Trapezoidal and Simpson's rule.
6. Students will be able to understand various method for linear simultaneous equations like gauss elimination method.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE03P02.1	Students will be able to get a practical view of the Numerical Method problems through programming.
UCE03P02.2	Students will be able to get idea about various matrix operation and their

	use.
UCE03P02.3	Students will be able to understand the uses of loops, arrays, pointers etc.
UCE03P02.4	Students will be able to understand the Numerical differential equations by Euler, Runga kutta method etc.
UCE03P02.5	Students will be able to understand the Numerical integration by Trapezoidal and Simpson's rule
UCE03P02.6	Students will be able to understand various method for linear simultaneous equatuions like gauss elimination method.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
UCE03P02.1	2	2	2	2	2	1	1	1	2	1	1	3
UCE03P02.2	2	2	2	2	2	1	1	1	2	2	1	3
UCE03P02.3	3	2	2	2	2	1	1	1	1	2	2	3
UCE03P02.4	2	2	2	2	2	1	1	1	1	1	1	3
UCE03P02.5	2	2	2	2	2	1	1	1	1	1	1	3
UCE03P02.6	3	2	2	2	2	1	1	1	2	2	2	3
Total	**14**	**12**	**12**	**12**	**12**	**6**	**6**	**6**	**9**	**9**	**8**	**18**
Average	**2.8**	**2.4**	**2.4**	**2.4**	**2.4**	**1.2**	**1.2**	**1.2**	**1.8**	**1.8**	**1.6**	**3.6**
Eq. Av Attain ment	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE03P02.1	3	3
UCE03P02.2	2	2
UCE03P02.3	3	3
UCE03P02.4	3	3
UCE03P02.5	3	2
UCE03P02.6	3	2
Total	**17**	**15**

Average	**2.833**	**2.5**
Equivalent Avg. Attainment	**3**	**3**

CIVIL ENGINEERING DRAWING

(UCE03P03**)**

Total Credit: 02 **Contact Periods: 03**

Courses objective:

1. To understand fundamentals of structural drawing.
2. To teach student to read, construct and understand basic civil engineering drawing.
3. To teach student to draw different plan, Elevation and section of different civil Engineering structure.

Course content:

1. Building Plan, elevation, Cross-section of walls, various bonds in brickworks, Wood works.
2. Lay out of Building and Building by-laws, Introduction to I.S. : 4326.
3. Typical drawing of Plan, elevation, Cross-section of walls for :
4. School Building, Library, Office Building, Market , Workshop, Culvert.
5. Introduction to AutoCAD .

Course outcome:

1. Students will able to know how to draw layout of plan considering building by-laws, elevation and section drawing for single storey building and masonry- closers and bats. ,
2. Students will able to know how to draw double storey residential building with dog legged stairs.
3. Students will able to get the idea of drawing School, library, building (plan, elevation and section).
4. Students will able to get the idea of drawing primary health centre
5. Students will able to use modern graphic tools to draw various types of building drawings , Prepare report and able to present it.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE03P03.1	Students will able to know how to draw layout of plan considering building by-laws, elevation and section drawing for single storey building and

	masonry- closers and bats.
UCE03P03.2	Students will able to know how to draw double storey residential building with dog legged stairs.
UCE03P03.3	Students will able to get the idea of drawing School, library, building (plan, elevation and section.
UCE03P03.4	Students will able to get the idea of drawing primary health centre.
UCE03P03.5	Students will able to use modern graphic tools to draw various types of building drawings, Prepare report and able to present it.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
UCE03P03.1	2	2	2	2	2	1	1	1	2	1	1	3
UCE03P03.2	2	2	2	2	2	1	1	1	2	2	1	3
UCE03P03.3	3	2	2	2	2	1	1	1	1	2	2	3
UCE03P03.4	2	2	2	2	2	1	1	1	1	1	1	3
UCE03P03.5	2	2	2	2	2	1	1	1	1	1	1	3
Total	**11**	**10**	**10**	**10**	**10**	**5**	**5**	**5**	**7**	**7**	**6**	**15**
Average	**2.2**	**2.0**	**2.0**	**2.0**	**2.0**	**1.0**	**1.0**	**1.0**	**1.4**	**1.4**	**1.2**	**3.0**
Eq. Av Attainment	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**3.0**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE03P03.1	3	3
UCE03P03.2	3	3
UCE03P03.3	2	3
UCE03P03.4	3	3
UCE03P03.5	2	3
Total	**12**	**15**

Average	**2.6**	**3**
Equivalent Avg. Attainment	**3**	**3**

SURVEY FIELD WORKS-I

(UCE03P04**)**

Total Credit: 03 **Contact Periods: 04**

Courses objective:

1) To know the instruments and their uses.
2) To know the use of instruments in their specific fields.
3) To know how to conduct the different methods of survey in the field.
4) To know after getting data from the field how to prepare the layout of it.

Course content:

Unit-1

Chain Surveying

Unit-2

Compass Surveying

Unit-3

Levelling

Unit-4

Plane Table Survey.

Unit-5

Use of Hand GPS

Unit-6

Use of Total Station

Course outcome:

1. Students will be able to learn the method and purpose of chain surveying.
2. Students will be able to learn the method and purpose of compass surveying.
3. Students will be able to learn the method and purpose of levelling.
4. Students will be able to learn the method and purpose of plane table surveying.
5. Students will be able to learn the method and purpose of using Total station.
6. Students will be able to learn the method and purpose of using GPS

Table 1

To establish the correlation between COs &POs

No. of Course Outcome(CO)	Course Outcome
UCE03P04.1	Students will be able to learn the method and purpose of chain surveying.
UCE03P04.2	Students will be able to learn the method and purpose of compass surveying.
UCE03P04.3	Students will be able to learn the method and purpose of levelling.
UCE03P04.4	Students will be able to learn the method and purpose of plane table surveying.
UCE03P04.5	Students will be able to learn the method and purpose of using Total station.
UCE03P04.6	Students will be able to learn the method and purpose of using GPS

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE03P04.1	3	2	2	2	3	2	1	1	3	2	2	3
UCE03P04.2	3	3	2	2	3	2	1	1	3	2	2	3
UCE03P04.3	3	3	3	2	3	2	1	1	3	2	3	3
UCE03P04.4	3	3	3	2	3	2	1	1	2	2	3	3
UCE03P04.5	3	3	3	2	3	2	1	1	3	2	3	3
UCE03P04.6	3	3	3	2	3	2	1	1	3	2	3	3
Total	**18**	**17**	**16**	**12**	**18**	**12**	**6**	**6**	**16**	**12**	**16**	**18**
Average	**3.0**	**2.8**	**2.7**	**2.0**	**3.0**	**2.0**	**1.0**	**1.0**	**2.8**	**2.0**	**2.7**	**3.0**
Equivalent Avg. Attainment	**3**	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**3**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE03P04.1	3	4
UCE03P04.2	3	4
UCE03P04.3	3	4
UCE03P04.4	3	3
UCE03P04.5	3	4
UCE03P04.6	3	3
Total	**18**	**22**
Average	**3**	**3.6**
Equivalent Avg. Attainment	**3**	**4**

DETAIL

COURSE CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.E/B.TECH

IN

CIVIL ENGINEERING

(4th SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

TRIPURA (WEST)

MECHANICS OF SOLID

(UCE04B01**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. To obtain fundamental understanding of the concepts of stress and strain and their relationship within linear elastic zone.
2. To understand the bending of beams and resulting stress across the beam sections under different loading and support conditions.
3. To obtain an understanding on the torsion.
4. To understand on the elastic stability of columns with different support conditions.

Course content:

Unit- 1

Simple Stresses and Strains: Tension, compression and shear stresses - Hooke's law – Poisson's Ratio- Principle of Superposition- Stresses due to impact- composite bars -Volumetric Strain- elastic constants-thermal stresses.

Unit 2

Compound Stresses: Principal stress and principal strain- Mohr's circle- Thin and Thick Cylinder

Unit – 3

Bending Moment and Shear Force: Beams and support conditions -Types of supports and loads - shear force and bending moment - their diagrams for simply supported beams, cantilevers and overhanging beams.

Unit – 4

Bending Stress and Shear Stress: Theory of simple bending – Stress distribution at a cross section due to Bending Moment and Shear Force

Unit – 5

Deflection of Beams: Slope and Deflection for determinate structures using Moment Area and Conjugate Beam Method.

Unit – 6

Torsion of Circular Shafts: Equation of Torsion-Strength and Stiffness-Torsional Rigidity-Polar Modulus-Power Transmitted by shaft of solid and hollow circular sections.

Unit – 7

Elastic Stability of Columns: Short and Long Column, Euler's Theory of Columns, Derivation of Buckling Load for different end conditions, Rankine's Formula.

Unit – 8

Unsymmetrical Bending and Shear Centre.

Course outcome:

1. Students will be able to identify the type of force, type of supports and the reactions on beams.
2. Students will be able to draw shear force and bending moment diagram of a beam.
3. Students will be able to identify the stress developed in beams due to bending.
4. Students will be able to analyze the deflection of beams.
5. Students will be able to understand on the torsion of solid circular shaft and resulting shear stress on the cross section.
6. Students will be able to compute the buckling load of short and long columns with different end conditions.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE04B01.**1**	Students will be able to identify the type of force, type of supports and the reactions on beams.
UCE04B01.**2**	Students will be able to draw shear force and bending moment diagram of a beam.
UCE04B01.**3**	Students will be able to identify the stress developed in beams due to bending.
UCE04B01.**4**	Students will be able to analyze the deflection of beams.
UCE04B01.**5**	Students will be able to understand on the torsion of solid circular shaft and resulting shear stress on the cross section.
UCE04B01.**6**	Students will be able to compute the buckling load of short and long columns with different end conditions.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04B01.1	3	2	1	1	-	-	-	-	-	-	-	1
UCE04B01.2	3	1	1	1	1	-	-	-	-	-	-	1
UCE04B01.3	3	2	1	1	1	-	-	-	-	-	-	1
UCE04B01.4	3	2	1	1	1	1	-	-	-	-	-	1
UCE04B01.5	3	3	1	1	1	-	-	-	-	-	-	1
UCE04B01.6	3	2	1	1	-	-	-	-	-	-	-	1
Total	**18**	**12**	**6**	**6**	**4**	**1**	**-**	**-**	**-**	**-**	**-**	**6**

Average	**3**	**2**	**6**	**1**	**0.67**	**0.17**	**-**	**-**	**-**	**-**	**-**	**1**
Equivalent Avg. Attainment	**3**	**2**	**6**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE04B01.1	3	2
UCE04B01.2	2	3
UCE04B01.3	2	3
UCE04B01.4	3	2
UCE04B01.5	3	3
UCE04B01.6	3	3
Total	**16**	**16**
Average	**2.67**	**2.67**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Elements of Strength of Materials	Timosenko, S.P. and Young, D.H.	Affiliated East-West Press Pvt. Ltd.
2	Strength of Materials	Srinath, L.S. and Desai. P.	Tata McGraw-Hill
3	Engineering Mechanics of Solids	Popov, E.P.	PHI
4	Solid Mechanics	Kazimi	Tata McGraw-Hill
5	Introduction to Solid Mechanics	Shames, H.	PHI
6	Strength of Materials	Shaneloy, F.R.	McGraw Hill
7	Strength of Materials Vol. I	Timoshenko, S.	McGraw Hill
8	Strength of Materials	Belyaeb,N.M.	Moscow
9	Advanced Mechanics Of Solids	Srinath, L.S.	Tata McGraw-Hill
10	Mechanics of Solids & Structures	Benham, P.P., & Warnock, F.V	Pitman Publishing
11	Advanced Mechanics of Materials	Seely, F.B.& Smith, J.O	Tokyo,Toppan
12	An introduction to the Mechanics of solids	S.H.Crandall, N.C. Dahl and T.J. Lardner	McGraw Hill, New York, 1978

SURVEYING-II

(UCE04B02**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. To understand the field information using instruments like theodolite before starting any project work.
2. To study how to create and use contour map for any project work.
3. To study tacheometry and trigonometrical levelling in the field.
4. To study the surface condition in water body.
5. To study the use of curve in any project.
6. To understand basics related to any project surveys.

Course content:

Unit- 1

Theodolite Surveying – Introduction, Types of Theodolite, Definitions of Terms, Temporary adjustments, Measurement of various angels, Fundamental lines and desire relations, Sources of Error in theodolite work. Traversing, balancing of traverse, Calculation of traverse area.

Unit- 2

Tachometry – Introduction, Use of tachometry, Different types of Tacheometric measurements, Principle of stadia method, Anallatic lens, Determination of contents, Measurements of horizontal and vertical distance, Substance bar.

Unit- 3

Contouring – Definition, uses, characteristics, Method of contouring, Contour Gradient, Ghat tracer.

Unit- 4

Trigonometrical leveling – Introduction, Base of the object accessible, Base of the object inaccessible.

Unit- 5

Hydrographic Surveying – Introduction, Methods, Sounding, Locating the sounding, Reduction of soundings, the capacity of a reservoir or lake, Stream gauging.

Unit- 6

Curve- Introduction, Classification, Elements of curves and notation, Designation of curve, Formula for various elements of curve, setting of horizontal and vertical curve, Field problem in setting out work.

Adjustment of Survey instruments.

Unit- 7

Project Surveys- Introduction, Railway projects, Road projects, Project survey on flow Irrigation, Water Supply, and Sanitary scheme, Tunneling, Topographic Survey and City Survey.

Course outcome:

1. Students will be able to understand the use of theodolite in the field.
2. Students will be able to understand the application and use of tacheometry and Trigonometrical leveling in the field.
3. Students will be able to understand the application and use of contour in the field.
4. Students will be able to understand application and use of Hydrographic Surveying in the field.
5. Students will be able to use curve in roads railways etc.
6. Students will be able to understand basics of any type of Project Survey.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE04B02.1	Students will be able to understand the use of theodolite in the field.
UCE04B02.2	Students will be able to understand the application and use of tacheometry and Trigonometrical leveling in the field.
UCE04B02.3	Students will be able to understand the application and use of contour in the field.
UCE04B02.4	Students will be able to understand application and use of Hydrographic Surveying in the field.
UCE04B02.5	Students will be able to use curve in roads railways etc.
UCE04B02.6	Students will be able to understand basics of any type of Project Survey.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
UCE04B02.1	2	2	1	1	-	-	-	-	2	-	-	1
UCE04B02.2	2	2	1	1	-	-	-	-	2	-	-	1
UCE04B02.3	3	3	1	1	-	-	-	-	2	-	-	1

UCE04B02.4	2	2	1	1	-	-	-	-	2	-	-	2
UCE04B02.5	2	1	1	1	-	-	-	-	2	-	-	1
UCE04B02.6	3	1	1	1	-	-	-	-	2	-	-	2
Total	**14**	**11**	**6**	**6**	**-**	**-**	**-**	**-**	**12**	**-**	**-**	**8**
Average	**2**	**1.8**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1.2**
Eq. Av Attainment	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE04B02.1	3	3
UCE04B02.2	3	3
UCE04B02.3	3	3
UCE04B02.4	3	3
UCE04B02.5	3	3
UCE04B02.6	3	3
Total	**18**	**18**
Average	**3**	**3**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Surveying Vol. I & II	Agor, R.	Khanna publications
2	Surveying Vol. I & II	Arora, K.R	Standard Book House
3	Solving Problems in Surveying	Bannister	Longman Scientific Technical
4	Engineering Surveying Technology	A. and Baker, R Bannister A., and Baker, R	Khanna publications
5	Surveying Vol. I & II	Punmia, B.C	Laxmi publications Delhi,
6	Surveying I, II	Kanetkar, T.P.	Pune VidyarthiGrihaPrakashan.

HYDRAULICS

(UCE04B03**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. To know about the properties of fluids and the applications of fluid mechanics.
2. To formulate and analyze problems related to calculation of forces in fluid structure interaction.
3. To know about equilibrium condition of the floating and submerged bodies.
4. To know the concept of fluid measurement, types of flows and dimensional analysis.
5. To know about most efficient channel section, critical depth of flow and concept of specific energy.
6. To know about Hydraulic jump, surges and water waves.

Course content:

Unit-1

Properties of Fluid: Surface tension, viscosity – Ideal and real fluids, Newtonian and non-Newtonian fluids, Incompressible and compressible fluids.

Unit-2

Fluid pressure and Hydrostatics: Pressure at a point, Pascal's law etc. Introduction to Pressure measuring devices (Manometers & Mechanical Gauge). Total pressure and centre of pressure on plane and curved submerged bodies.

Unit-3

Buoyancy: Centre of buoyancy, Metacentric height, Equilibrium analysis.

Unit-4

Kinematics of fluid flow: Lagrangian and Eulerian approaches, Types of fluid flow, Continuity equation, Velocity potential function and Stream Function.

Unit-5

Dynamics of fluid flow: Euler's Equation of motion, momentum equation, Bernoulli's equation, Applications of Bernoulli's equation, Flow through Orifice, Mouth piece, Notches and weirs.

Unit-6

Dimensional Analysis and Hydraulic Similitude: Dimensional Analysis, Buckingham's theorem, important dimensionless numbers and their significance.

Unit-7

Introduction of open channel flow: Critical depth, Concepts of specific energy and specific force, application of specific energy.

Unit-8

Uniform Flow: Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section.

Unit-9

Hydraulic Jump: Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds.

Course outcome:

On completion of the course, the students will be able to:

1. Determine the values of fluid properties and relationship between different properties of fluids and knowledge about the principles of continuity, momentum, and energy as applied to fluid motions.
2. Analyze the hydrostatic forces on different types of surfaces which is used to design the hydraulic structures.
3. Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.
4. Determine frictional losses in a pipe when there is a flow between two places.
5. Calculate the critical depth flow and knowledge about the most economical channel section.
6. Compute discharge and loss of head through pipes, open channels, notches and other hydraulic structures.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE04B03.1	Determine the values of fluid properties and relationship between different properties of fluids and knowledge about the principles of continuity, momentum, and energy as applied to fluid motions.
UCE04B03.2	Analyze the hydrostatic forces on different types of surfaces which is used to design the hydraulic structures.
UCE04B03.3	Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.
UCE04B03.4	Determine frictional losses in a pipe when there is a flow between two places.
UCE04B03.5	Calculate the critical depth flow and knowledge about the most economical channel section.
UCE04B03.6	Compute discharge and loss of head through pipes, open channels, notches and other hydraulic structures

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04B03.1	3	4	1	4	1	3	2	1	1	2	3	4
UCE04B03.2	3	4	1	3	1	3	2	1	2	2	3	4
UCE04B03.3	3	3	1	4	1	3	1	2	1	1	3	3
UCE04B03.4	3	3	1	3	1	3	2	2	2	1	3	4
UCE04B03.5	3	4	1	4	1	3	1	1	1	1	3	3
UCE04B03.6	3	3	1	3	1	3	1	1	2	2	3	4
Total	**18**	**21**	**6**	**21**	**6**	**18**	**9**	**8**	**9**	**9**	**18**	**22**
Average	**3**	**3.5**	**1**	**3.5**	**1**	**3**	**1.5**	**1.33**	**1.5**	**1.5**	**3**	**3.66**
Eq. Av Attainment	**3**	**4**	**1**	**4**	**1**	**3**	**2**	**1**	**2**	**2**	**3**	**4**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE04B03.1	3	4
UCE04B03.2	3	4
UCE04B03.3	3	3
UCE04B03.4	2	2
UCE04B03.5	4	4
UCE04B03.6	2	3
Total	**17**	**20**
Average	**2.83**	**3.33**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Engineering Fluid Mechanics	Garde, R.J. and A.G. Mirajgaoker	Nem Chand & Bros Roorkee,1983.
2	Fluid Mechanics through Problems	Garde, R.J.	Wiley Eastern Limited New Delhi,1989.
3	Elementary Mechanics	Hunter Rouse.	John Wiley &

	of Fluids		Sons,Inc.,1946
4	Mechanics of Fluids	L.H.Shames.	Mc Graw Hill, Int. Student , Education
5	Fluid Mechanics and its Applications	Vijay Gupta and S.K.Gupta	Wiley Eastern Ltd
6	Fluid Mechanics	Streeter, V.L and Wylie, E.B	Mc Graw Hill, New York, 8th Ed., 1985.
7	Experimental Fluid Mechanics	Asawa, G.L	Vol 1, Nem Chand and Bros., 1992.
8	Fluid Mechanics and Hydraulic Machines	R.K.Bansal	Laxmi Publication Pvt. Ltd., 2005

ENGINEERING MATERIALS, CONSTRUCTION AND SERVICES

(UCE04B04**)**

Total Credit: 04 **Contact Periods: 04(3L+1T)**

Courses objective:

1. To obtain fundamental understanding of different building materials for the construction of building.
2. To understand different building rules and laws for building construction.
3. To obtain an idea of building construction and services.
4. To get the idea of various equipment used for building construction and services.

Course content:

Unit- 1

Bricks, Stone, Timber, Plywood, Steel: Classification, Properties and selection criteria.

Unit 2

Cement, Aggregate, Admixture: Types, Properties and selection criteria and tests.

Unit – 3

Concrete: Preparation and properties, concrete mix design. Mortar: Types, classification and strength, I.S. specifications.

Unit – 4

Building bye laws, modular co-ordination. Loads on buildings. Types of foundation and selection criteria.

Unit – 5

Brick Masonry, Stone Masonry, Bonds. Types of walls, partition and cavity walls. Prefabricated construction. Plastering and pointing. Damp proofing materials and techniques.

Unit – 6

Types of floors, Construction details and selection criteria. Types of roof and roof covering. Stair and Staircases: Types, materials, proportions.

Unit – 7

White Washing, Colour Washing, Painting, Distempering. Shuttering, Scaffolding and centering. Expansion and construction joints. Sound and fire proofing construction, I.S. specifications.

Unit – 8

Selection, bulldozer, dumpers, trenchers, excavators, hoe, hoists, graders, piling hammers, pumps, compressors, bitumen mix plant, rollers, clam shell, aggregate production techniques, crushers.

Course outcome:

1. Students will be able to identify the type of building materials based on its different use.
2. Students will be able to understand the use of admixture to be used in concrete mix.
3. Students will be able to understand the rules and laws of building constructions.
4. Students will be able to practice types of roof and roof covering. Stair and Staircases.
5. Students will be able to practice different types of plastering, painting and pointing.
6. Students will be able to understand the use of different equipment for building construction and services.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE04B04.1	Students will be able to identify the type of building materials based on its different use.
UCE04B04.2	Students will be able to understand the use of admixture to be used in concrete mix.
UCE04B04.3	Students will be able to understand the rules and laws of building constructions.
UCE04B04.4	Students will be able to practice types of roof and roof covering. Stair and Staircases.
UCE04B04.5	Students will be able to practice different types of plastering, painting and pointing.

UCE04B04.6	Students will be able to understand the use of different equipments for building construction and services

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO12
UCE04B04.1	3	2	1	2	1	1	2	1	1	1	2	1
UCE04B04.2	3	1	1	2	2	1	2	1	2	1	2	1
UCE04B04.3	3	2	1	2	1	1	2	1	2	1	2	1
UCE04B04.4	3	1	1	2	2	1	2	1	2	1	2	1
UCE04B04.5	3	2	1	2	2	1	2	1	2	1	2	1
UCE04B04.6	3	2	1	2	2	1	2	1	2	1	2	1
Total	**18**	**9**	**6**	**12**	**9**	**6**	**12**	**6**	**12**	**6**	**12**	**6**
Average	**3.00**	**1.67**	**1.00**	**2.00**	**1.67**	**1.00**	**2.00**	**1.00**	**1.83**	**1.00**	**2.00**	**1.00**
Eq. Av Attain ment	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE04B04.1	4	3
UCE04B04.2	4	3
UCE04B04.3	4	3
UCE04B04.4	4	3
UCE04B04.5	4	3
UCE04B04.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	A text book of Building	Arora, S.P.,	Dhanpat Rai
	Construction.	Bindra, S.P.	and Sons. Delhi.
2.	Building Construction.	Jha, J & Sinha, S.K.	Khanna Publishers, Delhi
3.	A text Book of Engineering, Materials.	Kulkarni, C.J.	Ahmedabad, Book Depot, Ahmedabad.
4.	A text Book of Engineering Construction.	Kulkarni, C.J.	Ahmedabad, Book Depot, Ahmedabad.
5.	Engineering Materials.	Kumar Sushil. Publishers.	Standard, Distributors, Delhi
6.	Building Construction.	Kumar Sushil.	Standard, Distributors, Delhi
7	Building Construction	McKay W.B.	Vol. 1 to 4, Orient, Longman Ltd., Hyderabad,
8.	A text book of Building	Punmia, B.C.	Laxmi Publications, Delhi, Madras.
9.	Engineering Materials.	Singh Surendra.	Konark Publishers Pvt. Ltd.

H.S.S ELECTIVE-I

(MANAGEMENT AND MANAGERIAL ECONOMICS)

(UCE04E01**)**

Total Credit: 03 **Contact Periods: 03 (3L+0T)**

Courses objective:

1. To make the Engineering student know about the basic concepts, functions, principles and techniques of management and their application, which complement the technical skills to execute their capabilities successfully.
2. To make the Engineering student know about the basic concepts of finance in carrying out any project

Course content:

Unit- 1

Basic Concepts and functions of management: planning, nature, purpose and objective of planning; organizing: nature and purpose, authority and responsibility, staff bug; supply of human resources, performance appraisal. Controlling: system and process of controlling, control techniques.

Unit 2

Human resource Management and Marketing Management: nature and scope of human resource of planning, planning and development, recruitment and selection, career growth, grievances, motivation and its type, needs for motivation, reward and punishment, models of motivation. Leaders: kinds of leaders, leadership styles, roles and functions of leader; conflict management: kinds and causes of conflict, settlement of conflict, Group and team working, organizational design and development.

Unit – 3

Financial Management: Need of finance, kinds and sources of capital shares and debentures, fixed and working capital , capital structure of a firm, operating and financial leverage, EBIT and EPS analysis, financial ratio analysis : uses and natures, liquidity coverage ratios, practical problems.

Unit – 4

Investment decisions and forecasting of working capital: Kinds of capital Budgeting decisions, evaluation of proposals, capital discounting and non discounting based methods. Practical problems. Definition and importance of working capital. Working capital operating cycle, factors affecting Working capital, inventory management

Unit – 5

Cost Analysis and Cost Control: elements of cost, types of cost, direct and indirect, variable and fixed, labour cost, material cost, overhead cost, cost control techniques. Budget: meaning, kinds,

budgetary controls, break even analysis, practical problems.

Unit – 6

Perfect Competition- Perfect Competition, Features; Short run and long run equilibrium of firm and industry, shut down point

Unit – 7

Monopoly- features, monopoly power, pricing under monopoly, price discrimination.

Unit – 8

Oligopoly- Features, kincked demand Curve, Cournot's Duoploy Model Cartels, Price leadership.

Unit – 9

Monopolistic Competition- Features, Pricing under monopolistic competition, Product differentiation.

Unit – 10

Macroeconomics- Inflation; Function of Central & Commercial Bank

Course outcome:

1. Be able to understand the principles of management and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
2. Be able to make a plan how to organize, control and motivate people.
3. Be able to understand the Cost analysis in the context of short and long term decision making and the use of discounted cash flow analysis.
4. Be able to identify and explain economic concepts and theories related to the markets, industry and firm structures.
5. Be able to pursue the larger objectives of the firm besides profit maximization.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE04E01.1	Students will be able understand the principles of management and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
UCE04E01.2	Students will be able to make a plan how to organize, control and motivate people.
UCE04E01.3	Students will be able to understand the Cost analysis in the context of short and long term decision making and the use of discounted cash flow analysis.

UCE04E01.4	Students will be able to identify and explain economic concepts and theories related to the markets, industry and firm structures
UCE04E01.5	Students will be able to pursue the larger objectives of the firm besides profit maximization

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04E01.1	3	2	3	2	1	-	-	-	-	-	-	1
UCE04E01.2	3	3	2	2	1	-	-	-	-	-	-	1
UCE04E01.3	3	3	2	2	1	-	-	-	-	-	-	1
UCE04E01.4	3	2	3	2	1	-	-	-	-	-	-	2
UCE04E01.5	3	3	2	2	1	-	-	-	-	-	-	1
Total	**15**	**13**	**12**	**10**	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**6**
Average	**3**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE04E01.1	3	3
UCE04E01.2	3	3
UCE04E01.3	3	3
UCE04E01.4	2	2
UCE04E01.5	3	2
Total	**14**	**13**
Average	**2.8**	**2.6**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Financial Management,	M.Y.Khan and P.K.Jain,	Tata McGraw Hill,
2	Fundamental of business, Organisation and Managemen	Y.K.Bhusan	S.Chand and Sons.
3	Marketing Management	Plilip Kotler	Prentice Hall of India.
4	Fundamental of	Chandra Presanna.	Tata McGraw Hill.
5	Human Resource And Management	Fred Luthans	Tata McGraw Hill
6	Organisational Behavior Concepts, Controversies, and Applications	Stephen P. Rabbins	Prentice Hall, New Gersy.
7	Managerial Economics	Suma Damodaran	Oxford University Press
8	Managerial Economics	D.N.Dwivedi's.	Vikash Publishing house Pvt. Ltd

Hydraulics Lab

(UCE04P01**)**

Total Credit: 01 **Contact Periods: 02**

Course objectives

1. Illustrate physical concepts of fluid flows and explore the fundamental principles of fluid mechanics through experimentation
2. Demonstrate and analyze hydraulic phenomena using hands-on physical devices
3. To help the students acquire knowledge about flow through pipes, open channel flows
4. Develop the ability for team work, ability to design, conduct experiments, analyze and interpret data.

Course contents

List of Experiments:

1. To verify the momentum equation experimentally.

2. To verify the Bernoulli's Equation experimentally
3. To determine the co-efficient of friction in pipe
4. To determine the coefficient of discharge of venturimeter.
5. To determine the coefficient of discharge of an orifice meter.
6. To determine the coefficient of discharge of Triangular Notch.
7. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
8. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors.
9. To study the flow characteristics over a hump placed in an open channel.
10. To study the flow through a horizontal contraction in a rectangular channel.
11. To study the characteristics of free hydraulic jump.

Course outcomes

At the end of the course, the student will be able to:

1. Able to determine fluid flow properties and understand Bernoulli's theorem experimentally.
2. Able to determine the coefficient of discharge of various notches and flow meters like venture meter and orifice meter.
3. Apply the concept of fluid mechanics to design various pipe and open channel systems.
4. Able to determine Manning's and Chezy's coefficients for smooth and rough channels energy losses in hydraulic jumps.
5. Understand the various flow conditions, flow characteristics in open channel flows.
6. Able to determine the loss of energy in different section of an open channel flow.

Table 1

To establish the correlation between Cos & POs

No. of Course Outcome (CO)	Course Outcome
UCE04P01.1	Determine the values of fluid properties and relationship between different properties of fluids and knowledge about the principles of continuity, momentum, and energy as applied to fluid motions.
UCE04P01.2	Analyze the hydrostatic forces on different types of surfaces which is used to design the hydraulic structures.
UCE04P01.3	Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.
UCE04P01.4	etermine frictional losses in a pipe when there is a flow between two places.

UCE04P01.5	alculate the critical depth flow and knowledge about the most economical channel section.
UCE04P01.6	Determination of loss of energy in different section of a open channel flow.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: - "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
UCE04P01.1	3	3	1	1	2	1	1	1	2	1	1	2
UCE04P01.2	3	2	2	1	3	1	1	1	2	1	1	3
UCE04P01.3	3	2	2	2	3	2	1	1	2	1	1	3
UCE04P01.4	3	2	3	1	2	1	1	1	2	1	1	2
UCE04P01.5	3	3	2	2	3	1	1	1	1	1	1	2
UCE04P01.6	3	3	2	2	3	1	1	1	1	1	1	2
Total	**15**	**15**	**10**	**7**	**13**	**6**	**5**	**5**	**9**	**5**	**5**	**12**
Average	**3**	**4.29**	**3.14**	**2.29**	**4.14**	**1.86**	**1.57**	**1.57**	**2.71**	**1.57**	**1.57**	**3.71**
Equivalent Average Attainment	**3**	**4**	**3**	**2**	**4**	**2**	**2**	**2**	**3**	**2**	**2**	**4**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCEB04P01.1	3	4
UCEB04 P01.2	3	3
UCEB04 P01.3	4	3
UCEB04 P01.4	3	3
UCEB04 P01.5	3	4
UCEB04 P01.6	3	4
Total	**19**	**21**
Average	**3.2**	**3.5**
Equivalent Avg. Attainment	**3**	**4**

Solid Mechanics Lab

(UCE04P02**)**

Total Credit: 01 **Contact Periods: 02**

Courses objective:

1. To know the instruments and their uses.
2. To know about the different types of materials used in Civil Engineering field and their physical and mechanical properties.
3. To know how to compare experimental results with their theoretical values.

Course content:

Unit-1

Introduction to testing equipments

Unit-2

Uniaxial tension test (Mild Steel, Timber)

Unit-3

Uniaxial compression test (Timber along and across, concrete, bricks etc.)

Unit-4

Torsion test (Mild Steel, aluminum)

Unit-5

Bending stress distribution in beams using demec gauges extensometer

Unit-6

Analysis of truss model with spring members.

Unit-7

Compression test on brick masonry specimen

Unit-8 Hardness test

Unit-9 Creep test

Unit-10 Impact test

Unit-11 Strength of Etched and Un-etched glasses

Unit-12 Spring test

Unit-13 To study the microstructure of various metals.

Course outcomes

1. Students will be able to know about the instruments and their uses for determining the properties of materials.
2. Students will be able to study the stress-strain curves of different materials such as steel, concrete, timber etc. used in the field under different loading conditions.
3. Students will be able to understand the physical and mechanical properties (such as impact, torsion, hardness, creep etc) of various materials.
4. Students will be able to calculate simple tensile and shear stress using the appropriate guidelines and formats.
5. Students will be able to analyze the bending stress on different types of sections.
6. Students will be able to understand deflection of different sections at different loading conditions.

Table 1

To establish the correlation between Cos & POs

No. of Course Outcome (CO)	Course Outcome
UCE04P02.1	Students will be able to know about the instruments and their uses for determining the properties of materials.
UCE04P02.2	Able to study the stress-strain curves of different materials such as steel, concrete, timber etc. used in the field under different loading conditions.
UCE04P02.3	Able to understand the physical and mechanical properties (such as impact, torsion, hardness, creep etc) of various materials.
UCE04P02.4	Able to calculate simple tensile and shear stress using the appropriate guidelines and formats.
UCE04P02.5	Able to analyze the bending stress on different types of sections.
UCE04P02.6	Able to understand deflection of different sections at different loading conditions.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04P02.1	3	1	1	3	3	1	2	1	3	3	1	3

UCE04P02.2	3	1	1	3	3	1	2	1	3	3	1	3
UCE04P02.3	3	1	1	3	3	1	2	1	3	3	1	3
UCE04P02.4	3	1	1	3	3	1	2	1	3	3	1	3
UCE04P02.5	3	1	1	3	3	1	2	1	3	3	1	3
UCE04P02.6	3	1	1	3	3	1	2	1	3	3	1	3
Total	**18**	**6**	**6**	**18**	**18**	**6**	**12**	**6**	**18**	**18**	**6**	**18**
Average	**3**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**3**	**3**	**1**	**3**
Eq. Av Attainment	**3**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**3**	**3**	**1**	**3**

Table 3

To establish the correlation between COs & PSOs

CO	**PSO1**	**PSO2**
UCE04P02.1	4	4
UCE04P02.2	4	4
UCE04P02.3	4	4
UCE04P02.4	4	4
UCE04P02.5	4	4
UCE04P02.6	4	4
Total	**4**	**4**
Average	**4**	**4**
Equivalent Avg. Attainment	**4**	**4**

References:

Sl. No.	**Name of Book**	**Author**	**Publisher**
1	IS: 1608-1995	Mechanical Testing of metal tensile Testing	BIS

SURVEYING FIELD WORKS-II

(UCE04P03**)**

Total Credit: 03 **Contact Periods: 04**

Courses objective:

1. To know the instruments and their uses.
2. To know the use of instruments in their specific fields.
3. To know how to conduct the different methods of survey in the field.
4. To know after getting data from the field how to prepare the layout of it.

Course content:

Unit-1

Triangulation Survey including adjusted coordinates.

Unit-2

Theodolite surveying - horizontal angle by repetition & reiteration methods.

Unit-3

Determination of tacheometric constants

Unit-4

Layout of Curves.

Unit-5

Layout of Building and Culvert.

Unit-6

Topographic Mapping (i.e. Plotting of the details of well contours area).

Unit-7

Volume Calculation.

Course outcome:

1. Student will be able to understand the physical appearance of the instruments.
2. Student will be able to learn the practical applications of the instruments.
3. Student will be able to relate the concepts with the broad application of the instruments.
4. Students will be able to learn survey methods like tacheometry, curve settings, GPS and GIS technology.
5. Students will be able to interpret survey data and compute areas and volumes.
6. Students will be able to learn different topographical maps and their applications.

Table 1

To establish the correlation between Cos & POs

(CO)	Course Outcome
UCE04P03.1	Student will be able to understand the physical appearance of the instruments.
UCE04P03.2	Student will be able to learn the practical applications of the instruments.
UCE04P03.3	Student will be able to relate the concepts with the broad application of the instruments.
UCE04P03.4	Students will be able to learn survey methods like tachometry, curve settings, GPS and GIS technology.
UCE04P03.5	Students will be able to interpret survey data and compute areas and volumes.
UCE04P03.6	Students will be able to learn different topographical maps and their applications.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04P03.1	2	2	2	2	2	1	1	1	3	3	2	3
UCE04P03.2	2	2	2	2	2	1	1	1	2	2	2	2
UCE04P03.3	1	1	2	2	2	1	1	1	3	3	2	2
UCE04P03.4	2	1	2	1	2	1	1	1	3	2	2	2
UCE04P03.5	2	2	2	1	2	2	1	1	2	2	2	2
UCE04P03.6	3	2	2	2	1	2	2	2	2	2	2	2
Total	**12**	**11**	**12**	**10**	**11**	**8**	**7**	**7**	**15**	**14**	**12**	**13**
Average	**2**	**1.83**	**2**	**1.66**	**1.83**	**1.33**	**1.16**	**1.16**	**2.5**	**2.33**	**2.00**	**2.16**
Eq. Av Attainment	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**3**	**2**	**2**	**2**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCEB04P03.1	4	4
UCEB04P03.2	3	2
UCEB04P03.3	3	3
UCEB04P03.4	3	3

UCEB04P03.5	3	4
UCEB04P03.6	3	3
Total	**19**	**19**
Average	**3.16**	**3.16**
Equivalent Avg. Attainment	**3**	**3**

COMPUTER LAB-II

(UCE04P04**)**

Total Credit: 01 **Contact Periods: 02**

Courses objective:

1. To know the use of software AutoCAD.
2. To know how to draw different building and other Civil Engineering structures by AutoCAD.
3. To know use of software MATLAB.
4. To how to solve different problems by MATLAB software.

Course content:

Unit-1

Hands-on in Auto-Cad

Unit-2

Hands-on in MATLAB

Course outcome:

1. Students will be able to learn about AutoCAD software.
2. Students will be able to learn the uses of different commands and tools of AutoCAD.
3. Students will be able to learn different types of building and structural models using AutoCAD
4. Students will be able to learn the use of MATLAB software.
5. Students will be able to learn different types problems analysis using MATLAB software.

Table 1

To establish the correlation between Cos & Pos

No. of Course Outcome (CO)	Course Outcome
UCE04P04.1	Students will be able to learn about AutoCAD software.
UCE04P04.2	Students will be able to learn the uses of different commands and tools of AutoCAD.
UCE04P04.3	Students will be able to learn different types of building and structural models using AutoCAD
UCE04P04.4	Students will be able to learn the use of MATLAB software.
UCE04P04.5	Students will be able to learn different types problems analysis using MATLAB software.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and for NO CORELATION "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04P04.1	2	2	2	2	2	1	1	1	2	1	1	3
UCE04P04.2	2	2	2	2	2	1	1	1	2	2	1	3
UCE04P04.3	3	2	2	2	2	1	1	1	1	2	2	3
UCE04P04.4	2	2	2	2	2	1	1	1	1	1	1	3
UCE04P04.5	2	2	2	2	2	1	1	1	1	1	1	3
Total	**11**	**10**	**10**	**10**	**10**	**5**	**5**	**5**	**7**	**7**	**6**	**15**
Average	**2.2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1.4**	**1.4**	**1.2**	**3**
Eq. Av Attainment	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE04P04.1	3	3
UCE04P04.2	3	2
UCE04P04.3	3	3
UCE04P04.4	3	3
UCE04P04.5	3	3
Total	**15**	**14**
Average	**3**	**2.8**
Equivalent Avg. Attainment	**3**	**3**

DETAIL

COURSE CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.E/B.TECH

IN

CIVIL ENGINEERING

(5th SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

TRIPURA (WEST)

Structural Analysis-I

(UCE05B01**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

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Course objectives:

1. To obtain fundamental understanding of different type of structures and their characteristics based on which their analysis procedures are determined.
2. To understand different analysis procedures of plane determinate truss.
3. To obtain an understanding on the strain energy stored in the structures due to different type of stress resultants and to use this concept to determine structural deflection by using different methods.
4. To obtain an understanding on rolling load and influence line diagram for determinate and indeterminate structures.
5. To understand different methods for analysis of Cable, Arch, indeterminate beams and simple framed structures.

Course content:

Unit- 1

Introduction: Classification of Structures, Stress resultants, Degrees of freedom per node, Static and Kinematic Indeterminacy.

Unit 2

Analysis of Plane Truss: Classification of Pin jointed Determinate Trusses, Analysis of determinate plane Trusses by Method of Joints and Sections and Method of tension coefficient.

Unit – 3

Strain Energy: Strain energy due to axial load, bending and shear, theorem of minimum potential energy, principle of virtual work, law of conservation of energy, 1st and 2nd Castiglione's Theorem, Betti's & Maxwell's reciprocal theorem, Deflection of Beams using Strain Energy Method and Unit load method.

Unit – 4

Rolling Load and Influence Lines: Rolling loads, influence lines for beams and trusses, Absolute maximum bending moment.

Unit – 5

Analysis of Arches and Cables: Analysis of Arches, Linear Arch, Eddy's theorem, three hinged parabolic arch, Spandrel braced arch, moving loads & influence lines. Analysis of Cables under point loads and UDL.

Unit – 6

Indeterminate Structures- Compatibility Methods: Analysis of Fixed beam, Continuous beam and simple frames with and without translation of joints by Method of Consistent Deformation and Three moments Theorem. Analysis of Propped Cantilever, Two-hinged Arches.ILD for Continuous beam.

Unit – 7

Curved Beams: Introduction, Bending of Curved bars in plane of bending, stresses in bars of small and large initial curvatures.

Course outcome:

1. Students will be able to classify different type of structures.
2. Students will be able to determine the stress resultants, degrees of freedom, static and kinematic indeterminacy of a structure.
3. Students will be able to analyze a plane determinate truss.
4. Students will be able to derive the expression of strain energy of a structural component due to different stress resultants and also the deflection of beams from the strain energy function.
5. Students will be able to draw the influence line diagrams for determinate and indeterminate structures.
6. Students will be able to analyze indeterminate beams and simple plane frames by applying different method of analysis.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE05B01.1	Students will be able to classify different type of structures.
UCE05B01.2	Students will be able to determine the stress resultants, degrees of freedom, static and kinematic indeterminacy of a structure.
UCE05B01.3	Students will be able to analyze a plane determinate truss.
UCE05B01.4	Students will be able to derive the expression of strain energy of a structural component due to different stress resultants and also the deflection of beams from the strain energy function.
UCE05B01.5	Students will be able to draw the influence line diagrams for determinate and indeterminate structures.

UCE05B01.6	Students will be able to analyze indeterminate beams and simple plane frames by applying different method of analysis.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05B01.1	2	2	-	1	-	-	-	-	-	-	-	1
UCE05B01.2	3	1	-	1	1	-	-	-	-	-	-	1
UCE05B01.3	3	2	-	1	1	-	-	-	-	-	-	1
UCE05B01.4	3	2	-	1	1	-	-	-	-	-	-	1
UCE05B01.5	3	2	-	1	1	-	-	-	-	-	-	1
UCE05B01.6	3	2	1	1	1	-	-	-	-	-	-	1
Total	**17**	**11**	**1**	**6**	**5**	-	-	-	-	-	-	**6**
Average	**2.83**	**1.83**	**0.16**	**1**	**0.83**	-	-	-	-	-	-	**1**
Equivalent Avg. Attainment	**3**	**2**	**0**	**1**	**1**	-	-	-	-	-	-	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE05B01.1	2	2
UCE05B01.2	2	3
UCE05B01.3	2	1
UCE05B01.4	3	2
UCE05B01.5	2	3
UCE05B01.6	3	3
Total	**14**	**14**
Average	**2.33**	**2.33**
Equivalent Avg. Attainment	**2**	**2**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Basic Structural Analysis	Reddy, C. S.	Tata McGraw Hill
2	Elementary Structural Analysis	Norris and Wilbur	Tata McGraw-Hill
3	Theory & Analysis of StructuresVol. I&II	Jain, O. P. and Jain B. K.	Nem Chand & Bors., Roorkee, India
4	Structural Analysis	Coates, R. C.,Coutie, M. G. &Kong, F.K.	English Language &Book Society & Nelson
5	Structural Analysis	Ghali, A & Neville, M.	Chapman & Hall
6	Advanced Structural Analysis	Jain, A.K.	Nem Chand & Bors., Roorkee, India
7	Theory of Structures, Vol. II	Jain, O.P. & Arya A. S.	Nem Chand & Bors., Roorkee, India
8	Indeterminate Structural Analysis	Kinney, J. S.	McGraw Hill Book
9	Indeterminate Structural Analysis	Wang, C. K.	McGraw Hill Book

Design of Reinforcement Concrete Structures - I

(UCE05B02**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To know about properties of concrete and reinforcing steel, characteristic strengths, stress-strain curves and I.S. specifications.
2. To know about the working stress, ultimate strength and limit state method of design.
3. To analysis and Design of Sections in Bending such as beams and lintels.
4. To know how to design Columns, slabs and staircase.

Course content:

Unit-1

Material properties- Properties of concrete and reinforcing steel, characteristic strengths, stress-strain curves, I.S. specifications.

Unit-2

Design philosophies: Working stress, ultimate strength and limit state method of design. **Unit-3**

Analysis and Design of Sections in Bending: Flexure of beams by working stress and limit state methods, singly and doubly reinforced rectangular, T and L sections. cantilever beam, Lintel.

Unit-4

Shear and Bond: Behavior of beams in shear and bond, design for shear, anchorage and splicing of reinforcement, detailing of reinforcements.

Unit-5

Shrinkage and Creep and Deflection: Effect of shrinkage and creep on stresses in R.C. columns and beams. Limit State of Serviceability, Deflection, Crack Width

Unit-6

Design of Columns: Short and Long columns, eccentrically loaded columns.

Unit-6

Design of Slabs and Staircases: Design of one way and two way slabs; circular slabs, flat slab; yield line theory for slabs, design of stair cases.

Unit-7

Torsion: Design of beam for torsion.

Course outcome:

On completion of the course, the students will be able to:

1. Get a detailed picture of the properties of concrete and steel, which governs design.
2. Understand Design Philosophy and classification of it and which design method is the most useful one in which condition.
3. Know the several types of structural members and their uses in Civil Engineering field.
4. Know about I.S. Codes which are used for design.
5. Design various members (such as beams, columns, slabs, staircase, lintel etc.) in several environmental condition.
6. To know the torsional effects in analysis of different structural components of structures like beams, columns etc.

Table 1

To establish the correlation between Cos & POs

CO	COURSE OUTCOME
UCE05B02.1	Get a detailed picture of the properties of concrete and steel, which governs design
UCE05B02.2	Understand Design Philosophy and classification of it and which design method is the most useful one in which condition

UCE05B02.3	Know the several types of structural members and their uses in Civil Engineering field
UCE05B02.4	Know about I.S. Codes which are used for design
UCE05B02.5	Design various members (such as beams, columns, slabs, staircase, lintel etc.) in several environmental condition
UCE05B02.6	To know the torsional effects in analysis of different structural components of structures like beams, columns etc.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05B02.1	3	2	2	2	2	3	3	3	3	2	1	3
UCE05B02.2	3	2	2	2	2	3	3	3	3	2	1	3
UCE05B02.3	3	3	2	2	2	3	3	3	3	2	1	3
UCE05B02.4	3	3	2	2	2	3	3	3	3	2	1	3
UCE05B02.5	3	3	3	3	3	3	3	3	3	2	1	3
UCE05B02.6	3	3	3	2	2	1	1	1	3	1	1	2
TOTAL	**15**	**13**	**11**	**11**	**11**	**15**	**15**	**15**	**15**	**10**	**5**	**15**
AVERAGE ATTAINMENT	**3**	**2.6**	**2.2**	**2.2**	**2.2**	**3**	**3**	**3**	**3**	**2**	**1**	**3**
EQUIVALENT AVARAGE ATTAINMENT	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**3**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE05B02.1	4	2
UCE05B02.2	4	2
UCE05B02.3	4	2
UCE05B02.4	4	2

UCE05B02.5	4	2
UCE05B02.6	4	2
TOTAL	**24**	**12**
Average Attainment	**4**	**2**
Equivalent Average Attainment	**4**	**2**

References:

Sl. No	**Name of books**	**Author**	**Publisher**
1	Limit state Design of Reinforced Concrete	P.C Vargheese	P.H.I. Publisher
2	Limit State Design of R.C.C Structures	A.K. Jain	Nem chand Brothers, Roorkee
3	Design of Reinforced Concrete Structures	N.Krishnaraju	CBS Publishers
4	Reinforced Concrete Design	C.K.Wang and C.G. Salman	Harpur International Edition
5	Reinforced Concrete Design	Mallik and Gupta	Oxford and IBH Publications
6	Reinforced concrete design	S.U. Pillai and Devdas Menon	Tata Mcgraw –Hill Publishing company limited

Concrete Technology

(UCE05B03**)**

Total Credit: 03 **Contract Period: 03 (3L+0 T)**

Courses objective:

1. To learn about the history, production method and components of cement.
2. To understand about the components of concrete and effect on its properties.
3. To understand the use of admixtures in improving properties and quality concreting practices.

4. To learn about mix design and selection of cement types for construction of specific structures.

Course content:

Unit- 1

Cement and admixtures:

Types of Portland cement- hydration- setting and hardening process- Special hydraulic cement- Chemical and mineral admixtures.

Unit 2

Aggregates:

Shape and texture-bond strength-specific gravity-bulk density- and moisture content of aggregates-bulking of sand-deleterious substances in aggregates-alkali-aggregate-reaction- sieve analysis and grading curves-fineness modulus-practical grading-gap grades aggregates.

Unit – 3

Fresh Concrete:

Rheological aspects such as workability– flow ability, compatibility and mobility of concrete- factors affecting workability- Determination of workability, segregation- bleeding & laitance.

Unit – 4

Strength of concrete:

Compressive strength and factors affecting it- behaviors of concrete under various stress states-testing of hardened concrete-cube and cylindrical test-platen affect-flexure test-splitting test-non-destructive test such as rebound hammer, USPV, core cutting stress strain relation and modulus of elasticity-shrinkage-creep of concrete and its effect.

Unit – 5

Durability of concrete:

Corrosion of rebars- sulphate attack- frost action- deterioration by fire- concrete in sea water- acid attack-carbonation.

Unit – 6

Mix-Design:

Basic consideration-cost-workability-strength and durability-grading –method of mix design-acceptance criteria of mix design.

Unit – 7

Advances in construction materials:

High strength concrete, High performance concrete, Fiber reinforced concrete, Concrete containing polymers, Heavy weight and light weight concrete, Mass concrete, Blended concrete, Ferro cement and

its application.

Course Outcome:

1. The students will be learning mix designs and also the beneficial use of admixtures.
2. The students will be able to understand the different types of cement, hydration process and various admixtures used.
3. The students will learn the different compositions of cement and concrete and its influence on strength.
4. The students will be well versed with different preliminary test and quality control tests.
5. The students will be able to understand the compressive strength characteristics of concrete, size effect, non-destructive tests and factors affecting concrete.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE05B03.1	The students will be learning mix designs and also the beneficial use of admixtures.
UCE05B03.2	The students will be able to understand the different types of cement, hydration process and various admixtures used.
UCE05B03.3	The students will learn the different compositions of cement and concrete and its influence on strength.
UCE05B03.4	The students will be well versed with different preliminary test and quality control tests.
UCE05B03.5	The students will be able to understand the compressive strength characteristics of concrete, size effect, non-destructive tests and factors affecting concrete.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05B03.1	3	3	3	3	2	-	-	-	-	-	-	3

UCE05B03.2	3	1	2	2	1	-	-	-	-	-	-	3
UCE05B03.3	3	1	2	2	1	-	-	-	-	-	-	3
UCE05B03.4	3	2	2	3	2	-	-	-	-	-	-	3
UCE05B03.5	3	3	3	3	2	-	-	-	-	-	-	3
Total	**15**	**10**	**12**	**13**	**8**	**-**	**-**	**-**	**-**	**-**	**-**	**15**
Average	**3**	**2**	**2.5**	**2.6**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
Equivalent Avg. Attainment	**3**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE05B03.1	2	2
UCE05B03.2	3	3
UCE05B03.3	4	4
UCE05B03.4	3	4
UCE05B03.5	3	3
Total	**15**	**16**
Average	**3**	**3.2**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Concrete Technology	M.S.Shetty	S.Chand & Comp.Ltd
2	Properties of concrete	A.M.Neville	Longman,UK
3	Concrete Structure, properties and materials	P.K.Mehta	Prentice Hall.Inc.USA
4	Concrete technology	M.L.Gambhir	Tata McGraw Hill, New Delhi
5	Polymers in Civil Engg.	J.H.Bungey	Surrey University Press, New York

Geotechnical Engineering - I

(UCE05B04**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To understand the physical and mechanical properties of soils
2. To determine parameters from soil testing to characterize soil properties, soil strength, and soil deformations
3. To apply the principles of soil mechanics to analyze and design simple geotechnical systems

Course content:

Unit 1

Introduction: Introduction to Geotechnical Engineering; Unique nature of soil; Soil formation and soil types.

Unit 2

Simple Soil Properties: Basic Definitions; Phase relations; Index properties of soil-soil grain and soil aggregate properties of coarse grained and fine grained soils.

Unit 3

Soil Classification: Indian Standard Soil Classification System

Unit 4

Principle of Effective Stress and related Phenomena: Principle of effective stress; Capillarity; seepage force and quick sand condition; Total pressure and elevation heads.

Unit 5

Permeability: One dimensional flow; Permeability of soils-Darcy's law; Laboratory methods of determination; Permeability as a function of soil type, void ratio, soil fabric, and effective stress; Pumping out test for field determination of permeability.

Unit 6

Seepage through Soils: Two dimensional flow problems- steady flow, confined flow and unconfined flow; Flow nets and their characteristics; Uplift pressure; Exit gradient; Failure due to piping; Criteria for design of filters; Quick Sand; Liquefaction.

Unit 7

Compaction Behavior: Clay minerals (basic concepts) and soil structure; Compaction- Theory of compaction; Laboratory compaction tests; Different methods of compaction control.

Unit 8

Compressibility and Consolidation behavior: Compressibility-Effects of soil type, stress history and effective stress on compressibility; Consolidation-Factors affecting consolidation and compressibility parameters; Normally consolidated and over consolidated soils; Different forms of primary consolidation equation; Transient flow condition; Terzaghi's theory of one-dimensional consolidation and time-rate of consolidation; Evaluation of compressibility and consolidation parameters from consolidation parameters from consolidometer test data.

Unit 9

Stress Due to Applied Load: Introduction; Stress-Strain parameters; Geo-static Stresses; Vertical stress due to concentrated loads; Isobar diagram; Isobar diagram; Vertical Stress distribution on a horizontal plane; Influence Diagram; Vertical stress distribution due to line load, strip load, circular area, rectangular area; Nemark's Influence charts.

Unit 10

Shear Strength Behavior: Introduction; Stress at a point and Mohr's stress circle; Mohr-Coulomb failure criterion; Laboratory tests for shear strength determination; Effective stress and total stress shear strength parameters; UU, CU and CD tests and their relevance to field problems; Shear strength characteristics of normally consolidated and pre-consolidated clays; Shear strength characteristics of sands

Course outcome:

1. Students will be able to describe soils and determine their physical characteristics such as grain size, water content, and void ratio
2. Students will be able to classify different type of soils
3. Students will be able to determine compaction characteristics of soils
4. Students will be able to understand the concept of total, effective stresses and pore water pressures
5. Students will be able to determine soil permeability
6. Students will be able to determine how surface stresses are distributed within a soil mass, understand the effects of seepage on the stability of structures, understand the concept of shear strength behavior of soils under different drainage condition by different test methods in the laboratory and field

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome (CO)	Course Outcome
UCE05B04.1	Students will be able to describe soils and determine their physical characteristics such as grain size, water content, and void ratio
UCE05B04.2	Students will be able to classify different type of soils
UCE05B04.3	Students will be able to determine compaction characteristics of soils
UCE05B04.4	Students will be able to understand the concept of total, effective stresses and pore water pressures
UCE05B04.5	Students will be able to determine soil permeability
UCE05B04.6	Students will be able to determine how surface stresses are distributed within a soil mass, understand the effects of seepage on the stability of structures, understand the concept of shear strength behavior of soils under different drainage condition by different test methods in the laboratory and field

Table 2

Slight (Low): 1 **Moderate: 2** **Substantial (High): 3** **No Correlation: "-"**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05B04.1	3	3	2	1	1	3	2	-	1	-	-	1
UCE05B04.2	3	3	2	1	1	3	2	-	1	-	-	1
UCE05B04.3	3	3	2	1	1	3	2	-	1	-	-	1
UCE05B04.4	3	3	2	1	1	3	2	-	1	-	-	1
UCE05B04.5	3	3	2	1	1	3	2	-	1	-	-	1
UCE05B04.6	3	3	2	1	1	3	2	-	1	-	-	1
Total	**18**	**18**	**12**	**6**	**6**	**18**	**12**	**-**	**6**	**-**	**-**	**6**
Average	**3**	**3**	**2**	**1**	**1**	**3**	**2**	**-**	**1**	**-**	**-**	**1**
Equivalent Avg. attainment	**3**	**3**	**2**	**1**	**1**	**2**	**2**	**-**	**1**	**-**	**-**	**1**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE05B04.1	4	3
UCE05B04.2	3	3
UCE05B04.3	4	3
UCE05B04.4	4	3
UCE05B04.5	3	3
UCE05B04.6	4	4
Total	**22**	**19**
Average	**3.67**	**3.17**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Soil Mechanics And Foundation Engineering	K R Arora	Standard Publisher Dist.
2	Soil Mechanics and Foundations	B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
3	Textbook of Soil Mechanics and Foundation Engineering: Geotechnical Engineering series	V N S Murthy	CBS
4	Geotechnical Engineering	C. Venkatramaiah	New Age International Pvt Ltd
5	Soil Mechanics	T. William Lambe, Robert V. Whitman	Wiley

Transportation Engineering - I

(UCE05B05**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To understand the importance of transportation and characteristics of road transport
2. To know about the history of highway development, surveys and classification of roads
3. To study about the geometric design and construction of highways.
4. To know about the use and different tests on pavement materials.
5. To know about road failure and pavement maintenance and use of surface drainage in the highway.

Course content:

Unit-1

Role of Transportation Engineering; Modes of transportation-Their importance and limitations; Importance of Highway Transportation;

Unit-2

Highway Planning- Principle of Highway Planning, Road development and Financing, Privatization of Highways,

Unit-3

Highway Alignment

Requirements, Engineering Surveys for Highway locations;

Unit-4

Geometric Design

Cross section elements, Width, Camber, Design Speed, Sight distances, Requirements and Design of horizontal and Vertical Alignments; Hill Road

Unit-5

Construction of Highway Pavements

Different type of Road; Pavement construction- Types of Pavement, Earth work, Sub grade, Water bound macadam, Bituminous Macadam, Earthen Roads, Bituminous Surfacing: Rigid Pavement Joints;

Unit-6

Highway Materials- Material Characterization, Test of Subgrade soil, Aggregates and Bituminous Materials, Bituminous Mix design;

Unit-7

Highway Drainage-Surface Drainage and Sub-soil drainage; Maintenance and Strengthening;

Course outcome:

On completion of the course, the students will be able to:

1. Carry out surveys involved in planning and highway alignment.
2. Design cross section elements, sight distance, horizontal and vertical alignment.
3. Determine the characteristics of pavement materials and construction of pavements.
4. Understand road failures and remedial measures for road failures.
5. Use of highway drainage and its maintenance.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE05B05.1	Carry out surveys involved in planning and highway alignment.
UCE05B05.2	Design cross section elements, sight distance, horizontal and vertical alignment.
UCE05B05.3	Determine the characteristics of pavement materials.
UCE05B05.4	Understand road failures and remedial measures for road failures.
UCE05B05.5	Use of highway drainage and its maintenance.

Table 2

Slight (Low): 1 **Moderate: 2** **Substantial (High): 3** **No Correlation: "-"**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05B05.1	3	3	2	2	3	1	2	-	3	3	3	2
UCE05B05.2	3	3	2	2	3	1	2	-	3	3	3	2
UCE05B05.3	3	3	2	2	3	1	2	-	3	3	3	2
UCE05B05.4	3	3	2	2	3	1	2	-	3	3	3	2
UCE05B05.5	3	3	2	2	3	1	2	1	3	3	3	2
Total	**12**	**12**	**8**	**8**	**12**	**4**	**8**	**-**	**12**	**12**	**12**	**8**

Average	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**-**	**3**	**3**	**3**	**2**
Equivalent Avg. atainment	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**-**	**3**	**3**	**3**	**2**

Table 3

To establish the correlation between COs & PSOs

CO	**PSO1**	**PSO2**
UCE05B05.1	4	3
UCE05B05.2	4	3
UCE05B05.3	4	3
UCE05B05.4	4	3
UCE05B05.5	4	3
Total	**20**	**15**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	**Name of Book**	**Author**	**Publisher**
1	Highway Engineering	Khanna, S.K. and Justo, CEG,	Nem Chand & Bros
2	Highway Engineering	Kadiyali, L.R	Khanna Publishers, Delhi, 1996.

Environmental Engineering - I

(UCE05B06**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To make the students conversant with sources of water and its demand.
2. To understand the basic characteristics of water and its determination.
3. To provide adequate knowledge about the water treatment processes and its design.
4. To have adequate knowledge on distribution network and pumping.
5. To have proper knowledge on noise pollution and its adverse effect on environment.
6. To study the effect of air pollution and its control measures.
7. To gain knowledge about solid waste characteristics and disposal.

Course content:

Unit- 1

Water Demand:

Environment and its components, Design flows, design periods, and design population, factors affecting water consumption, water demand, and design capacities for various water supply components, Role of an Environmental Engineer.

Unit 2

Quality of Water:

The hydrological cycle and water quality, physical, chemical and biological water quality, water quality parameters, water quality requirements, Indian standards.

Unit – 3

Purification of Water supplies:

Historical overview of water treatment, water treatment process (Theory and Application):screening, plain sedimentation tank and its theory, sedimentation aided with coagulation, design of sedimentation tank, flocculation sand filtration, rapid gravity filter, pressure filters, disinfections- Necessary requirements of a disinfectant, methods of disinfecting, softening, Aeration.

Unit – 4

Distribution of Water:

Methods of distribution of water, distribution reservoirs, distribution systems, distribution system components, capacity and pressure requirements, design of distribution system, hydraulic analysis of

distribution systems, pumping required for water supply systems.

Unit – 5

Noise Pollution:

Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Unit – 6

Air Pollution Sources and Meteorological aspects of air pollutant dispersion:

Classification and properties of air pollutants, emission sources and impacts, behavior and fate of air pollutants, air quality standards and limits, Temperature lapse rates and stability, plume behavior, dispersion of air pollutants, estimation of plume rise.

Unit – 7

Engineered Systems for Air pollution Control:

Atmospheric Cleansing process, Control devices for particulate contaminants, Control devices for gaseous contaminants.

Unit – 8

Municipal Solid Wastes:

Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid wastes management (reuse/ recycle, energy recovery, treatment and disposal).

Course outcome:

1. Students will be able to analyze characteristics of water and air.
2. Students will be able to forecast the population and estimate water demand.
3. Students will be able to design various water treatment units.
4. Students will be able to design the water distribution network and air pollution controlling devices.
5. Students will be able to identify the physical and chemical composition of wastes
6. Students will be able to understand the design of waste containment systems.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE05B06.1	Students will be able to analyze characteristics of water.
UCE05B06.2	Students will be able to forecast the population and estimate water demand.

UCE05B06.3	Students will be able to design various water treatment units.
UCE05B06.4	Students will be able to design the distribution network.
UCE05B06.5	Students will be able to identify the physical and chemical composition of wastes and design waste containment systems.
UCE05B06.6	Students will be able to understand the design of waste containment systems.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO1 1	PO1 2
UCE05B06.1	2	2	1	1	-	-	-	-	2	-	-	1
UCE05B06.2	2	2	1	1	-	-	-	-	2	-	-	1
UCE05B06.3	2	2	1	1	-	-	-	-	2	-	-	1
UCE05B06.4	2	2	1	1	-	-	-	-	2	-	-	2
UCE05B06.5	2	1	1	1	-	-	-	-	2	-	-	1
UCE05B06.6	2	1	1	1	-	-	-	-	2	-	-	1
Total	**12**	**1.67**	**6**	**6**	**-**	**-**	**-**	**-**	**12**	**-**	**-**	**7**
Average	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1.16**
Equivalent Avg. Attainment	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE05B06.1	**3**	**3**
UCE05B06.2	**3**	**3**
UCE05B06.3	**3**	**4**
UCE05B06.4	**4**	**4**
UCE05B06.5	**2**	**3**
UCE05B06.6	**3**	**3**

Total	**18**	**20**
Average	**3**	**3.33**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Environmental Engineering	Peavy, H.S.,Rowe, D.R and Tchobanoglous	McGraw Hill Book Company,1985.
2	Water and waste water Engineering	G.M.,Geyer,J.C Okun,D.S College	Harper Collins College
3	Water supply and Pollution Control	Viessman,Jr. and Hammer,M.J	
4	Water supply, Waste Disposal and Environmental Pollution Engineering	A.K.Chatterjee	Khanna Publishers
5	Water supply and sanitary Engineering	S.C.Rangawala, K.S.Rangawala, P.S.Rangawala	Charotar publishing housing
6	Water supply and sanitary Engineering	G.S.Birdie & J.S. Birdie	Dhanpat Rai, publishing Company,
7	Environmental Engineering	Row D.R. and Row D.R. and Tchobanoglous	McGraw Hill Book Company, 1985
8	Sewage Disposal and Air Pollution Control Engineering Environmental Engineering Vol.I	GS.K.Garg,	Khanna Publishers,1979
	Water and Waste water Engg	Metcalf & Eddy	Tata McGraw Hill

Cement and Concrete Lab-I

(UCE05P01)

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. Determination of Fineness and Specific Gravity of cement, course aggregate and fine aggregate.
2. Determination of consistency, initial and Final Setting times of standard Cement Paste.
3. Determination of Compressive, tensile and flexural Strength of Cement
4. Soundness test of cement.
5. Mix Design: IS Code method and workability of cement by slump test and compaction factor test.
6. Determination of percentage of voids, Bulk density, moisture content and water absorption of coarse and Fine Aggregates.
7. Preparing and curing concrete specimens for tests & Determination of compressive strength of concrete cubes.
8. Study of stress - strain characteristics of concrete and tests for tensile strength of concrete.
9. Water absorption and compressive strength of bricks.
10. Tensile and bend test of M.S. and HYSD bars.

Course content:

Unit-1

Fineness and Specific Gravity of cement, course aggregate and fine aggregate.

Unit-2

Consistency, initial and Final Setting times of standard Cement Paste.

Unit-3

Compressive, tensile and flexural Strength of Cement

Unit-4

Soundness test of cement.

Unit-5

Mix Design: IS Code method and workability of cement by slump test and compaction factor test.

Unit-6

Determination of percentage of voids, Bulk density, moisture content and water absorption of coarse and Fine Aggregates.

Unit-7

Preparing and curing concrete specimens for tests & Determination of compressive strength of concrete cubes.

Unit-8

Study of stress - strain characteristics of concrete and tests for tensile strength of concrete.

Unit-9

Water absorption and compressive strength of bricks.

Unit-10

Tensile and bend test of M.S and HYSD bar

Course outcome:

On completion of the course, the students will be able to:

1) Understand the physical and engineering properties of ingredients of concrete i.e cement, fine aggregate and coarse aggregate.
2) Understand the engineering property of mild steel and HYSD bars.
3) Conduct Quality Control tests on fresh & hardened concrete.
4) Design of concrete mix.
5) Identify the class of brick by conducting compressive strength tests.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE05P01.1	Students will be able to Understand the physical and engineering properties of ingredients of concrete i.e cement, fine aggregate and coarse aggregate
UCE05P01.2	Students will be able to Understand the engineering property of mild steel and HYSD bars.
UCE05P01.3	Students will be able to Conduct Quality Control tests on fresh & hardened concrete.
UCE05P01.4	Students will be able to Design of concrete mix.
UCE05P01.5	Students will be able to Identify the class of brick by conducting compressive strength tests.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05P01.1	3	-	3	3	1	2	-	3	3	-	2	3
UCE05P01.2	3	-	3	3	2	2	-	3	3	-	2	3
UCE05P01.3	3	-	3	3	3	2	-	3	3	-	2	3
UCE05P01.4	3	-	3	3	2	2	-	3	3	-	2	3
UCE05P01.5	3	-	3	3	3	2	-	3	3	-	2	3
Total	**15**	**0**	**15**	**15**	**11**	**10**	**-**	**15**	**15**	**-**	**10**	**15**
Average	**3**	**0**	**3**	**3**	**2.2**	**2**	**-**	**3**	**3**	**-**	**2**	**3**
Equivalent Avg. attainment	**3**	**0**	**2**	**3**	**2**	**3**	**-**	**3**	**3**	**-**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE05P01.1	3	3
UCE05P01.2	3	3
UCE05P01.3	3	3
UCE05P01.4	3	3
UCE05P01.5	3	3
Total	**3**	**20**
Average	**3**	**3.33**
Equivalent Avg. Attainment	**3**	**3**

References:

SL. NO	**Name of the Books**	**Authors**	**Publishers**
1	Concrete Technology	M.S.Shetty	S.Chand & Comp.Ltd
2	Properties of concrete	A.M.Neville	Longman,UK

3	Concrete Structure, properties and materials	P.K.Mehta	Prentice Hall.Inc.USA
4	Concrete technology	M.L.Gambhir	Tata McGraw Hill,New Delhi
5	Polymers in Civil Engineering	J.H.Bungey	Surrey University Press,New York

GEOTECHNICAL ENGINEERING LABORATORY-I

(UCE05P02)

Total Credit: 01 **Contact Periods: 02(0L+0T+2P)**

Courses objective:

1. To identify soils in geotechnical engineering practice
2. To perform laboratory tests needed to determine soil design parameters

List of Experiments:

1. Sieve analysis of Soil.
2. Specific Gravity of Soil.
3. Hydrometer analysis of Soil.
4. Field Density of Soil.
5. Atterberg Limits of Soil.
6. Permeability test of Soil.
7. Relative Density Test.
8. Determination of moisture content by Rapid Moisture Meter.
9. Standard Proctor test of Soil.
10. Modified Proctor test of Soil.

Course outcome:

1. Students will be able to identify and classify soil based on standard geotechnical engineering practice
2. Students will be able to perform and analyze the permeability tests.
3. Students will able to learn to determine the specific gravity of soil by different methods.
4. Students will able to learn to determine the optimum moisture content and maximum dry density of soil by different method.
5. Students will able to learn to determine the Atterberg limits (i.e Liquid limit, Plastic limit, Shrinkage limit and Plasticity Index) of soil.

Table 1

To establish the correlation between COs &Pos

No. of Curse Outcome (CO)	Course Outcome
UCE05P02.1	Students will be able to identify and classify soil based on standard geotechnical engineering practice
UCE05P02.2	Students will be able to perform and analyze the permeability tests
UCE05P02.3	Students will able to learn to determine the specific gravity of soil by different methods
UCE05P02.4	Students will able to learn to determine the optimum moisture content and maximum dry density of soil by different method.
UCE05P02.5	Students will able to learn to determine the Atterberg limits (i.e Liquid limit, Plastic limit, Shrinkage limit and Plasticity Index) of soil.

Table 2

Slight (Low): 1 **Moderate: 2** **Substantial (High): 3** **No Correlation: 0**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05P02.1	3	3	2	1	1	3	2	1	1	1	0	3
UCE05P02.2	3	3	2	1	1	3	2	1	1	1	0	3
UCE05P02.3	3	3	2	1	1	3	2	1	1	1	0	3
UCE05P02.4	3	3	2	1	1	3	2	1	1	1	0	3
UCE05P02.5	3	3	2	1	1	3	2	1	1	1	0	3
Total	**15**	**15**	**10**	**5**	**5**	**15**	**10**	**5**	**5**	**5**	**0**	**15**

Average	**3**	**3**	**2**	**1**	**1**	**3**	**2**	**1**	**1**	**1**	**0**	**3**
Equivalent Avg. attainment	**3**	**3**	**2**	**1**	**1**	**3**	**2**	**1**	**1**	**1**	0	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE05P02.1	4	3
UCE05P02.2	3	3
UCE05P02.3	3	3
UCE05P02.4	3	3
UCE05P02.5	3	3
Total	**16**	**13**
Average	**3.2**	**2.6**
Equivalent Avg. Attainment	**3**	**3**

References:

Name of the Books	Author	Publisher
Soil Testing and Instrumentation.	Alam Singh,	New Age International, New Delhi, 1998. (Revised Edition),

Transportation Engg. Lab-I

(UCE05P03**)**

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. To know the instruments and their uses.
2. To know the material properties so that we can use them in specific field.
3. To know how to select the materials on the basis of result for different use in Civil Engineering field.

4. To compare the experimental value with IS values and use it judiciously.

Course content:

Unit-1

Determination of Water absorption of road aggregates

Unit-2

Determination of Specific gravity of aggregates

Unit-3

Determination of Impact Test of aggregates

Unit-4

Los Angel's abrasion test

Unit-5

Devel's abrasion test

Unit-6

Test for Crushing Strength of Aggregates

Unit-7

Determination o f Flakiness and Elongation Indices of aggregates, Angularity number

Unit-8

Determination of Penetration of bitumen.

Unit-9

Determination of Viscosity of bitumen (Saybolt)

Course outcome:

1. Students will be able to learn procedure and purpose of Specific gravity and Water absorption of road aggregates.
2. Students will be able to learn procedure and purpose of Impact and Crushing Strength value of aggregates.
3. Students will be able to learn procedure and purpose of Los Angel's abrasion and Devel's abrasion value of aggregates.
4. Students will be able to learn procedure and purpose Flakiness Index and Elongation Index, and Angularity number of aggregates.
5. Students will be able to learn procedure and purpose of Penetration of bitumen and Determination of Viscosity of bitumen (Saybolt).

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE05P03.1	Students will be able to learn procedure and purpose of Water absorption test of road aggregates.
UCE05P03.2	Students will be able to learn procedure and purpose of Impact and Crushing Strength value of aggregates.
UCE05P03.3	Students will be able to learn procedure and purpose of Los Angel's abrasion and Devel's abrasion value of aggregates.
UCE05P03.4	Students will be able to learn procedure and purpose Flakiness Index and Elongation Index, and Angularity number of aggregates.
UCE05P03.5	Students will be able to learn procedure and purpose of Penetration of bitumen and Determination of Viscosity of bitumen (Saybolt).

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05P03.1	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P03.2	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P03.3	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P03.4	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P03.5	3	2	2	2	2	1	1	1	2	2	2	3
Total	**15**	**10**	**10**	**10**	**10**	**5**	**5**	**5**	**10**	**10**	**10**	**15**
Average	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**
Equivalent Avg. atainment	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE05P03.1	3	3
UCE05P03.2	3	3
UCE05P03.3	3	3
UCE05P03.4	3	3
UCE05P03.5	3	3
Total	**15**	**15**
Average	**3**	**3**
Equivalent Avg. Attainment	**3**	**3**

References:

Name of the Books	Author	Publisher
.Concrete Technology	M.S.Shetty S.Chand & Comp.Ltd	New Age International, New Delhi, 1998. (Revised Edition),
Method of Test for aggregate IS:2386,(Part I,II,III,IV) 1963.		Bureue of Indian Standars
Determination of Softening point of bitumen. IS:1205-1978		Bureue of Indian Standars
Determination of Penetration of bitumen. IS:1203-1978		Bureue of Indian Standars
Determination of Viscosity of bitumen. IS:1206-1978(I)		Bureue of Indian Standars
Determination of Flash Point of bitumen. IS:1209-1978		Bureue of Indian Standars

Environmental Engg. Lab-I

(UCE05P04**)**

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. To obtain the collection procedure and analysis of sound samples.
2. To obtain the concepts of classification of solid wastes.
3. To obtain the sampling procedure of air sample.
4. To obtain the characterizing parameters of water sample like turbidity, dissolved oxygen, colour, conductivity, pH, alkalinity, acidity etc.
5. To obtain the alkalinity and acidity of water sample.
6. To obtain the hardness, chlorides content of water sample.
7. To obtain the chloride content, residual chlorine of water sample.

Course content:

Unit- 1

Collection and analysis of sound samples.

Unit 2

Classification of Solid wastes.

Unit – 3

Air volume sampling.

Unit – 4

Determination of turbidity, color and conductivity.

Unit – 5

Determination of pH, alkalinity and acidity.

Unit – 6

Determination of hardness and chlorides.

Unit – 7

Determination of residual chlorine and chlorine demand.

Unit – 8

Determination of Dissolved Oxygen.

Course outcome:

1) Students will be able to learn about the sampling procedure and analysis of sound samples.
2) Students will be able to learn about the classification of solid waste.

3) Students will be able to determine turbidity, color and conductivity.
4) Students will be able to determine pH, alkalinity and acidity.
5) Students will be able to determine hardness and chlorides.
6) Students will be able to determine residual chlorine and chlorine demand, Dissolved Oxygen.

Table 1

To establish the correlation between Cos & Pos

No. of Course Outcome (CO)	Course Outcome
UCE05P04.1	Students will be able to learn about the sampling procedure and analysis of sound samples.
UCE05P04.2	Students will be able to learn about the classification of solid waste.
UCE05P04.3	Students will be able to determine turbidity, color and conductivity.
UCE05P04.4	Students will be able to determine pH, alkalinity and acidity**.**
UCE05P04.5	Students will be able to determine hardness and chlorides.
UCE05P04.6	Students will be able to determine residual chlorine and chlorine demand, Dissolved Oxygen.

Table2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05P04.1	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P04.2	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P04.3	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P04.4	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P04.5	3	2	2	2	2	1	1	1	2	2	2	3
UCE05P04.6	3	2	2	2	2	1	1	1	2	2	2	3
Total	**18**	**12**	**12**	**12**	**12**	**6**	**6**	**6**	**12**	**12**	**12**	**18**
Average	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**
Eq. Av Attainment	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE05P04.1	4	3
UCE05P04.2	4	3
UCE05P04.3	4	3
UCE05P04.4	4	3
UCE05P04.5	4	3
UCE05P04.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

DETAIL

COURSE CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.E/B.TECH

IN

CIVIL ENGINEERING

(6th SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

TRIPURA (WEST)

Structural Analysis-II

(UCE06B01**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To obtain fundamental understanding of the concepts of rotation and translation of joints.
2. To understand the concept of contribution of bending moment due to external load, rotation and translation of joints.
3. To obtain an understanding of various classical methods of analysis and their relative advantages and limitations.
4. To understand the concept of elastic and plastic analysis of structure.

Course content:

Unit- 1

Slope Deflection Method:

Introduction, Development of slope-deflection equations and analysis of fixed beam, continuous beam and simple frame with and without translation of joints

Unit 2

Moment Distribution Method:

Introduction, Definition of terms-Distribution factor, Carry over factor, Development of method of analysis of fixed beam, continuous beam and simple frame with and without translation of joints.

Unit – 3

Kani's Method:

Introduction, Basic Concept, Analysis of Continuous beams and analysis of rigid jointed no sway plane frames.

Unit – 4

Column Analogy Method:

Introduction, Development of method, Analysis of fixed beam, and frame.

Unit – 5

Cables and Suspension Bridge:

Suspension Bridges, Analysis of cables with concentrated and distributed loadings. Basics of two and three hinged stiffening girders, influence line for bending moment and shear force in stiffening girders.

Unit – 6

Analysis of Multistorey Building Frame:

Analysis by approximate methods – Substitute Frame Method, Portal Method, Cantilever Method and

Factor Method

Unit – 7

Plastic Analysis:

Basics of Plastic Analysis, Application of Static and Kinematic theorem for plastic analysis of beams and plane frames.

Course outcome:

1. Students will be able to find out amount of rotation and translation of joints in indeterminate structure due to loading.
2. Students will be able to find out end moment of the member, shear force, bending moment at any cross section of indeterminate structure.
3. Students will be able to identify the critical section in shear and bending.
4. Students will get multiple tools to analyze the structure.
5. Students will be able to analyze the complete frame structure.
6. Students will be able to analyze cable and suspension bridges, further they will be able to get idea about plastic analysis and failure mechanism.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE06B01.1	Students will be able to find out amount of rotation and translation of joints in indeterminate structure due to loading.
UCE06B01.2	Students will be able to find out end moment of the member, shear force, bending moment at any cross section of indeterminate structure.
UCE06B01.3	Students will be able to identify the critical section in shear and bending.
UCE06B01.4	Students will get multiple tools to analyse the structure.
UCE06B01.5	Students will be able to analyse the complete frame structure.
UCE06B01.6	Students will be able to analyze cable and suspension bridges, further they will be able to get idea about plastic analysis and failure mechanism.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE06B01.1	3	3	3	3	3	1	1	1	3	1	1	3
UCE06B01.2	3	3	3	3	3	1	1	1	3	1	1	3
UCE06B01.3	3	3	3	3	3	1	1	1	3	1	1	3
UCE06B01.4	3	3	3	3	3	1	1	1	3	1	1	3
UCE06B01.5	3	3	3	3	3	1	1	1	3	1	1	3
UCE06B01.6	3	3	3	3	3	1	1	1	3	1	1	3
Total	**18**	**18**	**18**	**18**	**18**	**6**	**6**	**6**	**18**	**6**	**6**	**18**
Average	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**1**	**1**	**3**
Equivalent Avg. atainment	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**1**	**1**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE06B01.1	4	3
UCE06B01.2	4	3
UCE06B01.3	4	3
UCE06B01.4	4	3
UCE06B01.5	4	3
UCE06B01.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Name of Books		Author	Publisher
1.	Basic Structural Analysis	Reddy, C. S.	Tata McGraw Hill
2.	Elementary Structural Analysis	Norris and Wilbur	Tata McGraw Hill
3.	Theory & Analysis of Structures Vol. I&II	Jain, O. P. and Jain B. K	Nem Chand & Bros.Roorkee
4.	Structural Analysis	Coates, R. C., Coutie, M. G. & Kong, F.K	English Language & Book Society & Nelson
5	Structural Analysis	Ghali, A & Neville,	Chapman & Hall Publications
6	Advanced Structural Analysis	Jain, A.K	Nem Chand & Bors., Roorkee, India
7	Theory of Structures, Vol. II	Jain, O.P. & Arya A. S	Nem Chand & Bors., Roorkee, India
8	Indeterminate Structural Analysis	Kinney, J.S	McGraw Hill Book Company
9	Indeterminate Structural Analysis	Wang, C. K	McGraw Hill Book Company
10	Matrix Analysis of framed Structures	Weaver, W& Gere, J. M.	CBS Publishers Distributors, Delhi.
11	Plastic Method of Structural	Neal, B. G	Chapman and Hall

Design of Steel Structures- I

(UCE06B02**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To primarily learn the behaviour and design of various structural steel components.
2. To gain an educational and comprehensive experience in the design of simple steel members and their connections.
3. To learn the design of different steel members and its connections such as bolted connections using ordinary bolts and HSFG bolts, riveted connections etc, in two dimensions.

4. To obtain the ability to analyze and design structural steel components such as tension members, compression members and flexural members.
5. To garner familiarity with professional and contemporary issues in the design of modern and practical structural steel components.

Course content:

Unit- 1

Introduction

Properties of structural steel, I.S. Rolled Sections, I.S. Specifications.

Unit 2

Design Approach

Factor of safety, permissible and working stresses, elastic method, plastic method, introduction to limit states of design.

Unit – 3

Connections

Riveted, bolted and welded connections, strength & efficiency and design of joints, Introduction to high strength friction grip bolts.

Unit – 4

Tension Members

Design of tension members.

Unit – 5

Compression members

Strut and column, built-up column, column with lacings and batten. column splices.

Unit – 6

Beams

Stability of flange and web, built-up sections, plate girders including stiffeners, connections and curtailment of flange plates. Design of web Splice.

Unit – 7

Beam-column connection.

Stability considerations, Interaction formulae.

Unit –8

Column bases

Slab base, Gusseted base and Grillage footing.

Course outcome:

1. Similarity with structural steel fabrication process and construction through lecture presentation.
2. Identify and compute the design loads on a typical steel building.
3. Identify the different failure modes of bolted and welded connections, and determine their design strengths.
4. Design bolted and welded connections for tension and compression members and beams.
5. Identify the different failure modes of steel tension and compression members and beams, and compute their design strengths.
6. Select the most suitable section shape and size for tension and compression members and beams (flexural members) according to the specific design criteria as per IS-800 (2007) and SP-6 (1964).
7. Apply the relevant IS-800 (2007) codal provisions to ensure safety and serviceability of structural steel elements.

Table 1

To establish the correlation between COs &POs

No. of Course Outcome (CO)	Course Outcome
UCE06B02.1	Familiarity with structural steel fabrication process and construction through lecture presentation.
UCE06B02.2	Identify and compute the design loads on a typical steel building.
UCE06B02.3	Identify the different failure modes of bolted and welded connections, and determine their design strengths.
UCE06B02.4	Design bolted and welded connections for tension and compression members and beams
UCE06B02.5	Identify the different failure modes of steel tension and compression members and beams, and compute their design strengths.
UCE06B02.6	Select the most suitable section shape and size for tension and compression members and beams (flexural members) according to the specific design criteria as per IS-800 (2007) and SP-6 (1964).
UCE06B02.7	Apply the relevant IS-800 (2007) codal provisions to ensure safety and serviceability of structural steel elements.

Table2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -"-"

CO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12
UCE06B02.1	3	3	3	3	1	1	1	1	1	1	1	3
UCE06B02.2	3	3	3	3	1	1	1	1	1	1	1	3
UCE06B02.3	3	3	3	3	1	1	1	1	1	1	1	3
UCE06B02.4	3	3	3	3	1	1	1	1	1	1	1	3
UCE06B02.5	3	3	3	3	1	1	1	1	1	1	1	3
UCE06B02.6	3	3	3	3	1	1	1	1	1	1	1	3
UCE06B02.7	3	3	3	3	1	1	1	1	1	1	1	3
Total	**21**	**21**	**21**	**21**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**21**
Average	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE06B02.1	4	2
UCE06B02.2	3	3
UCE06B02.3	3	4
UCE06B02.4	4	4
UCE06B02.5	4	4
UCE06B02.6	4	4
UCE06B02.7	4	4
Total	**26**	**25**
Average	**3.7**	**3.5**
Equivalent Avg. Attainment	**4**	**4**

References:

Sl No.	Name of Book	Author	Publisher
1.	Design of Steel Structures	S.S. Bhavikatti,	I.K.International Publishing House Pvt. Ltd., New Delhi, Bangalore.
2.	Design of Steel Structures	Duggal S K	Tata McGraw Hill, New Delhi
3.	Design of Steel Structures	Dayarathnam P	S Chand and Company Ltd., New Delhi.
4.	Design of Steel Structures	Kazim S M A and Jindal R S	Prentice Hall of India, New Delhi.
5.	IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.		
6.	Steel Structure Design and Behaviour	. Charles E Salman, Johnson &Mathas	Pearson Publications
7.	Behaviour and Design of Steel Structures to EC -III	Nether Cot, et.al,	CRC Press.

Water Resources Engineering-I

(UCE06B03**)**

Total Credit: 04 **Contract Period: 04 (3L+1T)**

Course Objectives

1. To impart the knowledge on the basic types of irrigation, irrigation standards, various irrigation techniques, and crop water requirement assessment.
2. To learn about water distribution systems for canal irrigation, design of unlined and lined irrigation canals design and sediment problems associated with canal.

3. To understand flow hydraulics in rivers, sediment deposition and transport, lining of irrigation canals and their drainage arrangement and to design lined canal based on soil and water requirements and will also able to understand the phenomenon of sediment transport in rivers and sediment load.

4. Student will be able to design hydraulic structure such as weir and barrage based on seepage analysis.

5. To have knowledge on the various waterlogging effects in irrigation systems and their preventive measures, design of surface and sub-surface systems.

6. Student will be able to design of channel in regime concept and stable channel.

Course Content

Unit-1

Introduction : Definition, functions and advantages of irrigation, Present Status of irrigation in India, Soil classification for agriculture, Soil moisture and Crop-Water relations, Irrigation- Water quality, Duty and consumptive use of water, Principal Indian crop seasons and water requirements, Multiple cropping, Hybrid crops.

Unit-2

Canal Irrigation : Types of canals, Parts of canal Irrigation system, Planning and alignments of irrigation canals, assessment of water requirements, Estimation of channel losses, Estimation of design discharge of a canal, Canal outlets, canal regulations, Flow measurements.

Unit-3

Design of Channel on Regime Concept : Design of channel based on maximum permissible velocity, Kennedy's silt theory, Lacey's theory, Lacey's regime equation, design of channel on Lacey's theory, other regime equations' fitted equation.

Unit-4

Design of Stable Channels : Rigid boundary channels carrying Clearwater and sediment laden water, Alluvial Channels carrying Clearwater and sediment laden water, Procedure for design of irrigation channels, Various components of canal structures, Sediment distribution, Silting and berming of channel.

Unit-5

Hydraulics of Alluvial Rivers : Critical tractive force, Incipient motion of sediment, Regimens of flow, Resistance of flow in alluvial channels, Transport of sediment.

Unit-6

Lining of channel : Necessity of lining, types of lining, Types of drainage arrangement, Selection of drainage arrangement, Design aspect of lined channel, procedure of design, Use of design chart Data of lined canals.

Unit-7

Surface and Subsurface Flow considerations for design of Canal Structures : Design for surface and subsurface flows, Bligh's, Lane's and Khosla's methods, Design of falls distributory and cross regulators, energy dissipation.

Unit-8

Water logging and Drainage Engineering : Causes of water logging, effects of water logging, Measures for it prevention, Causes of Reclamation of salt effected Lands, Reclamation Procedure.

Unit-9

Drainage Engineering: Importance and objective of drainage, Surface drainage systems, Open or surface drains, design aspect of open drain. Closed or Sub surface drainage system, Design of Tile drain. Steady state formulae, Kirkhams formulae, Bureau of Reclamation formula, leaching requirements.

Course Outcomes:

At the end of the course, the student will be able to:

1. Assess the basic requirements of irrigation and various irrigation techniques, requirements of the crops, irrigation needs of crops.
2. Enable to design distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design.
3. Enable students to design lined canals based on soil and water requirements, assess seepage losses in channels, phenomenon of sediment transport in rivers and sediment load determination.
4. Design various hydraulic structures relate to operation and maintenance of irrigation system network.
5. To analyse and determine water logging measures, land reclamation from waterlogged lands; effective design of both irrigation and drainage systems.
6. Student will be able to design in any channel in regime concept and also will be able to design a stable channel.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE06B03.1	sess the basic requirements of irrigation and various irrigation techniques, requirements of the crops, irrigation needs of crops.
UCE06B03.2	Enable to design distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design.

UCE06B03.3	Enable students to design lined canals based on soil and water requirements, assess seepage losses in channels, phenomenon of sediment transport in rivers and sediment load determination.
UCE06B03.4	Design various hydraulic structures relate to operation and maintenance of irrigation system network.
UCE06B03.5	To analyse and determine water logging measures, land reclamation from waterlogged lands; effective design of both irrigation and drainage systems.
UCE06B03.6	Student will be able to design in any channel in regime concept and also will be able to design stable channel.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 4. No Correlation: "-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
UCE06B03.1	2	2	1	2	1	3	2	2	1	1	1	2
UCE06B03.2	2	3	2	2	1	2	1	1	1	1	1	2
UCE06B03.3	3	3	3	2	2	1	1	1	1	1	1	2
UCE06B03.4	3	3	2	2	2	2	1	1	1	1	1	2
UCE06B03.5	1	2	2	3	1	2	3	1	1	1	1	1
UCE06B03.6	3	3	2	2	2	2	1	1	1	1	1	2
Total	**14**	**16**	**12**	**13**	**9**	**12**	**9**	**5**	**6**	**6**	**6**	**11**
Average	**2.33**	**2.67**	**2.00**	**2.17**	**1.50**	**2.00**	**1.50**	**1.17**	**1.00**	**1.00**	**1.00**	**1.83**
Equivalent Avg. Attainment	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE06B03.1	4	3
UCE06B03.2	4	3
UCE06B03.3	4	3
UCE06B03.4	4	3
UCE06B03.5	4	3
UCE06B03.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Name of Book	Author	Publisher
Irrigation and water Resources.	R.S.varshney	New age International Engineering
Theory and Design of Irrigation	Nem Chand	Bros.Roorkee
Engineering Hydrology	K Subramanya	Tata-McGrawHill
Applied Hydrology	V.T.Chow	Mc Graw Hill
Introduction to Hydrology	W.Viesman	Kneep,Harper and Row G.L.Lewis,L.W

Geotechnical Engineering-II

(UCE06B04**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To understand the physical and mechanical properties of soils
2. To determine parameters from soil testing to characterize soil properties, soil strength, and soil deformations
3. To apply the principles of soil mechanics to analyze and design simple geotechnical systems

Course content:

Unit 1

Seismic Behavior of Soils: Introduction, effect of soil shaking, Soil Liquefaction, Ground Improvement Techniques.

Unit 2

Earth Pressures and Retaining Structures: Earth pressure at rest; Active and passive earth pressure computations using Rankine's and Coulomb's earth pressure theories; Culmann's graphical construction; Additional Earth pressure due to surcharge and earthquake loading.

Stability analysis for retaining walls; Choice of backfill material and importance of drainage.

Bracing for open cuts- Recommended design diagrams of earth pressure for typical soils.

Unit 3

Soil Exploration: Purpose; Method of soil exploration; Boring, sampling; Standard penetration test; Static and dynamic cone tests; Correlation between penetration resistance and strength parameters; Plate load test.

Planning of soil Investigation; Number of bore holes and depth of exploration; Types of tests to suit soil conditions.

Unit 4

Soil Stabilisation: Introduction; Mechanical stabilization; Cement stabilization; Lime stabilization; Bitumen stabilization; Chemical stabilization; Thermal stabilization; Electrical stabilization; Stabilisation by grouting; Stabilisation by Geotextile and fabrics; Reinforced earth.

Unit 5

Stability of Slope: Introduction; Basis of Analysis; Different factors of safety; Types of slope failures; Stability of an infinite slope in cohesive soils and cohesionless soil; Wedge failure; Culmann's method, Friction circle method; Swedish circle method; Stability of slope under steady seepage condition;

Stability of slope during construction; Bishop's simplified method; Improving of Stability of Slope.

Unit 6

Geosynthetics: Introduction; Various types of Geosynthetics, Major Uses of Geosynthetics; Emerging and Future Developments of Geosynthetics.

Course outcome:

1. Students will able to determine the stability of earth retaining structures.
2. Students will able to analyze the stability of slope and can suggest various methods of improvement of slope stability.
3. Students will be able to understand the importance of soil investigations and field test.
4. Students will be able to understand the different types of Geosynthesis and their uses in Geo-engineering.
5. Students will be able to describe the behaviour of soil under seismic conditions.
6. Students will be able to learn different methods of soil stabilization.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE06B04.1	Students will able to determine the stability of earth retaining structures.
UCE06B04.2	Students will able to analyze the stability of slope and can suggest various methods of improvement of slope stability.
UCE06B04.3	Students will be able to understand the importance of soil investigations and field test.
UCE06B04.4	Students will be able to understand the different types of Geo-synthesis and their uses in Geo-engineering.
UCE06B04.5	Students will be able to describe the behaviour of soil under seismic conditions.
UCE06B04.6	Students will be able to learn different methods of soil stabilization.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE06B04.1	3	2	2	1	1	3	3	2	1	2	1	1
UCE06B04.2	3	2	2	1	1	3	3	2	1	2	1	1
UCE06B04.3	3	2	2	1	1	3	3	2	1	2	1	1
UCE06B04.4	3	2	2	1	1	3	3	2	1	2	1	1
UCE06B04.5	3	2	2	1	1	3	3	2	1	2	1	1
UCE06B04.6	3	2	2	1	1	3	3	2	1	2	1	1
Total	**18**	**12**	**12**	**6**	**6**	**18**	**18**	**12**	**6**	**12**	**6**	**6**
Average	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**1**	**2**	**1**	**1**
Equivalent Avg. attainment	**3**	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**1**	**2**	**1**	**1**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE06B04.1	4	3
UCE06B04.2	4	3
UCE06B04.3	4	3
UCE06B04.4	4	3
UCE06B04.5	4	3
UCE06B04.6	3	3
Total	**23**	**16**
Average	**3.8**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Soil Mechanics And Foundation Engineering	K R Arora	Standard Publisher Dist.
2	Soil Mechanics and Foundations	B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications
3	Textbook of Soil Mechanics and Foundation Engineering: Geotechnical Engineering series	V N S Murthy	CBS
4	Geotechnical Engineering	C. Venkatramaiah	New Age International Pvt Ltd
5	Soil Mechanics	T. William Lambe, Robert V. Whitman	Wiley

Transportation Engineering - II

(UCE06B05)

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To obtain fundamental understanding of the concepts of design of various types of transportation facilities like railway, airport, dock & harbour etc.
2. To study the various design parameters of different sections of transportation facilities.
3. To study the signal and operation related parameters.
4. To understand on the various surface, air and waterways operation improvement techniques and safety measures.

Course content:

Unit- 1

Role of Railway Transportation, Elements of permanent track way: Rails, Rail Gauges.

Unit 2

Railways: Sleepers, Ballast, Rail Joints, Fittings, Principal of Traction: Tractive Effort, Train resistances, Geometric Design: Gradients, Curves, Cant. Points and Crossings: Turnouts, Diamond crossings, Crossovers.

Unit – 3

Stations and Yards, Signals: Signaling and interlocking, Safety in Railways, Modernization of Track for High Speeds, Modern Methods for Track Maintenance.

Unit – 4

Role of water transportation, Basic consideration- Ocean Winds, Waves, Tides, Wharf, Pier, Harbour, Port, Layout of Harbour, Port entrance, Construction and operation of Lock gates.

Unit – 5

Dock**:** Wet, dry and floating docks, Break water-different types, dredging.

Unit – 6

Role of Air transportation, Airport classification-aerodrome, airfield, airport, Elements of Airport engineering, Airport planning and layout- Site selection, Imaginary surface, Approach surface, Horizontal surface, conical surface, Transitional surface, Terminal Building.

Unit – 7

Airport Geometric design- Runway, Taxiway, Wind rose, runway orientation, Visual ground aids- Airport lighting, Runway-Taxiway lighting, Runway-Taxiway marking. Airport pavement and design

Course outcome:

1. Students will be able to understand different components of Railway.
2. Students will be given a broad idea regarding different design parameters of railway engineering.
3. Students will be able to understand the different components of airport engineering.
4. Students will be able to know the facilities to be provided at airport.
5. Students will be able to understand various structures in water transport system.

Table 1

To establish the correlation between COs &POs

No. of Course Outcome(CO)	Course Outcome
UCE06B05.1	udents will be able to understand different components of Railway.
UCE06B05.2	Students will be given a broad idea regarding different design parameters of railway engineering.

UCE06B05.3	Students will be able to understand the different components of airport engineering.
UCE06B05.4	udents will be able to know the facilities to be provided at airport.
UCE06B05.5	Students will be able to understand various structures in water transport system.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE06B05.1	3	3	1	1	-	-	-	-	1	-	-	1
UCE06B05.2	3	3	2	1	-	-	-	-	1	-	-	2
UCE06B05.3	3	3	1	1	-	-	-	-	1	-	-	1
UCE06B05.4	3	3	1	1	-	-	-	-	1	-	-	1
UCE06B05.5	3	3	1	1	-	-	-	-	1	-	-	2
Total	**15**	**15**	**6**	**5**	**-**	**-**	**-**	**-**	**5**	**-**	**-**	**7**
Average	**3**	**3**	**1.2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1.4**
Equivalent Avg. atainment	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE06B05.1	4	3
UCE06B05.2	4	3
UCE06B05.3	4	3
UCE06B05.4	4	3
UCE06B05.5	4	3
Total	**20**	**15**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Railway Track Engineering	R M Mundry	Tata McGraw Hill
2	Railway Track Engineering	Agarwal M. M	Prabha&Co.
3	Harbour, Dock and Tunnel Engineering	Srinivasan, R	Charotar Publishing House, Anand
4	Dock and Harbour Engineering	Oza, H.P., Oza, G.H.	Charotar Publishing House, Anand
5	Dock and Harbour Engineering	Bindra, S.P.	Charotar Publishing House, Anand
6	Airport Engineering	Rangwala	Charotar Publishing House, Anand
7	Airport Engineering	Bindra, S.P.	Charotar Publishing House, Anand

Environmental engineering -II

(UCE06B06)

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To obtain the basic characteristics of sewage and the inter relations between quality parameters.
2. To obtain the collection and transportation system of sewage.
3. To obtain the design strategy of sewers according to the available condition and material.
4. To obtain the sequential treatment process of sewage.
5. To obtain the environment friendly disposal of sewage.

Course content:

Unit- 1

Terms: Sewerage, Domestic Sewage, Scope, Role of an Environmental Engineer, Historical overview.

Unit- 2

Sewage Characteristics Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus.

Unit – 3

Collection System of Sewage: Separate, combined and partially separate, components of sewerage systems, systems of layout.

Unit – 4

Design of Sewers: Quantity of sanitary sewage and variations, quantity of storm water, rational method, shapes of sewer, circular and egg shaped, Hydraulic design of sewers: diameter, self cleansing velocity and slopes.

Unit – 5

Sewage Treatment Units: Various units purposes, sequence and efficiencies.

Unit – 6

Primary Treatment of Sewage: Preliminary treatment: Screening and grit removal units oil and grease removal, Primary treatment.

Unit – 7

Secondary Treatment of Sewage: Activated sludge process, Slow and rapid sand filter, Sludge disposal. Stabilization pond, Septic tank, Recent trends in sewage treatment.

Unit – 8

Tertiary Treatment of Sewage: Disinfection of effluents, Chlorination, Sludge treatment and Disposal.

Unit – 9

Sewage Disposal: Standards of disposal into natural watercourses and on land, Indian standards, Wastewater Disposal and Reuse Disposal of sewage by dilution, self purification of streams, sewage disposal by irrigation & sewage farming, wastewater reuse, landfills.

Course outcome:

1. Students will be able to learn about the quality parameters and interrelations among themselves.
2. Students will be able to find out the value all of the quality parameters of sewage.
3. Students will be able to make the layout and the design procedures of sewers.
4. Students will be able to learn the stepwise treatment procedures of sewage.
5. Students will be able to learn the efficient disposal techniques of sewage.
6. Students will be able to learn about self purification of streams.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE06B06.1	Students will be able to learn about the quality parameters and interrelations among themselves
UCE06B06.2	Students will be able to find out the value all of the quality parameters of sewage.
UCE06B06.3	Students will be able to make the layout and the design procedures of sewers.
UCE06B06.4	Students will be able to learn the stepwise treatment procedures of sewage.
UCE06B06.5	Students will be able to learn the efficient disposal techniques of sewage.
UCE06B06.6	Students will be able to learn about self-purification of streams.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE05B06.1	2	2	1	1	-	-	-	-	2	-	-	1
UCE05B06.2	2	2	1	1	-	-	-	-	2	-	-	1
UCE05B06.3	2	2	1	1	-	-	-	-	2	-	-	1
UCE05B06.4	2	2	1	1	-	-	-	-	2	-	-	2
UCE05B06.5	2	1	1	1	-	-	-	-	2	-	-	1
UCE05B06.6	2	1	1	1	-	-	-	-	2	-	-	1
Total	**12**	**1.67**	**6**	**6**	**-**	**-**	**-**	**-**	**12**	**-**	**-**	**7**
Average	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1.16**
Equivalent Avg. Attainment	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Table 3

To establish the correlation between COs & PSOs

. CO	PSO1	PSO2
UCE06B06.1	3	2
UCE06B06.2	3	3
UCE06B06.3	4	2
UCE06B06.4	4	2
UCE06B06.5	3	3
UCE06B06.6	3	3
Total	**20**	**15**
Average	**3.33**	**2.5**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	. Environmental Engineering	Peavy, H.S.,Rowe,D.R and Tchobanoglous	McGraw Hill Book Company,1985
2	Water and waste water Engineering	G.M.,Geyer,J.C and Okun,D	Harper Collins SCollege
3	Water supply and Pollution Control	Viessman,Jr.and	Hammer,M.J publishers,1985
4	Water supply, Waste Disposal and Environmental Pollution Engineering	A.K.Chatterjee	Khanna Publishers
5	Water supply and sanitary Engineering	S.C.Rangawala, K.S.Rangawala P.S.Rangawala	Charotar publishing housing
6	Water supply and sanitary Engineering	G.S.Birdie & J.S. Birdie	Dhanpat Rai publishing Company, New Delhi.
7	Environmental Engineering	Peavy H.S., Row D.R. and	McGraw Hill Book Company, 1985

		Tchobanoglous G	
8	Sewage Disposal and Air Pollution Control Engineering Environmental Engineering Vol.I	S.K.Garg,	Khanna Publishers, 1979.
9	Water and Waste water Engg	Metcalf & Eddy	Tata McGraw Hill

Structural Engg Lab –I

(UCE06P01**)**

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. To know the instruments and their uses.
2. To know the material properties so that we can use them in specific field.
3. To know how to compare experimental results with their theoretical values.
4. To compare the experimental value and respected value using STAAD PRO software.

Course content:

Unit-1

Clark Maxwell's Reciprocal theorem using a beam

Unit-2

Deflections of a truss

Maxwell's Reciprocal theorem

Unit-3

Elastic displacements of curved members

Unit-4

Elastic properties of beams

Unit-5

Three hinged arch and Two hinged arch

Unit-6

Behaviour of struts and columns.

Unit-7

Experimental and Analytical study of 3 bar pin jointed truss.

Unit-8

Experimental and Analytical study of deformations in bar-beam combination

Unit-9

. Experimental and Analytical study of deflections in unsymmetrical bending.

Unit-10

Verification of Muller-Breslau principle-Arch / continuous beam / frame models.

Unit-11

Verification of Muller-Breslau principle-Begg's deformeter

Unit-12

To find carry over factor for the beam with far end fixed

Unit-13

Application of the analysis software.

Unit-14

Behaviour of under reinforced and over reinforced R.C. beams in flexure.

Unit -15

Behaviour of R.C. beams, with and without shear reinforcement in shear.

Course outcome:

1. On completion of the course, the students will be able to get a practical view of the materials and their properties used in Civil Engineering in different construction.
2. Students will be able to check the quality of material so that we can use them in specific field.
3. Students will be able to learn the behaviour of under reinforced and over reinforced R.C. beams in flexure
4. Students will be able to get a clear idea about behaviour of R.C. beams, with and without shear reinforcement.
5. Students will be able to analyse the deflection, bending moment and other structural properties with help of software during the entire course.
6. Students will be able to analyse the buckling properties of different types of column.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE06P01.1	On completion of the course, the students will be able to get a practical view of the materials and their properties used in Civil Engineering in different construction.
UCE06P01.2	Students will be able to check the quality of material so that we can use them in specific field.

UCE06P01.3	Students will be able to learn the behaviour of under reinforced and over reinforced R.C. beams in flexure
UCE06P01.4	Students will be get a clear idea about behaviour of R.C. beams, with and without shear reinforcement in shear.
UCE06P01.5	Students will be able to analyze the deflection, bending moment and other structural properties with help of software during the entire course.
UCE06P01.6	6. Students will be able to analyze the buckling properties of different types of column.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE06P01.1	3	3	3	2	3	1	2	1	3	1	2	1
UCE06P01.2	3	3	3	2	3	1	2	1	3	1	2	1
UCE06P01.3	3	3	3	2	3	1	2	1	3	1	2	1
UCE06P01.4	3	3	3	2	3	1	2	1	3	1	2	1
UCE06P01.5	3	2	3	2	3	1	2	1	2	1	2	1
UCE06P01.6	2	3	2	2	3	1	2	1	3	1	2	1
Total	**17**	**17**	**17**	**12**	**18**	**6**	**12**	**6**	**17**	**6**	**12**	**6**
Average	**3.0**	**2.8**	**3.0**	**2.0**	**3.0**	**1.0**	**2.0**	**1.0**	**2.8**	**1.0**	**2.0**	**1.0**
Equivalent Avg. attainment	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**3**	**1**	**2**	**1**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE06P01.1	3	2
UCE06P01.2	3	2
UCE06P01.3	3	2
UCE06P01.4	3	2
UCE06P01.5	2	3
UCE06P01.6	2	3
Total	**16**	**14**
Average	**2.66**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

References:

Sl. No.	Name of Book	Author	Publisher
1	Basic Structural Analysis	Reddy, C. S.	Tata McGraw Hill
2	Elementary Structural Analysis Hill	Norris and Wilbur	Tata McGraw Hill

Geotechnical Engineering lab-II

(UCE06P02**)**

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. To know about the various important parameter of the soil for design and construction of different Civil Engineering structure.
2. To know about the different field tests and their utility

Course content:

Unit 1

Direct shear test

Performance of direct shear test, Plot the curves of direct shear test, Evaluate the shear strength values

Unit 2

Tri-axial test

To perform tri-axial test (drained and undrained conditions), Plot the curves of direct shear test, Evaluate the shear strength values

Unit 3

Standard Penetration Test

To determine the SPT value at different depths, to provide different corrections on observed SPT values, to find out the corresponding strength parameters on the basis of corrected SPT value

Unit 4

Static Cone Penetration Test

To evaluate the cone penetration resistance under constant loading.

Unit 5

Dynamic Cone Penetration Test

To evaluate dynamic cone penetration resistance. To evaluate the SPT value from the DCPT value

Unit 6

Plate Load Test

To perform the plate load test, to plot load settlement curve

Unit 7

Block Vibration Test -- To perform Block Vibration Test, to plot amplitude vs frequency curve and to evaluate resonant frequency and maximum amplitude

Course outcome:

1. Students will able to determine the shear strength of soil.
2. Students will able to determine the standard penetration no. and relative density by SPT test method.
3. Students will able to determine the shear parameter of soil.
4. Students will able to evaluate dynamic cone penetration resistance.
5. In case of machine foundation they can perform the block vibration test to evaluate resonant frequency, resonant amplitude etc.
6. Students will able to determine the bearing capacity of soil by the plate load test.

Table-1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE06P02.1	Students will able to determine the shear strength of soil.
UCE06P02.2	Students will able to determine the standard penetration no. and relative density by SPT test method.
UCE06P02.3	Students will able to determine the shear parameter of soil.
UCE06P02.4	Students will able to evaluate dynamic cone penetration resistance.
UCE06P02.5	In case of machine foundation they can perform the block vibration test to evaluate resonant frequency, resonant amplitude etc.
UCE06P02.6	Students will able to determine the bearing capacity of soil by the plate load test.

Table-2

Slight (Low): 1Moderate: 2Substantial (High): 3No Correlation: "-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
UCE06P02.1	3	3	2	2	3	1	2	2	3	2	2	2
UCE06P02.2	3	3	2	2	3	1	2	2	3	2	2	2
UCE06P02.3	3	3	2	2	3	1	2	2	3	2	2	2
UCE06P02.4	3	3	2	2	3	1	2	2	3	2	2	2
UCE06P02.5	3	3	2	2	3	1	2	2	3	2	2	2
UCE06P02.6	3	3	2	2	3	1	2	2	3	2	2	2
Total	**18**	**18**	**12**	**12**	**12**	**6**	**12**	**12**	**18**	**12**	**12**	**12**
Average	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**2**	**3**	**2**	**2**	**2**

Equivalent Avg. attainment	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**2**	**3**	**2**	**2**	**2**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE06P02.1	**3**	**2**
UCE06P02.2	**3**	**2**
UCE06P02.3	**3**	**2**
UCE06P02.4	**3**	**2**
UCE06P02.5	**3**	**2**
UCE06P02.6	**3**	**2**
Total	**18**	**12**
Average	**3**	**2**
Equivalent Avg. Attainment	**3**	**2**

References:

Sl. No.	**Name of Book**	**Author**	**Publisher**
1	Soil Testing and Instrumentation (Revised Edition),	Alam Singh	New Age International, New Delhi, 1998

Transportation Engineering lab- II

(UCE06P03**)**

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. To know the instruments and their uses.
2. To know the material properties so that we can use them in specific field.
3. To know how to select the materials on the basis of result for different use in Civil Engineering field.
4. To compare the experimental value with IS values and use it judiciously.

Course content:

Unit-1

Determination of Specific Gravity of bitumen

Unit-2

Determination of Ductility of bitumen

Unit-3

Determination of Softening point of bitumen

Unit-4

Determination of Water content of bitumen

Unit-5

Determination of Loss on Heating of bitumen

Unit-6

Marshal Test

Unit-7

Determination of CBR value (Field)

Unit-8

Determination of CBR value (Lab)

Unit-9

Roughness Measurement by Merlin.

Unit-10

Roughness Measurement by Bump Integrator.

Course outcome:

1. Students will be able to learn the procedure and purpose of Specific Gravity test and Ductility test of bitumen.
2. Students will be able to learn the procedure and purpose of Softening point and Water content of bitumen.
3. Students will be able to learn the procedure and purpose of Loss on Heating of bitumen.
4. Students will be able to learn the procedure and purpose of Marshal Test of bitumen.
5. Students will be able to learn the procedure and purpose of CBR value (Lab and Field Methods).
6. Students will be able to learn the procedure and purpose of Roughness Measurement (Using Merlin and Bump Integrator).

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE06P03.1	Students will be able to learn the procedure and purpose of Specific Gravity test and Ductility test of bitumen.
UCE06P03.2	Students will be able to learn the procedure and purpose of Softening point and Water content of bitumen.
UCE06P03.3	Students will be able to learn the procedure and purpose of Loss on Heating of bitumen.
UCE06P03.4	Students will be able to learn the procedure and purpose of Marshal Test of bitumen.
UCE06P03.5	Students will be able to learn the procedure and purpose of CBR value (Lab and Field Methods).
UCE06P03.6	Students will be able to learn the procedure and purpose of Roughness Measurement (Using Merlin and Bump Integrator).

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE06P03.1	3	2	2	2	2	1	1	-	2	2	2	3
UCE06P03.2	3	2	2	2	2	1	1	-	2	2	2	3
UCE06P03.3	3	2	2	2	2	1	1	-	2	2	2	3
UCE06P03.4	3	2	2	2	2	1	1	-	2	2	2	3
UCE06P03.5	3	2	2	2	2	1	1	-	2	2	2	3
UCE06P03.6	3	3	2	2	2	1	1	-	2	2	2	3
Total	**27**	**18**	**18**	**18**	**18**	**9**	**9**	**-**	**18**	**18**	**18**	**27**
Average	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**2**	**2**	**2**	**3**
Eq. Av Attainment	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**2**	**2**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE06P03.1	3	3
UCE06P03.2	3	2
UCE06P03.3	3	3
UCE06P03.4	3	3
UCE06P03.5	3	3
UCE06P03.6	3	2
Total	**18**	**16**
Average	**3**	**2.7**
Equivalent Avg. Attainment	**3**	**3**

References:

Name of Book	Author	Publisher
Determination of Specific Gravity of bitumen. IS:1202-1978(I)		Bureau of Indian Standard
Determination of Viscosity of bitumen. IS:1206-1978(I)		Bureau of Indian Standard
Determination of Flash Point of bitumen. IS:1209-1978		Bureau of Indian Standard

Environmental Engineering lab II

UCE06P04

Total Credit: 01 **Contract Period: 02**

Courses objective:

1. To analyze the physical and chemical characteristics of water and wastewater

2. To familiarize the methods to estimate the organic strength of water and wastewater

3. To know the optimum dose of coagulants

4. To know the amount of heavy metals in water

5. To measure the pollutant concentration in indoor environment

Course content:

Unit- 1

Determination of B.O.D of sewage

Unit 2

Determination of C.O.D of domestic and industrial sewage

Unit – 3

Determination of kjeldal nitrogen

Unit – 4

Determination of volatile, mixed, filterable and dissolved solids

Unit – 5

Determination of optimum dose of coagulants

Unit – 6

Determination iron and chromium

Unit – 7

Determination of Nitrate and Phosphate content in water

Unit – 8

Measurement of particulate matter in air

Course outcome:

1. Students will be able to determine BOD and COD and kjeldal Nitrogen content of sewage sample.

2. Students will be able to determine different types of solid content of water and wastewater sample.

3. Students will be able to determine optimum coagulant dosage.

4. Students will be able to determine iron, chromium.

5. Determination of Nitrate and Phosphate content in water sample.

6. Measurement of air pollutant concentration.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE06P04 .1	Students will be able to determine BOD and COD and kjeldal Nitrogen content of sewage sample.
UCE06P04 .2	Students will be able to determine different types of solid Content Of water and wastewater sample.
UCE06P04 .3	Students will be able to determine optimum coagulant dosage.
UCE06P04 .4	Students will be able to determine iron content of Water and Wastewater sample.
UCE06P04 .5	Students will be able to determine chromium content of Water and wastewater sample.
UCE06P04 .6	Students will be able to determine Nitrate and Phosphate content in Water.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) 4. NO CORELATION-"-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
UCE06P04 .1	3	2	2	2	2	-	1	1	2	2	2	3

UCE06P04 .2	3	2	2	2	2	-	1	1	2	2	2	3
UCE06P04 .3	3	2	2	2	2	-	1	1	2	2	2	3
UCE06P04 .4	3	2	2	2	2	-	1	1	2	2	2	3
UCE06P04 .5	3	2	2	2	2	-	1	1	2	2	2	3
UCE06P04 .6	3	2	2	2	2	-	1	1	2	2	2	3
Total	**18**	**12**	**12**	**12**	**12**	**-**	**6**	**6**	**12**	**12**	**12**	**18**
Average	**3**	**2**	**2**	**2**	**2**	**-**	**1**	**1**	**2**	**2**	**2**	**3**
Eq. Av Attainment	**3**	**2**	**2**	**2**	**2**	**-**	**1**	**1**	**2**	**2**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE06P04 .1	4	3
UCE06P04 .2	4	3
UCE06P04 .3	4	3
UCE06P04 .4	4	3
UCE06P04 .5	4	3
UCE06P04 .6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

DETAIL

COURSE CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.E/B.TECH

IN

CIVIL ENGINEERING

(7th SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

TRIPURA (WEST)

Structural Analysis- III

UCE07B01

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To know how to analyze a structure using matrix method (both flexibility and stiffness method).
2. To know about structural dynamics and its elements.
3. To know how to analyze single degree of freedom system and response to harmonic and periodic loading.
4. To learn how to analyze structures using Finite element Methods.

Course content:

Unit-1

Introduction to Flexibility Method of Matrix Analysis-Introduction to flexibility method, Element flexibility matrix, Principle of contragradience, Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix. Matrix determination of the displacement vector, Determination of member forces.

Unit-2

Analysis of Beams and Frames using Flexibility Method-Analysis of axially rigid continuous beams by flexibility method using Force Transformation Matrix , Analysis of rigid plane frames with axially rigid members by flexibility method using Force Transformation Matrix.

Unit-3

Introduction to Stiffness Method of Matrix Analysis-Fundamentals of the stiffness method, equivalent joint loads, Displacement and Transformation matrix. Member stiffness matrix, Total or System stiffness matrix.

Unit-4

Analysis of Beams and Frames using Stiffness Method-Continuous Beam and rigid frame analysis with axially rigid members by stiffness method using Displacement Transformation Matrix.

Unit-5

Structural Dynamics-Elements of structural dynamics, free and forced vibration of single degree of freedom system, un-damped and damped system. Response of harmonic and periodic loading. Multi degree of freedom system-concept of shear building and modal analysis of structures. Ductility of structures, long & short period structures, concept of response spectrum.

Unit-6

Introduction to Finite Element Method.

Course outcome:

On completion of the course, the students will be able to get a practical view of the materials and their properties used in Civil Engineering.

1. Able to analyze beam by using matrix flexibility and stiffness methods.
2. Able to analyze frame by using matrix flexibility and stiffness methods.
3. Able to determine response of single degree of freedom un-damped system for free and forced vibration.
4. Able to determine response of single degree of freedom damped system for free and forced vibration.
5. Able to determine response of harmonic and periodic loading.
6. Able to implement basic concepts of finite element analysis.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE07B01.1	Able to analyze beam by using matrix flexibility and stiffness methods
UCE07B01.2	Able to analyze frame by using matrix flexibility and stiffness methods
UCE07B01.3	Able to determine response of single degree of freedom un-damped system for free and forced vibration
UCE07B01.4	Able to determine response of single degree of freedom damped system for free and forced vibration
UCE07B01.5	Able to determine response of harmonic and periodic loading
UCE07B01.6	Able to implement basic concepts of finite element analysis

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) 4. NO CORELATION-"-"

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
UCE07B01.1	3	3	3	3	3	1	1	1	3	1	1	3
UCE07B01.2	3	3	3	3	3	1	1	1	3	1	1	3
UCE07B01.3	3	3	3	3	3	1	1	1	3	1	1	3
UCE07B01.4	3	3	3	3	3	1	1	1	3	1	1	3
UCE07B01.5	3	3	3	3	3	1	1	1	3	1	1	3
UCE07B01.6	3	3	3	3	3	1	1	1	3	1	1	3
Total	**18**	**18**	**18**	**18**	**18**	**6**	**6**	**6**	**18**	**6**	**6**	**18**
Average	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**1**	**3**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**1**	**3**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07B01.1	4	4
UCE07B01.2	4	4
UCE07B01.3	4	4
UCE07B01.4	4	4
UCE07B01.5	4	4
UCE07B01.6	4	4
Total	**4**	**4**
Average	**4**	**4**
Equivalent Avg. Attainment	**4**	**4**

References:

Sl No	Name of Books	Author	Publisher
1.	Basic Structural Analysis	Reddy, C. S.	Tata McGraw Hill
2.	Indeterminate Structural Analysis	Kinney, J.S.	McGraw Hill Book Company
3.	Indeterminate Structural Analysis	Wang, C. K	McGraw Hill Book Company
4.	Matrix Analysis of framed Structures	Weaver, W. & Gere, J. M.	CBS Publishers & Distributors, Delhi.
5.	Structural Dynamics	Mario Paz	CBS publishers and Distributors
6.	Dynamics of Structures	Clough and Penziem	Mc- Graw Hill
7.	Dynamics of Structurs	A. K. Chopra	
8.	The Finite element Method vol.1	Zienkiewicz & Taylor	Mc-Graw Hill
9.	An Introduction to the Finite element Method	Reddy, J.N.	Mc-Graw Hill
10.	Finite Element Analysis (Theory and Programming)	Krishnamurthy, C. S.	Tata Mc-Graw Hill

Design of Reinforcement Concrete Structures - II

(UCE07B02**)**

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To know how to design column footings such as isolated and combined footing and continuous and curved beams using limit state method
2. To know the design criteria of bunker and silo by working stress method.
3. To design slab culverts, bridge decks, cross and main beams for bridges, T-beam bridge.
4. To get a brief overview of Prestressed concrete, types of prestressing, losses in prestressing, I.S. specifications analysis and design of prestressed concrete beams.
5. To determine the earthquake forces using IS: 1893 (part-I)-2002 code and to design and detailing of seismic resistant RC buildings.

Course content:

Unit-1

Column Footings: Isolated and combined column footings.

Unit-2

Continuous and Curved Beams: Design of continuous R.C. beams, moment redistribution, beams curved in plan.

Unit-3

Bunker & Silo: Design of silos, bunkers and their supporting structures.

Unit-4

Culverts and bridges: Design of slab culverts, bridge decks, cross and main beams for bridges, T-beam bridge design for I.R.C. loadings.

Unit-5

Elements of prestressed concrete: Analysis of stress concept, concrete tendon placed at an eccentricity, tendon with parabolic profile, load balancing method. Losses of prestress, I.S. specifications analysis and design of prestressed concrete beams – rectangular, I – section, T – section for flexure and shear, Design of end block

Unit-6

Introduction to Seismic Design and Detailing of RCC buildings: Determination of Earthquake Forces (IS: 1893 (part-I)-2002; seismic coefficient method; response spectrum method); seismic design and detailing of RC buildings.

Course outcome:

On completion of the course, the students will be able to:

1. Understand footing and their classification, their uses and design.
2. Design slab culverts, bridge decks, cross and main beams for bridges, T-beam bridge
3. Know about I.S. Codes which are used for prestressed concrete design and seismic resistant design.
4. Get a detailed picture of the properties of prestressed concrete, methods of prestressing , loss in prestressing and how to design of prestressed concrete beams.
5. To determine the earthquake forces using code and to design and detailing of seismic resistant RC buildings..
6. Design of some underground storing structures such as bunker, silo.

Table 1

To establish the correlation between COs &POs

UCE07B02.1	Understand footing and their classification, their uses and design
UCE07B02.2	Design slab culverts, bridge decks, cross and main beams for bridges, T-beam bridge
UCE07B02.3	Know about I.S. Codes which are used for prestressed concrete design and seismic resistant design.
UCE07B02.4	Get a detailed picture of the properties of prestressed concrete,methods of prestressing ,loss in prestressing and how to design of prestressed concrete beams.
UCE07B02.5	To determine the earthquake forces using code and to design and detailing of seismic resistant RC buildings.
UCE07B02.6	Design of some underground storing structures such as bunker, silo.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) 4. NO CORELATION-"-"

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
UCE07B02.1	2	3	2	1	2	1	1	1	1	1	2	2
UCE07B02.2	3	3	2	3	2	1	2	1	2	1	3	2
UCE07B02.3	3	3	2	1	1	1	1	1	1	1	1	2
UCE07B02.4	2	3	2	2	2	1	1	1	1	1	2	2
UCE07B02.5	3	3	2	2	2	2	2	1	1	1	1	2
UCE07B02.6	3	3	2	2	2	2	2	1	1	1	1	1
Total	**16**	**18**	**12**	**11**	**11**	**8**	**9**	**6**	**7**	**6**	**10**	**11**
Average	**2.67**	**3.00**	**2.00**	**1.83**	**1.83**	**1.3**	**1.5**	**1**	**1.16**	**1.00**	**1.67**	**1.83**
Eq. Avg. Attainment	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**2**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07B02.1	3	3
UCE07B02.2	4	4
UCE07B02.3	3	2
UCE07B02.4	2	2
UCE07B02.5	3	2
UCE07B02.6	3	2
Total	**18**	**15**
Average	**3**	**2.5**
Avg. Equivalent Attainment	**3**	**3**

References:

Sl. No	Name of books	Author	Publisher
1	Limit state Design of Reinforced Concrete	P.C Vargheese	P.H.I. Publisher
2	Limit State Design of R.C.C Structures	A.K. Jain	Nem chand Brothers, Roorkee
3	Design of Reinforced Concrete Structures	N.Krishnaraju	CBS Publishers
4	Reinforced Concrete Design	C.K.Wang and C.G. Salman	Harpur International Edition
5	Reinforced Concrete Design	Mallik and Gupta	Oxford and IBH Publications
6	Prestressed Concrete	Krishnaraju	Tata Mc Graw Hill, New Delhi
7	Design of R.C.C structures	Ramamurtham	Danpath Rai Publishing Co.
8	Prestressed Concrete	Dayarathnam	Oxford & IBH Publishing
9	Essentials of Bridge Engineering	Victor	Oxford& IBH
10	Reinforced concrete design	S.U. Pillai and Devdas Menon	Tata Mcgraw –Hill Publishing company limited

Water Resources Engineering –II

(UCE07B03**)**

Total Credit: 04 **Contract Period: 04 (3L+1T)**

Course Objectives

1. To serve as an introduction to the field of engineering hydrology covering the fundamentals such as hydrological cycle, precipitation characteristics, catchment water losses.
2. To understand and study measurements of various abstraction processes like evaporation, transpiration and infiltration occurring in catchment, hydrographs and hyetographs, climate change and rain water harvesting.
3. To understand change in hydrograph characteristics using routing methods, study hydrologic frequency analysis.
4. To know the basic principles and movement of ground water, well yields and pumping tests.
5. To give basic concepts of reservoir capacity determination, sedimentation and losses.

Course Content

Unit-1

Surface Water Hydrology: Introduction: Catchment and its physical characteristics; Hydrologic cycle.

Unit-2

Precipitation: Types and forms; measurement of point rainfall; rainfall missing data; Rainguages; average rainfall over an area –different methods; rainfall mass curve, hyetograph, intensity duration curve.

Unit-3

Evaporation: Process; evapotranspiration and infiltration; methods of measurement and estimation.

Unit-4

Run-off: Run-off components; factors affecting run-off; estimation of run-off.

Unit-5

Stream flow measurement: different direct and indirect methods; stage discharge curve; unsteady flow and backwater effects.

Unit-6

Hydrographs: Unit Hydrographs-assumptions; derivation, application and limitations-curve, Synthetic unit hydrograph, distribution graph, instantaneous unit hydrograph, Green house, Climate forecasting, Climate changes.

Unit-7

Floods: Rational method, empirical formulae,UH method, flood frequency studies, gumbel's method, Log

Pearson Type III distribution, design flood ,design storm, risk reliability and safety factor.

Unit-8

Flood Routing: Hydrologic routing, hydraulic routing

Unit-9

Ground Water Hydrology: Introduction: Aquifers, types of aquifers

Ground Water movement: Darcy's law, hydraulic conductivity and transmissivity

Unit-10

Well Hydraulics; Well Losses, specific capacity of well and well efficiency, various types of well, pumping test methods, various construction methods, salt water intrusion, artificial recharge of ground water.

Unit- 11

Reservoir: Types; physical; characteristics; computation of storage volume; reservoir losses, reservoir sedimentation and control.

Course outcome:

On completion of the course, the students will be able to:

1. Students will be able to understand basic hydrologic concepts, measure and analyze precipitation, evaporation, evapotranspiration etc. and perform hydrologic modeling.
2. Students will be able to understand the components of hyetographs, mass curve and their analysis, observation and measurement of flows and runoff in rivers and channels.
3. Students will be able to apply standard techniques, computational tools, and data for conducting frequency analysis on hydrologic data to determine flood return period.
4. Students will be able to conceptualize components of groundwater flow, understand aquifer properties – permeability, transmissivity and storage, and identify geological formations capable of storing and transporting groundwater.
5. Students will be able to know different methods of measurement of discharge, design flood estimation, perform flood routing, estimate flood peaks, fix capacity reservoir of reservoirs.
6. Students will be able to understand the components of hydrographs, unit hydrograph, synthetic unit hydrograph, and instantaneous unit hydrograph and their analysis, observation and measurement of flows in rivers and channels.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE07B03.1	Students will be able to understand basic hydrologic concepts, measure and analyze precipitation, evaporation, evapotranspiration etc. and perform
UCE07B03.2	Students will be able to understand the components of hyetographs, mass curve and their analysis, observation and measurement of flows and runoff in rivers and channels.
UCE07B03.3	Students will be able to apply standard techniques, computational tools, and data for conducting frequency analysis on hydrologic data to determine flood
UCE07B03.4	Students will be able to conceptualize components of groundwater flow, understand aquifer properties – permeability, transmissivity and storage, identify geological formations capable of storing and transporting
UCE07B03.5	Students will be able to know different methods of measurement of discharge, design flood estimation, perform flood routing, estimate flood
UCE07B03.6	Students will be able to understand the components of hydrographs, unit hydrograph, synthetic unit hydrograph, instantaneous unit hydrograph and their analysis, observation and measurement of flows in rivers and channels.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: - " - "

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07B03.1	2	2	1	1	2	3	2	2	1	1	1	2
UCE07B03.2	1	2	2	2	1	2	1	1	1	2	1	2
UCE07B03.3	3	2	3	2	2	1	1	1	1	1	1	1
UCE07B03.4	3	3	2	2	2	2	1	1	1	1	1	2
UCE07B03.5	1	2	2	3	1	2	3	1	1	1	1	1
UCE07B03.6	3	3	2	2	2	2	1	1	1	1	1	2
Total	**13**	**14**	**12**	**12**	**10**	**12**	**9**	**7**	**6**	**7**	**6**	**10**
Average	**2.16**	**2.33**	**2.00**	**2.00**	**1.66**	**2.00**	**1.50**	**1.16**	**1.00**	**1.16**	**1.00**	**1.66**
Equivalent Avg. Attainment	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE07B03.1	2	4
UCE07B03.2	3	2
UCE07B03.3	3	2
UCE07B03.4	3	4
UCE07B03.5	2	2
UCE07B03.6	3	3
Total	**16**	**17**
Average	**2.67**	**2.83**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No	Name of books	Author	Publisher
1	Irrigation and water Resources Engineering	G.L.Asawa	New age International Publishers
2	Theory and Design of Irrigation Structure	R.S.varshney	Nem Chand & Bros.Roorkee
3	Engineering Hydrology	K Subramanya	Tata-McGrawHill
4	Applied Hydrology	V.T.Chow	Mc Graw Hill
5	Introduction to Hydrology	W.Viesman,	Kneep,Harper and Row G.L.Lewis,L.W

Transportation Engineering - III

(UCE07B04)

Total Credit: 04 **Contract Period: 04 (3L+1 T)**

Courses objective:

1. To obtain fundamental understanding of the concepts of design of various types of pavements.
2. To study the quality testing mechanism for highway construction materials.
3. To study the highway traffic characteristics and related parameters.
4. To understand on the various highway traffic operation improvement techniques and road safety measures.

Course content:

Unit- 1

Pavement Design, and Layered system analysis and Design, Load and temperature stress.

Unit 2

Analysis and design, Design of joints and load transfer devices, Joints, Fillers and sealers.

Unit – 3

Quality control test for Highway construction.

Unit – 4

Highway traffic Characteristics, Traffic parameters and inter relationship, traffic volume, speed, density, capacity.

Unit – 5

Traffic studies- Volume speed, Original Destination(OD).

Unit – 6

Traffic operation and management, Traffic congestion, control devices.

Unit – 7

Various traffic operation improvement measures.

Unit – 8

Intersection & Road safety.

Course outcome:

1. Students will be able to analyze the different types of pavements used in highway transportation.
2. Students will be able to design the flexible and rigid pavements in real time situation.
3. Students will be able to identify the essential laboratory and field test needed for quality assurance of highway construction.

4. Students will be able to understand regarding essential traffic characteristics and parameters along with their interrelationships.
5. Students will be able to analyze various traffic operation improvement methodologies and road safety measures in a comprehensive way.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE07B04.1	Students will be able to analyze the different types of pavements used in highway transportation.
UCE07B04.2	Students will be able to design the flexible and rigid pavements in real time situation.
UCE07B04.3	Students will be able to identify the essential laboratory and field test needed for quality assurance of highway construction.
UCE07B04.4	Students will be able to understand regarding essential traffic characteristics and parameters along with their interrelationships.
UCE07B04.5	Students will be able to analyze various traffic operation improvement methodologies and about road safety measures in a comprehensive way.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) 4.NO CORELATION-"-"

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
UCE07B04.1	3	2	2	2	1	2	1	1	1	2	2	1
UCE07B04.2	3	2	2	2	2	2	1	1	2	2	2	2
UCE07B04.3	3	2	2	2	3	2	2	1	2	2	2	2
UCE07B04.4	3	2	2	2	2	2	2	1	2	2	2	2
UCE07B04.5	3	2	2	2	2	2	2	1	2	2	2	2
Total	**15**	**10**	**10**	**10**	**10**	**10**	**8**	**5**	**9**	**10**	**10**	**9**
Average	**3**	**2**	**2**	**2**	**2**	**2**	**1.6**	**1**	**1.8**	**2**	**2**	**1.8**
Eq. Av Attainment	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**

Table 3

To Establish the Correlation between COs &PSOs

CO	PSO1	PSO2
UCE07B04.1	4	3
UCE07B04.2	4	3
UCE07B04.3	4	3
UCE07B04.4	4	3
UCE07B04.5	4	3
Total	**20**	**15**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No	Name of books	Author	Publisher
1	Pavement Analysis and	Yang H. Hung,	Prentice-Hall Design,
2	Design and Performance of Road Pavements,	David Croney	McGraw Hill,
3	3. Guide for Design of Pavement Structures- I & II	AASHTO	AASHTO
4	Introduction To traffic Engg.: A manual for data collection & analysis,	Thomas R. Currin	Brooks
5	Traffic Engineering and Transport Planning,	Kadyali, L.R.,	Khanna Publisher**,**
6	Traffic Engineering,	Roger P Roess, Elena S Prassas,	Prentice Hall,
7	Traffic Engineering Design principle & Practice,	Mike Slinn, Poter Guest, Paul Matthews,	Elsevier,

Structural Engg Lab –II

(UCE07P01**)**

Total Credit: 01 **Contract Period: 2**

Courses objective:

1. To know the instruments and their uses.
2. To know the material properties so that we can use them in specific field.
3. To know how to compare experimental results with their theoretical values.
4. To compare the experimental value and respected value using STAAD PRO software.

Course content:

Unit-1

Clark Maxwell's Reciprocal theorem using a beam

Unit-2

Deflections of a truss

Maxwell's Reciprocal theorem

Unit-3

Elastic displacements of curved members

Unit-4

Elastic properties of beams

Unit-5

Three hinged arch and Two hinged arch

Unit-6

Behaviour of struts and columns.

Unit-7

Experimental and Analytical study of 3 bar pin jointed truss.

Unit-8

Experimental and Analytical study of deformations in bar-beam combination

Unit-9

. Experimental and Analytical study of deflections in unsymmetrical bending.

Unit-10

Verification of Muller-Breslau principle-Arch / continuous beam / frame models.

Unit-11

Verification of Muller-Breslau principle-Begg's deformeter

Unit-12

To find carry over factor for the beam with far end fixed

Unit-13

Application of the analysis software.

Unit-14

Behaviour of under reinforced and over reinforced R.C. beams in flexure.

Unit -15

Behaviour of R.C. beams, with and without shear reinforcement in shear.

Course outcome:

1. On completion of the course, the students will be able to get a practical view of the materials and their properties used in Civil Engineering in different construction.
2. Students will be able to check the quality of material so that we can use them in specific field.
3. Students will be able to learn the behaviour of under reinforced and over reinforced R.C. beams in flexure
4. Students will be able to get a clear idea about behaviour of R.C. beams, with and without shear reinforcement.
5. Students will be able to analyse the deflection, bending moment and other structural properties with help of software during the entire course.
6. Students will be able to analyse the buckling properties of different types of column.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE07P01.1	On completion of the course, the students will be able to get a practical view of the materials and their properties used in Civil Engineering in different construction.
UCE07P01.2	Students will be able to check the quality of material so that we can use them in specific field.
UCE07P01.3	Students will be able to learn the behaviour of under reinforced and over reinforced R.C. beams in flexure
UCE07P01.4	Students will be get a clear idea about behaviour of R.C. beams, with and without shear reinforcement in shear.
UCE07P01.5	Students will be able to analyse the deflection, bending moment and other

	structural properties with help of software during the entire course.
UCE07P01.6	6. Students will be able to analyse the buckling properties of different types of column.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM)3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07P01.1	3	3	3	2	2	1	1	1	2	1	1	1
UCE07 P01.2	3	2	3	2	3	2	2	2	2	1	1	1
UCE07 P01.3	3	3	3	3	3	2	2	2	1	1	1	1
UCE07 P01.4	3	2	3	2	3	3	3	2	2	2	2	2
UCE07 P01.5	3	3	2	3	3	3	3	2	2	2	2	1
UCE07 P01.6	3	3	3	3	3	3	2	2	2	2	1	2
Total	**18**	**16**	**17**	**15**	**17**	**14**	**13**	**11**	**11**	**9**	**8**	**8**
Average	**3.000**	**2.66**	**2.83**	**2.50**	**2.83**	**2.33**	**2.16**	**1.83**	**1.83**	**1.50**	**1.33**	**1.33**
Eq. Avg. Attainment	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE07P01.1	3	2
UCE07 P01.2	3	3
UCE07 P01.3	3	3
UCE07 P01.4	2	3
UCE07 P01.5	2	3
UCE07 P01.6	3	3
Total	**16**	**17**
Average	**2.66**	**2.83**
Equivalent Avg.	**3**	**3**

Attainment		

References:

Sl No.	Name of the Books	Authors	Publishers
1	Concrete Technology	M.S.Shetty	S.Chand & Comp.Ltd
2	Properties of concrete	A.M.Neville	Longman,UK
3	Concrete Structure, properties and materials	P.K.Mehta	Prentice Hall.Inc.USA
4	Concrete technology	M.L.Gambhir	Tata McGraw Hill,New Delhi
5	Polymers in Civil Engg.	J.H.Bungey	Surrey University Press,New York

Water Resources Engg Lab.

(UCE07P02**)**

Total Credit: 01 **Contract Period: 2**

Course objectives

1. To learn the basic hydrological measurement technique – measurement of rainfall and rainfall intensities.

2. To determine the abstraction losses like evaporation, infiltration etc. through experiments and estimate the infiltration characteristics and evaporation in catchments.

3. Study of flow measurement in rivers and channels

4. Study of topographical and contour maps for watershed characterization.

5. To familiarize the students about various water resources modelling software for hydrologic and hydraulic design of small-scale rural or urban watersheds.

Course Contents

List of Experiments:

1. Rainfall Measurement

2. Measurement of rate of evaporation

3. Measurement of rate of infiltration of water in soil.
4. Measurement of velocity of flow in river or stream.
5. Delineation of catchment boundary and drainage network to determine the hydrological parameters.
6. Computer Aided (CAD) design in water resources engineering.

Course Outcome:

1. The students will be able to apply their knowledge about fluid mechanics in addressing problems in open channels.

2. The students will be able to know hydrological measurement technique – measurement of rainfall and rainfall intensities, abstractions in hydrological processes like evaporation, infiltration, etc.

3. The students will be able to measure velocity in rivers and streams using current meter, measure velocity in flow channels.

4. The students will be able to study topographical maps and delineate watersheds from the maps, evaluate catchment morphological characteristics.

5. The students will be able to make streamflow measurements in fields, runoff computations and determine precipitation intensities.

6. The students will develop skills to solve problems using current softwares like HEC-HMS, HEC-RAS,etc for hydrological modelling.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE07P02.1	The students will be able to apply their knowledge about fluid mechanics in addressing problems in open channels.
UCE07P02.2	The students will be able to know hydrological measurement technique – measurement of rainfall and rainfall intensities, abstractions in hydrological processes like evaporation, infiltration, etc.
UCE07P02.3	The students will be able to measure velocity in rivers and streams using current meter, measure velocity in flow channels.
UCE07P02.4	The students will be able to study topographical maps and delineate watersheds from the maps, evaluate catchment morphological
UCE07P02.5	The students will be able to make streamflow measurements in fields, runoff computations and determine precipitation intensities.

UCE07P02.6	The students will develop skills to solve problems using current softwares like HEC-HMS, HEC-RAS, etc for hydrological modelling.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 4. No Correlation: -"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE04P02.1	3	2	2	1	3	2	1	-	3	2	-	3
UCE04P02.2	3	2	3	2	3	1	2	-	2	2	-	2
UCE04P02.3	2	2	2	2	3	1	2	-	3	2	-	2
UCE04P02.4	3	2	1	2	2	1	2	-	2	1	-	2
UCE04P02.5	2	2	2	1	2	1	1	-	3	1	-	2
UCE04P02.6	2	1	2	3	2	2	1	-	2	2	-	2
Total	15	11	12	11	15	8	9	-	15	10	-	13
Average	2.50	1.83	2.00	1.83	2.50	1.33	1.50	-	2.50	1.67	-	2.17
Equivalent Avg	3	2	2	2	3	1	2	-	3	2	-	2

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE04P02.1	2	3
UCE04P02.2	3	3
UCE04P02.3	3	3
UCE04P02.4	3	2
UCE04P02.5	3	4
UCE04P02.6	3	4
Total	**17**	**19**
Average	**2.83**	**3.17**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Books	Author	Publisher
1.	Engineering Hydrology	K Subramanya	Tata-McGrawHill

2	Applied Hydrology	V.T.Chow	Mc Graw Hill
3	Introduction to Hydrology	W.Viesman, G.L.Lewis,L.W	Kneep, Harper and Row
4	IRC:SP-13-2004	Indian Road Congress	IRC New Delhi,2004

Project-I

(UCE07P03**)**

Total Credit: 03 **Contract Period: 4**

The Project-I / Thesis work will involve in-depth study / review / evaluation / assessment / analysis / design / experimental investigation/software development related to civil engineering problem of interest.

The findings and results are to be presented appropriately in the form of reports/photographic records / drawings / computer printout, presentation in seminar will be encouraged.

Seminar & Viva -Voce (UCE07P04**)**

Total Credit: 01 **Contract Period:2**

It is for assessing the candidates overall performances in subject matters related to civil engineering and their ability to communicate effectively. Each student will perform a presentation in seminar on a topic related to the field of Civil Engineering and at the end of semester they will appear before the departmental viva-voce.

Departmental Elective–I

A.Structural Engineering

Advanced Structural Analysis

(UCE07E01)

Total Credit: 04 **Contact Periods: : 04 (3L+1 T)**

Course objectives:

1. To obtain an understanding of basic principles and usual methods used in structural analysis.
2. To obtain a fundamental understanding of matrix methods using stiffness approach and its application on beams, trusses etc.
3. To understand analysis procedures of matrix methods using flexibility approach and its application.
4. To obtain an understanding on Influence lines for hyper static structures and beams on elastic foundation
5. To obtain an understanding on Plastic Analysis of beams, frames and slabs.

Course content:

Module-1

Review of fundamental principles and classical methods of structural analysis.

Module-2

Matrix methods of structural analysis: Stiffness and flexibility approach and their application to trusses, continuous beams, plane and grid frames.

Module-3

Influence lines for hyperstatic structures. Analysis of beams on elastic foundation.

Module-4

Plastic Analysis of beams, frames and slabs.

Course outcome:

1. Students will be able to usebasic principles and classical methodsof structural analysis.
2. Students will be able to analyze a truss, continuous beam, frames etc. using Stiffness method.
3. Students will be able to analyze a beam or truss using flexibility method.
4. Students will be able to analyze beams on elastic foundation

5. Students will be able to examine beams, frames and slabs using plastic analysis.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE07E01.1	Students will be able to use basic principles and classical methods of structural analysis.
UCE07E01.2	Students will be able to analyze a truss, continuous beam, frames etc. using Stiffness method
UCE07E01.3	Students will be able to analyze a beam or truss using flexibility method
UCE07E01.4	Students will be able to analyze beams on elastic foundation
UCE07E01.5	Students will be able to examinebeams, frames and slabs using plastic analysis

CORRELATION LEVELS:

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
UCE07E01.1	3	3	3	1	1	1	-	-	-	-	-	1
UCE07E01.2	3	3	2	1	1	1	-	-	-	-	-	1
UCE07E01.3	3	3	2	1	1	1	-	-	-	-	-	1
UCE07E01.4	3	3	2	1	2	1	-	-	-	-	-	1
UCE07E01.5	3	3	2	1	2	1	-	-	-	-	-	1
Total	15	15	11	5	7	5	-	-	-	-	-	5
Average	3	3	2.2	1	1.4	1	-	-	-	-	-	1
Equivalent Avg. Attainment	3	3	2	1	1	1	-	-	-	-	-	1

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07E01.1	3	2
UCE07E01.2	3	2
UCE07E01.3	3	3
UCE07E01.4	3	2
UCE07E01.5	3	2
Total	15	11
Average	3	2.2
Equivalent Avg. Attainment	3	2

References:

Sl. No.	Name of the Books	Authors	Publishers
1	Dynamics and Structural system	Mukhopadhyay, M, Vibrations,	Oxford and IBH
2	The Plastic Methods of Structural Analysis	Neal B.G.	Chapman & Hall Ltd
3	Theory of Structures,	Sinha& Gayen	Dhanpat Rai & Sons
4	Advanced Structural Analysis	Borg &Gennaro,	
5	Matrix Method of Structural Analysis,	Madhu B. Kanchi,	Wiley Eastern Limited
6	Analysis of Indeterminate Structures	Grassie, James C.	Longmans
7	Structural Analysis,	Pandit Gupta,	Mc. Graw Hill
8	Matrix Analysis of Framed Structures	W. Weaver & J.M.Gere CBS.	McGraw Hill.
9	Theory of Elastic Stability	S.P. Timoshenko & J.M. Gere	McGraw Hill.

10	Mechanics of Materials	E.J. Hearn, Butter Worth	Hanemann
11	Matrix Method of Structural Analysis	R.K. Liveslely	Pergamon Press, The Macmillan Co.,Newyork

Advanced Structural Design

(UCE07E02)

Total Credit: 04 **Contact Periods: : 04 (3L+1 T)**

Course objectives:

1. To obtain concept for Design Philosophy of Reinforced concrete structure.
2. To obtain an understanding for Behavior of Reinforced concrete element under flexure, shear, torsion.
3. To obtain concept for Design of Special RCC structures like Chimneys, Dome, folded plate etc.
4. To obtain basic concepts of Prestressed concrete structures.
5. To obtain an understanding of Design of Prestressed Concrete Structures

Course content:

Module-1

Design Philosophy, modeling of loads, material characteristics. Reinforced Concrete: M-φ relationship: IS code, ACI code,

Module-2

Behavior of RC element under flexure, shear, torsion and combined axial load-bending moment, Provision of IS ACI code.

Module-3

Design of Special RCC structures: Design of RC member in tension, Design of Chimney, Grid slab, Dome, Water tank, Folded plate.

Module-4

Prestressed concrete: Introduction, Prestressed systems, Pre-tensioned and post tensioned members,

Analysis, Losses in Prestressed concrete, Pressure line, Load balancing concept, Factors influencing deflection, Analysis and design of statically determinate prestressed concrete structure for flexure and shear, Statically indeterminate beams.

Module-5

Design of Prestressed Concrete Structures: Design of flexural members, Design for Shear, bond and torsion. Design of End blocks and their importance.

Course outcome:

1. Students will be able to apply the concepts of Design Philosophy of Reinforced concrete structure.
2. Students will be able to use the concepts of behavior of Reinforced concrete element under various forces
3. Students will be able to design Special RCC structures like Chimneys, Dome, folded plate etc.
4. Student will be able to apply the concepts of Prestressed concrete structures.
5. Student will be able to design Prestressed Concrete Structures

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE07E02.1	Students will be able to apply the concepts of Design Philosophy of Reinforced concrete structure.
UCE07E02.2	Students will be able to use the concepts of behavior of Reinforced concrete element under various forces.
UCE07E02.3	Students will be able to design Special RCC structures like Chimneys, Dome, folded plate etc.
UCE07E02.4	Student will be able to apply the concepts of Prestressed concrete structures
UCE07E02.5	Student will be able to design Prestressed Concrete Structures

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
UCE07E02.1	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E02.2	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E02.3	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E02.4	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E02.5	3	3	2	2	3	-	-	-	-	-	-	1
Total	15	15	10	10	11	-	-	-	-	-	-	5
Average	3	3	2	2	2.2	-	-	-	-	-	-	1
Equivalent Avg. Attainment	3	3	2	2	2	-	-	-	-	-	-	1

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07E02.1	3	2
UCE07E02.2	3	2
UCE07E02.3	3	2
UCE07E02.4	3	2
UCE07E02.5	3	2
Total	15	10
Average	3	2
Equivalent Avg. Attainment	3	2

References:

Sl. No.	Name of the Books	Authors	Publishers
1	Reinforced Concrete structural elements	P. Purushotham.	Tata McGraw Hill.
2	Reinforced Concrete Design	R. Park and T. Pauly	John willy & sons.
3	Design of Prestressed Concrete	A.H. Nilson.	John willy & sons
4	Reinforced Concrete Designer's	Chas E Reynold	Cement Concrete Hand book association 52
5	Design of Steel structures	.	P. Dayaratnam
6	Design of Steel structures	E.H. Gaylord, C,N.Gaylord and	McGraw Hill

		J.E.Stellmeyer	
7	Steel Structures	R.Englekirk	Willey
8	Composite steel & Concrete Structural members	D.J. Oehlers, M.A.Bradford	Pergamon

Advance Solid Mechanics

(UCE07E03)

Credit: 04 **LTP: : 04 (3L+1 T)**

Courses objective:

1. To solve for bending stresses of non-symmetrical sections, beams on elastic foundation, curved beams and Beam columns.
2. To understand the theory of elasticity for thick cylinders, pressure vessels and for torsion on non-circular and cellular members.
3. To analyze solid mechanics problems using energy methods.
4. To obtain constitutive relations for different materials.
5. To apply various failure criteria for general stress states at points.

Course content:

Unit- 1

Stress Analysis: Strength of Materials approach: a) Bending of non-symmetric sections b) Beams on elastic foundation, c) Curved Beams, d) Beam columns.

Unit 2

Theory of Elasticity: a) Introduction to theory of elasticity, b) Simple problems (semi-inverse method), c) Thick cylinders and pressure vessels, d) Torsion on non- circular sections, cellular members.

Unit – 3

Energy Methods: a) Min. Potential and complementary energy, b) Betti-Maxwell Reciprocal theorem, c) Curved members, rings, closed Boxes, frame.

Unit – 4

Constitutive relations: a) Anisotropy, b) Plasticity, c)Visco-elasticity (Kelvin, Voigt,3- element), d) Thermo-elasticity**.**

Unit – 5

Theories of failure: Practical considerations of design a) Stress concentration, b) Fatigue, c) Dynamic

Loading, d) Creep and relaxation.

An independent term project is recommended after midterm.

Course outcome:

1. Students will be able to analyze bending stresses of non-symmetrical sections, beams on elastic foundation, curved beams and Beam columns.
2. Students will be able to analyze elasticity problems for thick cylinders, pressure vessels and for torsion on non-circular and cellular members.
3. Students will be able to solve solid mechanics problems using energy methods.
4. Students will be able to solve solid mechanics problems for Curved members, rings, closed Boxes,frame etc.
5. Students will be able to understand and use the constitutive relationships for Anisotropic, Plastic, Visco-elastic and Thermo-elastic materials.
6. The students will be able to understand and use different theories of failure considering Stress concentration,Fatigue,Dynamic Loading,Creep and relaxation.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE07E03.1	Students will be able to analyze bending stresses of non-symmetrical sections, beams on elastic foundation, curved beams and Beam columns.
UCE07E03.2	Students will be able to analyze elasticity problems for thick cylinders, pressure vessels and for torsion on non-circular and cellular members.
UCE07E03.3	Students will be able to solve solid mechanics problems using energy
UCE07E03.4	Students will be able to solve solid mechanics problems for Curved members, rings, closed Boxes,frame etc.
UCE07E03.5	Students will be able to understand and use the constitutive relationships for Anisotropic, Plastic, Visco-elastic and Thermo-elastic materials.
UCE07E03.6	The students will be able to understand and use different theories of failure considering Stress concentration,Fatigue,Dynamic Loading,Creep and relaxation.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E03.1	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E03.2	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E03.3	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E03.4	3	3	2	2	2	-	-	-	-	-	-	1
UCE07E03.5	3	3	2	2	3	-	-	-	-	-	-	1
UCE07E03.6	3	3	2	2	3	-	-	-	-	-	-	1
Total	15	15	10	10	11	-	-	-	-	-	-	5
Average	3	3	2	2	2.2	-	-	-	-	-	-	1
Equivalent Avg. Attainment	3	3	2	2	2	-	-	-	-	-	-	1

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07E03.1	3	2
UCE07E03.2	3	2
UCE07E03.3	3	2
UCE07E03.4	3	2
UCE07E03.5	3	2
Total	15	10
Average	3	2
Equivalent Avg. Attainment	3	2

References:

Sl. No.	Name of the Books	Authors	Publishers
1	Elements of Strength of Materials	Timosenko, S.P. and Young, D.H.	Affiliated East-West Press Pvt. Ltd
2	Engineering Mechanics of Solids	Popov, E.P.	PHI
4	Solid Mechanics	Kazimi	Tata McGraw-Hill
5	Introduction to Solid Mechanics	Shames, H	PHI
6	Strength of Materials	Shaneloy, F.R	McGraw Hill
7	Strength of Materials Vol. II	Timoshenko, S	McGraw Hill
8	Strength of Materials	Feodosyev, V	Mir Publishers

9	Mechanics & Solids & Structures	Benham, P.P., & Warnock, F.V	Mir Publishers
10	Mechanics & Solids & Structures	Benham, P.P Warnock, F.V	Pitman Publishing
11	Advanced Mechanics of Materials	Seely, F.B.& Smith, J.O	Tokyo,Toppan,
12	An introduction to the Mechanics of solids	S.H.Crandall, N.C.Dahal, T.J.Lardener	McGraw Hill,
13	Advanced Mechanics	Srinath, L.S.	Tata McGraw-Hil

ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES

(UCE07E04)

Total Credit: 04 **Contact Periods: : 04 (3L+1 T)**

Courses objective:

1) To give a clear idea on the energy consumed in building construction along with environmental issues the present world is facing.
2) To provide proper knowledge regarding building blocks alternate to burnt bricks that are used for construction.
3) To describe various wall construction techniques used around the world to develop a sustainable and eco friendly constructions.
4) To give an insight into different type of alternate roofing systems available.

Course content:

Unit- 1

Introduction:

Energy in building materials and building, Environmental issues related to building materials, global warming, and environment friendly and cost effective building materials, building in different climatic region.

Unit 2

Building Blocks:

Introduction, stone and laterite blocks, burnt bricks, concrete blocks: hollow/solid, burnt clay hollow

blocks, stabilized mud blocks (SMB), stone masonry blocks, and selection of building blocks.

Unit – 3

Lime and lime- pozzolana cement:

Introduction, raw materials, process, properties and uses, some practical aspects.

Unit – 4

Alternatives for wall construction:

Types of walls, construction techniques.

Unit – 5

Masonry Mortars:

Introduction, cementitious materials, sand, types of mortars, properties and requirements of mortar, selection of mortar.

Unit – 6

Ferro-cement and ferro-concrete:

Introduction, materials, construction methods, durability, mechanical properties, applications, design example, ferroconcrete, applications, design examples.

Unit – 7

Structural masonry:

Introduction: stresses in masonry in compression; factor influencing compressive strength of masonry; strength of masonry in compression; brick-mortar bond strength; elastic properties of masonry materials and masonry; design of masonry under vertical gravity loads.

Unit – 8

Alternative roofing system:

Concept in roofing alternatives, filter slab roofs, composite beam and panel roofs.

Course Outcome:

1. Students will learn the various types of building materials.
2. Students will be able to decide on the energy consumption using different construction technique and materials.
3. Students will be well verse in methods of making building materials like SMB and different types of wall construction.
4. Students will learn about ferro-cement and its design.
5. Students will learn about the possible alternative materials for sand, bricks burning etc.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE07E04.1	Students will learn the various types of building materials.
UCE07E04.2	Students will be able to decide on the energy consumption using different construction technique and materials.
UCE07E04.3	Students will be well verse in methods of making building materials like SMB and different types of wall construction.
UCE07E04.4	Students will learn about ferro-cement and its design.
UCE07E04.5	Students will learn about the possible alternative materials for sand, bricks burning etc.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -" -"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E04.1	3	1	2	1	3	2	3	-	3	-	-	3
UCE07E04.2	3	3	3	3	1	2	3	-	3	-	-	3
UCE07E04.3	3	1	3	3	3	2	3	-	3	-	-	3
UCE07E04.4	3	3	2	1	2	2	2	-	2	-	-	3
UCE07E04.5	3	1	2	2	2	2	3	-	3	-	-	3
Total	**15**	**9**	**12**	**10**	**11**	**10**	**14**	**-**	**14**	**-**	**-**	**15**
Average	**3**	**1.8**	**2.4**	**2**	**2.2**	**2**	**2.8**	**-**	**2.8**	**-**	**-**	**3**
Equivalent Avg. Attainment	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**3**

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE07E04.1	3	2
UCE07E04.2	3	3
UCE07E04.3	3	4
UCE07E04.4	2	4

UCE07E04.5	2	4
Total	**13**	**17**
Average	**2.6**	**3.4**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Alternative Building Materials and Technologies	KS Jagadish, BV Venkatarama Reddy, KS Nanjunda Rao	New Age International Publishers
2	Concrete Technology	M.S.Shetty	S.Chand & Comp.Ltd
3	Propertis of concrete	A.M.Neville	Longman,UK
4	Concrete Structure, properties and materials	P.K.Mehta	Prentice Hall.Inc.USA
5	Polymers in Civil Engg.	J.H.Bungey	Surrey University Press,New York
6	Concrete technology	M.L.Gambhir	Tata McGraw Hill,New

B. Soil Mechanics & Foundation Engineering

Design of Foundation and Retaining Structure

(UCE07E05)

Total Credit: 04 **Contact Periods: : 04 (3L+1 T)**

Courses objective:

1. To understand the analytical and design approach of foundation on expansive and collapsible soils.
2. To understand the analytical and design approach of well foundation for bearing capacity and lateral stability.
3. To understand the analytical and design approach of braced excavations.
4. To understand the analytical and design approach of retaining walls.

Course content:

Unit 1

Foundations on expansive and collapsible soil; under- reamed pile, uplift resistance of piles.

Unit 2

Well foundation and its elements; size and depth; forces on well foundation; methods of sinking; scour depth; analysis of well foundation for bearing capacity and lateral stability.

Unit 3

Braced excavation: types of bracing system; stability considerations, heave and uplift computation of earth pressure and strut load. Ground movement. Construction control, Shield Tunneling.

Unit 4

Analysis and design of retaining wall under seismic loading condition, Check for stability of retaining wall under seismic loading condition, Pseudo-static and pseudo-dynamic method, tsunami.

Course outcome (CO):

1. Study the analytical and design approach of foundation on expansive and collapsible soils;
2. Study the analytical and design approach of well foundation for bearing capacity and lateral stability;
3. Study the analytical and design approach of braced excavations;
4. Study the analytical and design approach of retaining walls;
5. Study the modern methodology for analysis and design of the structures on difficult soils and rocks condition;
6. Study the methods for checking the structural stability and safety of structures.

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE07E05.1	Study the analytical and design approach of foundation on expansive and collapsible soils.
UCE07E05.2	Study the analytical and design approach of well foundation for bearing capacity and lateral stability
UCE07E05.3	Study the analytical and design approach of braced excavations
UCE07E05.4	Study the analytical and design approach of retaining walls

UCE07E05.5	Study the modern methodology for analysis and design of the structures on difficult soils and rocks condition
UCE07E05.6	Study the methods for checking the structural stability and safety of structures

Table2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -" -"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E05.1	3	3	3	-	-	-	-	-	-	-	-	3
UCE07E05.2	3	-	3	-	-	-	-	-	-	-	-	3
UCE07E05.3	3	-	-	3	-	-	-	-	-	-	-	3
UCE07E05.4	3	-	-	-	-	3	-	-	-	-	-	3
UCE07E05.5	3	3	-	-	-	-	-	-	-	-	-	3
UCE07E05.6	3	-	-	-	-	-	-	-	-	-	-	3
Total	**18**	**6**	**6**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**18**
Average	**3**	**1**	**1**	**0.5**	**-**	**0.5**	**-**	**-**	**-**	**-**	**-**	**3**
Eq. Av Attainment	**3**	**1**	**1**	**0**	**-**	**0**	**-**	**-**	**-**	**-**	**-**	**3**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE07E06.1	4	3
UCE07E06.2	3	3
UCE07E06.3	4	4
UCE07E06.4	4	4
UCE07E06.5	4	3
UCE07E06.6	4	4
Total	**23**	**21**
Average	**3.8**	**3.5**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Shallow Foundations: Bearing Capacity and Settlement	Braja.M.Das	McGraw-Hill Publishing Company
2	Foundation Engineering", (1^{st} and 2^{nd} Edition)	Peck, Hanson, Thomas.H. Thornburn	
3	Foundation Analysis and Design	Bowles, J.	McGraw-Hill Publishing Company
4	Analysis and Design of Foundations and Retaining Structures	Shamsher Prakash Braja.M.Das	

Ground Improvement in Civil Engineering

(UCE07E06)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1. To obtain fundamental understanding of the concepts of ground improvement in civil engineering.
2. To understand the details about in-situ soil improvement, so that this may be useful for shallow foundation for different civil engineering construction.
3. To give a clear idea regarding different ground improvement techniques to be applied in different soil conditions.
4. To understand clearly what is soil improvement and how and when to implement it.

Course content:

Unit- 1

Ground improvement principles and techniques.

Unit –2

Heavy damping. Compaction of piles. Preloading with sand drains/sand wicks.

Unit – 3

Field control. Principles of stone column.

Unit – 4

Grouting. Inserting reinforcing elements.

Unit – 5

Soil dynamics theory of vibration. Degrees of freedom. Principles of machine foundation design.

Unit – 6

Dewatering. Field pumping test. Common dewatering methods. Effects of dewatering.

Unit – 7

Application of Geosynthetics. Types of Geosynthetics. Functions, Properties and designing with geosynthetics.

Unit – 8

Reinforced earth. Foundation and retaining wall using reinforced earth.

Course outcome:

1. Students will be able to learn a new technique.
2. Students will be able to apply this technique in different soil conditions; to identify the vulnerable soil and the conditions under which this technique to be applied.
3. Students will be able to uplift their knowledge in recent techniques for improvement of existing ground; to understand how to apply shallow foundation as much as possible rather than deep foundation for structural construction.
4. Students will be able to learn different techniques like, compaction, dewatering, grouting, sand drains, wick drains, stone column; also applications of geosynthetics and stabilised soil, including soil dynamics.
5. Students will be able to learn the technique for economic design and to maintain existing topography of the area under considerations.
6. Students will be able to understand void ratio, porosity.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome	Course Outcome

(CO)	
UCE07E06.1	Students will be able to learn a new technique.
UCE07E06.2	Students will be able to apply this technique in different soil conditions; to identify the vulnerable soil and the conditions under which this technique to be applied.
UCE07E06.3	Students will be able to uplift their knowledge in recent techniques for improvement of existing ground; to understand how to apply shallow foundation as much as possible rather than deep foundation for structural construction.
UCE07E06.4	Students will be able to learn different techniques like, compaction, dewatering, grouting, sand drains, wick drains, stone column; also applications of geosynthetics and stabilised soil, including soil dynamics.
UCE07E06.5	Students will be able to learn the technique for economic design and to maintain existing topography of the area under considerations.
UCE07E06.6	Students will be able to understand void ratio, porosity.

Table2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -" -"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E06.1	3	3	3	-	-	-	-	-	-	-	-	3
UCE07E06.2	3	-	3	-	-	-	-	-	-	-	-	3
UCE07E06.3	3	-	-	3	-	-	-	-	-	-	-	3
UCE07E06.4	3	-	-	-	-	3	-	-	-	-	-	3
UCE07E06.5	3	3	-	-	-	-	-	-	-	-	-	3
UCE07E06.6	3	-	-	-	-	-	-	-	-	-	-	3
Total	**18**	**6**	**6**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**18**
Average	**3**	**1**	**1**	**0.5**	**-**	**0.5**	**-**	**-**	**-**	**-**	**-**	**3**
Eq. Av Attainment	**3**	**1**	**1**	**0**	**-**	**0**	**-**	**-**	**-**	**-**	**-**	**3**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE07E06.1	4	3

UCE07E06.2	3	3
UCE07E06.3	4	4
UCE07E06.4	4	4
UCE07E06.5	4	3
UCE07E06.6	4	4
Total	**23**	**21**
Average	**3.8**	**3.5**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Guidelines on ground improvement and facilities	U. S. Army Corps of Engineers (Paperback - Feb 28, 2005),	
2	Ground Control and Improvement	Petros P. Xanthakos, Lee W. Abramson, and Donald A. Bruce	
3	Reclamation and Choa, Ground Improvement	Myint-Win Bo and Victor	

HILL ROADS

(UCE07E07)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. To obtain knowledge about hill roads and construction related problems.
2. To understand the concept of geometric design and construction methods of hill roads.
3. To obtain knowledge about maintenance aspect of hill roads.

Course content:

Unit-1

Importance of hill roads, problems specific to hill road construction; alignment survey,

Unit-2

Geometric design of hill roads;

Unit-3

Construction of hill roads: formation cutting, protective structures, cross drainage works;

Unit-4

maintenance: drainage, landslides, snow clearance,

Unit-5

Curve layout in hill Road.

Course outcome:

1. Students will be able to know the importance of hill roads, problems related to hill road construction and alignment survey.
2. Students will be able to learn the geometric design of hill roads.
3. Students will be able to understand the construction procedures of hill roads.
4. Students will be able to know protective structures and cross drainage structures of hill roads.
5. Students will be able to understand the maintenance work associated with hill roads.
6. Students will be able to learn the curve layout of hill road.

Table1

To establish the correlation between COs & POs

UCE07E07.1	Students will be able to know the importance of hill roads, problems related to hill road construction and alignment survey.
UCE07E07.2	Students will be able to learn the geometric design of hill roads.
UCE07E07.3	Students will be able to understand the construction procedures of hill roads.
UCE07E07.4	Students will be able to know protective structures and cross drainage structures of hill roads.
UCE07E07.5	Students will be able to understand the maintenance work associated with hill roads.
UCE07E07.6	Students will be able to learn the curve layout of hill road.

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E07.1	3	3	2	2	1	2	2	1	2	1	1	2
UCE07E07.2	3	3	3	2	2	1	2	2	2	2	2	2
UCE07E07.3	3	3	2	1	3	1	2	2	3	2	3	2
UCE07E07.4	3	3	2	1	2	1	3	1	2	2	2	2
UCE07E07.5	3	3	3	2	3	2	3	1	3	2	2	2
UCE07E07.6	3	3	2	2	1	1	2	2	2	1	1	2
Total	**18**	**18**	**14**	**10**	**12**	**9**	**14**	**10**	**14**	**10**	**11**	**12**
Average	**3**	**3**	**2.33**	**1.67**	**2**	**1.5**	**2.33**	**1.67**	**2.33**	**1.67**	**1.83**	**2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07E07.1	3	2
UCE07E07.2	3	2
UCE07E07.3	3	3
UCE07E07.4	3	2
UCE07E07.5	3	2
UCE07E07.6	3	3
Total	**18**	**14**
Average	**3**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

References:-

Sl No.	Name of Books	Authors	Publishers
01.	Hill Road MannualIRC-SP:48-1998	--------	Indian Road Congress

Urban Transport Planning

(UCE07E08)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. To introduce the role of planning in analyzing and modelling travel demand
2. To understand the stages involved in the Urban Transportation Planning process
3. To impart knowledge about different urban mass transportation systems and urban goods movement.

Module-1

Urban Transportation Planning Process, Urban Travel and Transportation Systems Characteristics, Function and form of urban structures.

Module-2

Travel Demands Forecasting- trip generation, trip distribution, modal split and trip assignment, urban transport problems.

Module-3

Transport Behavior of Individuals and Households, Land use/ Transportation systems.

Module-4

Introduction to Urban Freight Transportation and Urban Mass Transportation Systems.

Module-5

Characteristics of buses, bicycle, para transit, rapid transit, Travel demand management measures; Case studies

Course outcome:

1. The students will gain an experience in the implementation of planning transportation routes in new developing towns and cities.
2. Students will understand four step modelling concept in Urban Transportation Planning

3 The students would be able to understand and evaluate current scenarios of traffic management and improve it.

Table 1

To establish the correlation between COs & POs

UCE07E08.1	The students will gain an experience in the implementation of planning transportation routes in new developing towns and cities.
UCE07E08.2	Students will understand four step modelling concept in Urban Transportation Planning
UCE07E08.3	The students would be able to understand and evaluate current scenarios of traffic management and improve it.

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E08.1	3	3	2	2	1	2	2	1	2	1	1	2
UCE07E08.2	3	3	3	2	2	1	2	2	2	2	2	2
UCE07E08.3	3	3	2	1	3	1	2	2	3	2	3	2
Total	9	9	7	5	6	4	6	5	7	5	6	6
Average	3	3	2.33	1.66	2	1.33	2	1.66	2.33	1.66	2	2
Equivalent Avg. Attainment	3	3	2	2	2	1	2	2	2	2	2	2

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE07E08.1	3	2

UCE07E08.2	3	2
UCE07E08.3	3	3
Total	9	7
Average	3	2.33
Equivalent Avg. Attainment	3	2

References:-

Sl No.	**Name of Books**	**Authors**	**Publishers**
01.	Traffic Engg.and Transport	Kadiyali, L.R	Khanna Publishers
02	Transportation Engineering and Planning	C.S. Papacostas and P.D. Prevedouros	Pearson Education India

C. Water Resource Engineering

WATER RESOURCES PLANNING AND MANAGEMENT

(UCE07E09)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. The objective of this course is to impart the knowledge of planning, developing and managing water resources to ensure adequate, inexpensive and sustainable supplies and qualities of water.

2. To impart the knowledge of various techniques, Cost-benefit analysis ,optimization techniques and system approach. and how to manage the water resources, to protect against flooding, or to make passage along or across rivers easier,

3. Integrated and multiple utilization of water development projects.

Course Content:

Module-1

Introduction: Role of water in national development, assessment of water resources of the country, scope of water resources development vis-a-vis environment.

Module-2

Planning: Water resources planning process; Planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives.

Module-3

Cost-benefit analysis Introduction to optimization techniques and system approach.

Module- 4

Management: Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation , flood control and power generation, inter-basin transfer of water, conjunctive use of surface and ground water.

Module- 5

Water quantity and quality modeling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentations and watershed management.

Course outcome (CO):

1. Identify available water resources and how these vary in time.

2. Build simple optimization models using linear programming.

3. Simulate changes in water quality and relate these to regulations.

4. Plan future demand scenarios based on climate change.

5. Evaluate system management options to optimize water availability.

6. Develop an archive that will be accessible for future research

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE07E09.1	Identify available water resources and how these vary in time.
UCE07E09.2	Build simple optimization models using linear programming
UCE07E09.3	Simulate changes in water quality and relate these to regulations.
UCE07E09.4	Plan future demand scenarios based on climate change..
UCE07E09.5	Evaluate system management options to optimize water availability.
UCE07E09.6	Develop an archive that will be accessible for future research

Table2

1: Slight (LOW) 2: Moderate (MEDIUM)3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO 1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
UCE07E09.1	2	2	1	3	2	2	2	3	3	2	2	1
UCE07E09.2	3	3	3	2	2	1	1	2	2	2	2	2
UCE07E09.3	3	1	2	1	3	1	2	1	2	2	2	2
UCE07E09.4	2	2	1	2	1	2	2	1	2	2	1	2

UCE07E09.5	3	2	2	2	1	2	2	1	2	2	2	1
UCE07E09.6	2	1	3	2	2	1	3	2	1	1	2	2
Total	**15**	**11**	**12**	**12**	**11**	**10**	**12**	**10**	**12**	**11**	**11**	**10**
Average	**2.5**	**1.83**	**2.0**	**2.0**	**1.83**	**1.66**	**2.0**	**1.66**	**2.0**	**1.83**	**1.83**	**1.66**
Eq. Av Attainment	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between COs &PSOs

CO	**PSO1**	**PSO2**
UCE07E09.1	4	3
UCE07E09.2	4	3
UCE07E09.3	3	3
UCE07E09.4	3	3
UCE07E09.5	3	3
UCE07E09.6	4	3
Total	**21**	**18**
Average	**3.5**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	**Name of Book**	**Author**	**Publisher**
1	Principle of water Resources Planning	G man, A.S	A.S Prentice Hall Inc.,Engle wood Cliffs,N.J.1984
2	Water Resources Engineering,	Linsley, R.K/and Frazini,J.B.,	Mc.Graw hill, NewYork,1979.

River Engineering and Flood Control

(UCE07E10)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1. The objective of this course is to impart the knowledge of hydrology and fluvial process that deals with the occurrence, distribution, movement and properties of water on the earth.

2. To impart the knowledge of various techniques, and how to manage the water resources, to protect against flooding, or to make passage along or across rivers easier,

3. To learn about the sediment problems associated with natural stream and reservoir.

Course content:

Unit- 1

River regions and their characteristics, Classifications of rivers on alluvial plains, meandering

Unit 2

Sediment transport, regime theory, critical shear stress, bed load, local and suspended load transport

Unit – 3

River training works: Objectives of river training, methods of rivertraining, river training structures

Unit – 4

Runoff estimation, flood, statistical methods, flood forecasting and warning.

Unit – 5

Flood routing, Modified Pul's method, Muskingum Methods, numerical methods,

Course outcome (CO):

1. Demonstrate an advanced understanding of hydrological and river engineering processes.

2. Identify methods of flood control and describe their appropriate application anduse it to hold water

3. Recognize the movement of sediments and its impact on river flow

4. Apply knowledge of mathematics, science, and technology in the field of river engineering.

5. An ability to communicate effectively

6. Develop an archive that will be accessible for future research.

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE07E10.1	Demonstrate an advanced understanding of hydrological and river engineering processes
UCE07E10.2	Identify methods of flood control and describe their appropriate application and use it to hold water
UCE07E10.3	Recognize the movement of sediments and its impact on river flow.
UCE07E10.4	Apply knowledge of mathematics, science, and technology in the field of river engineering.
UCE07E10.5	Students will be able to communicate effectively
UCE07E10.6	Develop an archive that will be accessible for future research

Table2

1: Slight (LOW) 2: Moderate (MEDIUM)3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
UCE07E10.1	3	2	2	2	1	2	1	2	1	2	2	1
UCE07E10.2	2	2	3	2	2	2	1	1	2	2	2	2
UCE07E10.3	3	1	2	1	3	1	2	1	2	2	2	2
UCE07E10.4	2	2	1	2	1	2	2	1	2	2	1	2
UCE07E10.5	3	2	2	2	2	2	2	1	2	2	2	1
UCE07E10.6	2	1	3	2	2	1	3	2	1	1	2	2
Total	**15**	**10**	**13**	**11**	**11**	**10**	**11**	**8**	**10**	**11**	**11**	**10**
Average	**2.5**	**1.66**	**2.16**	**1.83**	**1.83**	**1.66**	**1.83**	**1.33**	**1.66**	**1.83**	**1.83**	**1.66**
Eq. Av	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**

Attainment												

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE07E10.1	4	3
UCE07E10.2	4	3
UCE07E10.3	4	3
UCE07E10.4	4	3
UCE07E10.5	4	3
UCE07E10.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Irrigation and water power Engineering	B.C.Punmia	Standard Publishers 1992
2	Irrigation and Hydraulic Structures	S.K.Garg	Khanna Publishers,1992.

D. Environmental Engineering

INDUSTRIAL POLLUTION AND CONTROL

(UCE07E11)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. To understand the characteristics of industrial wastewater.
2. To understand the effects of discharge of industrial effluent on stream, land and environment.
3. To make the students conversant about water pollution caused by industrial effluent.
4. To make the students conversant with various industrial wastewater treatment method.
5. To study the combine treatment method of municipal wastewater along with industrial wastewater.
6. To study the effect of air pollution and its control measures.

Course content:

Module-1

Water Pollution:-

General

Effects of discharge of industrial wastewater on streams, land and environment Importance and scope. Problems involved in treatment. Variation in quality and quantity of industrial wastewater.

Module-2

Standards & Criteria: Indian standards for discharge of treated wastewaters on land, into municipal sewer and natural water courses. Sampling of Wastewaters, Representative sample. Grab and composite samples.

Module-3

Effluent Quality and Quantity

Approaches to minimization-good housekeeping, equalization and neutralization by Mixing of different effluent streams; recycling of wastewater streams. Process Modifications in terms of raw materials and chemicals used. Treatment of industrial Wastes, Removal of dissolved and suspended solids, organic waste treatment process, Sludge treatment and handling. General Approaches to planning of Industrial Wastewater Treatment and Disposal Equalization & proportioning, Neutralization. Treating different effluent streams separately. Including/ Excluding domestic wastewater along with the industrial waste. Treating different streams jointly after mixing them partly or fully treating industrial waste waters along with town waste.

Module-4

General Approaches for Handling and Treatment of Specific Characteristics of Industrial Waste waters.

Stream water quality, DO sag curve. Approaches for treating wastes having shock Loads, colors, toxic metal-ions, refractory substances e.g. ABS and other detergents, Growth inhibiting substances such as insecticides, high concentration of nutrients (N, P, K etc), oil and grease, suspended solids, BOD. Hot wastes, wastes with acidity, alkalinity, etc.

Process Flow Diagrams, Characteristics and Treatment of Various Industrial Wastes.

Industrial wastes of pulp and paper, textile, tannery, food, canning, sugar mill, distillery, dairy, pharmaceutical, electroplating etc.

Module-5

Air Pollution:

Meteorology & atmospheric dispersion. Air pollution due to industrial activities. Control at stationery & mobile sources.

Course outcome:

1. Students will be able to analyze characteristics of industrial wastewater.
2. Students will be able to understand the effects of discharge of industrial effluent on environment.
3. To make the students conversant about water pollution caused by industrial effluent.
4. Students will be able to design various wastewater treatment units.
5. Students will be able to analyze characteristics of air.
6. Students will be able to design air pollution controlling devices.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE07E11.1	Students will be able to analyze characteristics of water.
UCE07E11.2	Students will be able to forecast the population and estimate water demand.
UCE07E11.3	Students will be able to design various water treatment units.
UCE07E11.4	Students will be able to design the distribution network.
UCE07E11.5	Students will be able to analyze characteristics of air.
UCE07E11.6	Students will be able to design air pollution controlling devices.

Table 2

Slight (Low): 1 **Moderate: 2** **Substantial (High): 3** **No Correlation: "-"**

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
UCE07E11.1	3	2	1	1	-	1	2	-	2	-	-	2

UCE07E11.2	3	2	1	1	-	1	2	-	2	-	-	2
UCE07E11.3	3	2	3	3	-	1	2	-	2	-	-	2
UCE07E11.4	3	2	3	3	-	2	2	-	2	-	-	2
UCE07E11.5	3	2	1	1	-	2	2	-	2	-	-	2
UCE07E11.6	3	2	3	3	-	2	2	-	2	-	-	2
Total	**18**	**12**	**12**	**12**	**-**	**9**	**12**	**-**	**12**	**-**	**-**	**12**
Average	**3**	**2**	**2**	**2**	**-**	**1.5**	**2**	**-**	**2**	**-**	**-**	**2**
Equivalent Avg. Attainment	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**-**	**2**	**-**	**-**	**2**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE07E11.1	**3**	**3**
UCE07E11.2	**3**	**3**
UCE07E11.3	**3**	**3**
UCE07E11.4	**3**	**2**
UCE07E11.5	**3**	**3**
UCE07E11.6	**3**	**3**
Total	**18**	**17**
Average	**3**	**2.83**
Equivalent Avg. Attainment	**3**	**3**

References:-

Sl No.	Name of Books	Author	Publisher
01.	The Treatment of Industrial Wastes	Besselieure, E.B and Schwartz, M	McGraw Hill Kogakusha Ltd., New Delhi, 19
02.	Industrial Water Pollution	Ann Arbour Nemerow, N.L.	
03.	Air Pollution	Henry C	McGraw Hill KogaKusha Ltd., Tokyo, Japan
04.	Air Pollution	Stern, Arthur C.	Academic Press, New

			York, USA,1977.
05	Wastewater Engineering	Metcalf & Eddy, Inc	Tata McGraw Hill Edition.

ENVIRONMENTAL QUALITY & POLLUTION MONITORING TECHNIQUES

(UCE07E12)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. To make the students conversant with ecology and environment.
2. To understand the importance of human environment relationship.
3. To understand the Environmental policies and Legislation.
4. To understand the nature Causes of Environmental Problems.
5. To understand the concept of Environmental Impact Assessment.
6. To understand the concept of Sustainable Development.

Course content:

Module-1

General: Introduction and scope. Ecology and Environment. Recap of Environment: Pollution and control basic principles of management. Environmental quality a Solid waste management.

Module-2

Environmental policies and Legislation: Rule, act, code, standards, criteria, specification.

Module-3

Causes of Environmental Problems: Nature and scope of environmental problems, population and economic growth, energy growth, human environmental disturbances.

Module-4

Environmental Samples collection and Analysis

Fate of Pollutants in the Environment and pollution control Strategies: Dispersion and diffusion of pollutants in air and water, ground water pollution, leachate and gas movement in landfills, Propagation of noise, various pollution control devices/measures.

Module-5

Hazardous Waste and Risk Analysis.

Environmental Impact Assessment.

Sustainable Development.

Course outcome:

1. Students will be able to know about ecology and environment.
2. Students will be able to understand the importance of human environment relationship.
3. Students will be able to understand the Environmental policies and Legislation.
4. Students will be able to understand the nature Causes of Environmental Problems.
5. Students will be able to understand the concept of Environmental Impact Assessment.
6. Students will be able to understand the concept of Sustainable Development.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE07E12.1	idents will be able to analyze characteristics of water.
UCE07E12.2	idents will be able to forecast the population and estimate water demand.
UCE07E12.3	Students will be able to design various water treatment units.
UCE07E12.4	idents will be able to design the distribution network.
UCE07E12.5	Students will be able to analyze characteristics of air.
UCE07E12.6	Students will be able to design air pollution controlling devices.

References:-

Sl No.	Name of Books	Author	Publisher
01.	Introduction to Environmental Engineering and Scince	Masters, G.M.,Peavy, H.S.,Rowe,	Prentice Hall of India Pvt. Ltd
02.	Environmental Engineering	D.R and Tchobanoglous,G	McGraw Hill company

DETAIL

COURSE CURRICULUM

FOR

UNDERGRADUATE PROGRAMME

B.TECH

IN

CIVIL ENGINEERING

(8th SEMESTER)

NATIONAL INSTITUTE OF TECHNOLOGY, AGARTALA

TRIPURA (WEST)

Design of Steel Structures - II

(UCE08B01**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. To know how to design built up columns of same and different sections subjected to different loading conditions with Lacing and Battened system.
2. To calculate the forces in the members in a roof truss.
3. To design different steel beams such as welded and bolted plate girders and gantry girders with their applications.
4. To know about moment resistant connections for frames and brackets.
5. Analysis and design of industrial building frames.
6. Total overview of bridge and design of bridges for highway or railway loading, design of truss bridge for railway loading.
7. To study the plastic method of design for beams and frames.

Course content:

Unit-1

Design of Column Splices- Splices, Column – Column of same and different sections subjected to different loading conditions, Lacings and Battens

Unit-2

Design of Roof Trusses.

Unit-3

Design of Girders- Welded and Bolted Plate Girder Design, Design of Gantry Girder.

Unit-4

Moment resistant Connections- Connections for frames, brackets.

Unit-5

Industrial Buildings-Loads, General arrangement and stability considerations, industrial building frames design.

Unit-6

Bridge- Different Types, General arrangement, Design of bridges for highway / railway loading,

Design of truss bridge for railway loading.

Unit-7

Plastic methods- Design of beams and frames.

Course outcome:

1. On completion of the course, the students will be able to design Column Splices, lacing and batten systems.
2. Students are taught to design and analyze the roof truss and different parts of it.
3. Students will be able to design plate girder and gantry girder,
4. Understand the detail construction procedure of industrial building frame.
5. Understand the basic fundamentals of bridge structures.
6. Students will be able to understand the analysis of plastic methods regarding different beams and columns.

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08B01.1	On completion of the course, the students will be able to design Column Splices, lacing and batten systems, roof truss, plate girder and gantry girder, industrial building frame, bridges etc
UCE08B01.2	Students are taught to design and analyze the roof truss and different parts of it
UCE08B01.3	Students will be able to design plate girder and gantry girder,
UCE08B01.4	Understand the detail construction procedure of industrial building frame.
UCE08B01.5	Understand the basic fundamentals of bridge structures

Table2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -"-"

CO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12
UCE08B01.1	3	3	3	3	1	1	1	1	1	1	1	3
UCE08B01.2	3	3	3	3	1	1	1	1	1	1	1	3
UCE08B01.3	3	3	3	3	1	1	1	1	1	1	1	3
UCE08B01.4	3	3	3	3	1	1	1	1	1	1	1	3
UCE08B01.5	3	3	3	3	1	1	1	1	1	1	1	3
Total	**15**	**15**	**15**	**15**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**15**
Average	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE08B01.1	4	2
UCE08B01.2	3	3
UCE08B01.3	3	4
UCE08B01.4	4	4
UCE08B01.5	4	4
Total	**18**	**17**
Average	**3.6**	**3.4**
Equivalent Avg. Attainment	**4**	**3**

References

Sl. No.	Name of Book	Author	Publisher
1	Design of Steel Structures Vol –I, II, III	Ramchandra	Standard book House Delhi
2	Design of Steel Structures	L.S.Negi	Tata Mc Graw Hill

3	Design of steel structures	A.S Arya & J.L.Azmani	Nem Chand Brothers Roorkee
4	Design of Steel Structures	Dayarathnam P	A.H. Wheeler & Co. Ltd
5	Limit State Design of steel structure	S.K. Duggal	Tata Mc Graw Hill

Estimation, Costing and Valuation

(UCE08B02**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. Determination of quantities of items and labour requirement of civil engineering works.
2. Preparation of estimate of the civil engineering works.
3. Preparation of specification of construction items.
4. To introduce the students in depth knowledge of professional practice as well the quantity analysis of construction works like, multistoried structures, water works & sanitary works, irrigation works, road estimates culverts, etc.

Course content:

Unit-1

Types of estimate: Preliminary, detailed, supplementary, revised. Detail of measurement and calculation of quantities, bar bending schedule, abstract of cost of building work – slab, beam, foundation etc. Estimate of Earthwork (Road) in banking or cutting, bridges. Sanction: Administrative approval, expenditure sanction, Technical sanction

Unit-2

Specification: General and detailed specification, Use of IS and IRC codes and building laws, different manuals and guidelines.

Unit-3

DPR: Project survey and collection of technical and design data, preparation of DPR.

Unit-4

Rules & regulation for execution: Different types of tender - PNIT, DNIT, informal tender, earnest money, tendering procedure, rules and method of measurement, PWD accounts and procedure for works.

Course outcome:

On completion of the courses:

1) Students will be able to learn the different types of estimation and details of measurement and calculation of quantities.
2) Students will be able to learn the determination of cost of building works of roof slab, beam, foundation etc.
3) Students will be able to learn the estimation of earthwork (Road) in banking or cutting, bridges, retaining wall, masonry water tank, septic tank, staircase, slab culvert, single room and multiple room building etc.
4) Students will be able to learn the estimation of single room and multiple room building.
5) The students will be able to learn general and detailed specification, Use of IS and IRC codes and building laws, different manuals and guidelines.
6) The students will learn the purpose and importance of valuation, Different types of tender, earnest money, tendering procedure, contract system, rate analysis, rules and method of measurement, PWD accounts and procedure for works.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08B02.1	Students will be able to learn the different types of estimation and details of measurement and calculation of quantities.

UCE08B02.2	Students will be able to learn the determination of cost of building works of roof slab, beam, foundation etc.
UCE08B02.3	Students will be able to learn the estimation of earthwork (Road) in banking or cutting, bridges.
UCE08B02.4	Students will be able to learn the retaining wall, masonry water tank, septic tank, staircase, slab culvert.
UCE08B02.5	The students will be able to learn general and detailed specification, Use of IS and IRC codes and building laws, different manuals and guidelines
UCE08B02.6	The students will learn the purpose and importance of valuation, Different types of tender, earnest money, tendering procedure, contract system, rate analysis, rules and method of measurement, PWD accounts and procedure for works.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and for NO CORELATION-"-"

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
UCE08B02.1	2	2	1	1	1	1	1	1	1	1	1	3
UCE08B02.2	2	2	2	1	1	1	1	1	2	1	1	3
UCE08B02.3	2	2	2	1	1	1	1	1	2	1	1	3
UCE08B02.4	3	2	2	1	1	1	1	1	2	2	2	3
UCE08B02.5	3	2	2	1	1	1	1	1	2	2	2	3
UCE08B02.6	3	3	2	1	1	1	1	1	2	1	2	3
Total	**15**	**13**	**11**	**6**	**6**	**6**	**6**	**6**	**11**	**8**	**9**	**18**
Average	**2.5**	**2.16**	**1.83**	**1**	**1**	**1**	**1**	**1**	**1.83**	**1.33**	**1.5**	**3**
Eq. Av Attainment	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE08B02.1	3	4
UCE08B02.2	3	3
UCE08B02.3	2	3
UCE08B02.4	2	2
UCE08B02.5	3	3
UCE08B02.6	3	4
Total	**16**	**19**
Average	**2.66**	**3.16**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Masonry and timber structures Including earthquake resistant Design,	Arya, A.S	Nem chand & brothers.
2	Estimating and costing in civil	Dutta, B.N	UBS publishers engineering-Theory & Practice
3	Different IRC and IS codes,		IRC, IS

Geotechnical Engineering –III

(UCE08B03**)**

Total Credit: 04 **Contact Periods: 04 (3L+1T)**

Courses objective:

1. To obtain fundamental understanding of the concepts of geotechnical engineering - III.
2. To understand the details about different types of shallow and deep foundations.
3. To give a clear idea regarding different analysis and design procedure on different types of foundations.
4. To understand clearly about the proportioning of footing, bearing capacity failure, behaviour of expansive soil, machine foundations and settlement analysis.

Course content:

Unit- 1

Foundations: Common types of foundations with examples. Brief illustration of situations where each one of them is adopted. Basis for design.

Unit –2

Review of major soil parameters used in proportioning of foundations.

Unit – 3

Shallow Foundations: Types and their selection. Terminology. Bearing capacity-Terzaghi's equation. Terzaghi's Bearing Capacity theory. Types of shear failure. Computation of bearing capacity in cohesionless and cohesive soils. Effect of various factors on bearing capacity. Bearing Capacity from Standard Penetration Tests. Eccentrically loaded foundations.

Unit – 4

Settlement: Components of settlement. Limits of settlement. Accuracy in foundation settlement prediction. Allowable settlement. Allowable soil pressure. Plate load test. Estimation of settlement of footings and rafts on sands. Penetration and Plate load test data. Estimation of settlement of footing/rafts on cohesive soils using consolidation test data. Correction for rigidity

and 3D consolidation effect. Proportioning of footings.

Unit – 5

Pile Foundations: Situations where adopted; Types of piles; Outline of steps involved in proportioning; Bearing capacity and settlement of single and group of piles; Proportioning with field/laboratory data as input.

Unit – 6

6. Well Foundations: Situations where adopted; Elements of wells; Types; Methods of construction; Tilt and shift; Remedial measures. Proportioning: Depth and size of wells on the basis of scour depth, bearing capacity and settlement; Terzaghi's lateral stability analysis.

Unit – 7

Introduction to Machine Foundation. Types of machines and their foundations. Terminology. Design criteria. Field methods of determining design parameters: Cyclic Plate load test; Block vibration test. Response of block foundation under vertical vibrations.

Unit – 8

Foundation on Expansive Soil: Identification of expansive soil, Problems associated with expansive soil; Design consideration of foundation on expansive soil. Under-reamed piles.

Course Outcome:

1. Students will be able to learn in detail the advanced geotechnical engineering, i.e., geotechnical engineering – III.
2. Students will be able to learn in details about the proportioning of footing, bearing capacity failure, behaviour of expansive soil, machine foundations and settlement analysis.
3. Students will be able to understand detail analysis and design procedures of different foundations.
4. In depth study on different types of foundations based on different types of soil to be learned by the students.
5. Students will be able to learn detail about the investigation report on soil also and accordingly, foundations to be chosen.
6. Students will be able to learn also the proper application of the foundation in the field of geotechnical engineering.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08B03.1	Students will be able to learn in detail the advanced geotechnical engineering, i.e., geotechnical engineering – III.
UCE08B03.2	Students will be able to learn in details about the proportioning of footing, bearing capacity failure, behaviour of expansive soil, machine foundations and settlement analysis.
UCE08B03.3	Students will be able to understand detail analysis and design procedures of different foundations.
UCE08B03.4	In depth study on different types of foundations based on different types of soil to be learned by the students.
UCE08B03.5	Students will be able to learn detail about the investigation report on soil also and accordingly, foundations to be chosen.
UCE08B03.6	Students will be able to learn also the proper application of the foundation in the field of geotechnical engineering.

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08B03.1	3	3	3	-	-	-	-	-	-	-	-	3
UCE08B03.2	3	-	3	-	-	-	-	-	-	-	-	3
UCE08B03.3	3	-	-	3	-	-	-	-	-	-	-	3
UCE08B03.4	3	-	-	-	-	-	-	-	-	-	-	3
UCE08B03.5	3	3	-	-	-	-	-	-	-	-	-	3
UCE08B03.6	3	-	-	-	-	3	-	-	-	-	-	3
Total	**18**	**6**	**6**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**18**
Average	**3**	**1**	**1**	**0.5**	**-**	**0.5**	**-**	**-**	**-**	**-**	**-**	**3**
Eq. Av	**3**	**1**	**1**	**0**	**-**	**0**	**-**	**-**	**-**	**-**	**-**	**3**

Attainment												

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE08B03.1	3	2
UCE08B03.2	4	3
UCE08B03.3	4	3
UCE08B03.4	4	4
UCE08B03.5	4	3
UCE08B03.6	3	3
Total	**22**	**18**
Average	**3.66**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Basic and Applied Soil Mechanics	Gopal Ranjan and Rao, A.S.R	R New Age International, New Delhi, 1998
2	Soil Mechanics in Engineering Practice	Terzaghi, K, and Peck, R.B	John Wiley, New York, 1968
3	Soil Mechanics and Foundation Engineering	Arora, K.R.,	Standard Publishers

Structural Design and Drawing Lab- IV

(UCE08P01**)**

Total Credit: 02 **Contact Periods: 03**

Courses objective:

1. To have an overview of design methods of various Civil engineering structures.
2. To know the various codal provisions in respect to RCC and steel structure design.
3. To carry out hands-on practice on the method of preparation of drawing from actual design output.
4. To garner knowledge regarding use of software for preparation of drawing.

Course content:

Unit-1

Layout Drawing: General Layout of building showing position of columns, footings, beams and slabs with notifications, and slabs with notations

Unit-2

Layout Drawing: Continuous Beams, Beam and Slab Floor System

Unit-3

Layout Drawing: Dog legged Staircases

Unit-4

Layout Drawing: Column Footings, Rectangular and Square

Unit-5

Design and drawing: Cantilever and Counterfort type of Retaining Walls

Unit-6

Design and drawing: Circular and Rectangular Water Tanks resting on the ground

Unit-7

Design and drawing: Simple Portal Frame (Single bay and Single Storey)

Unit-8

Design and drawing: Connections: Bolted, Welded, Beam- Beam, Beam –Column, Seated, Stiffened and Unstiffened

Unit-9

Design and drawing: Columns: Splices, Column-Column of same and different sections, Column Bases: Slab base and Gusseted base

Unit-10

Design and drawing: Roof Truss (Forces in the member to be given), Pressed Water Tanks

Course outcome:

1. Students will learn to prepare layout plan of the building as a whole and its components.
2. Students will be able to design RC structures, e.g. building, retaining wall and water tank.
3. Students will be able to design steel structures, e.g. roof truss, water tank and various structural components including their connections.
4. Students will be able to learn the method of preparation of structural drawing for both RCC and steel structures.
5. Students will be well conversant about the various codal provisions.
6. Students will learn to do the problems using software.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course outcome
UCE08P01.1	Students will learn to prepare layout plan of the building as a whole and its components.
UCE08P01.2	Students will be able to design RC structures, e.g. building, retaining wall and water tank.
UCE08P01.3	Students will be able to design steel structures, e.g. roof truss, water tank and various structural components including their connections.
UCE08P01.4	Students will be able to learn the method of preparation of structural drawing for both RCC and steel structures.
UCE08P01.5	Students will be well conversant about the various codal provisions.
UCE08P01.6	Students will learn to do the problems using software.

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM)3: Substantial (HIGH) 4. NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08P01.1	3	3	3	3	3	1	1	1	3	3	1	3
UCE08P01.2	3	3	3	3	3	1	1	1	3	3	1	3
UCE08P01.3	3	3	3	3	3	1	1	1	3	3	1	3
UCE08P01.4	3	3	3	3	3	1	1	1	3	3	1	3
UCE08P01.5	3	3	3	3	3	1	1	1	3	3	1	3
UCE08P01.6	3	3	3	3	3	1	1	1	3	3	1	3
Total	**18**	**18**	**18**	**18**	**18**	**6**	**6**	**6**	**18**	**18**	**6**	**18**
Average	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**1**	**3**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**1**	**3**

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE08P01.1	4	3
UCE08P01.2	4	3
UCE08P01.3	4	3
UCE08P01.4	4	3
UCE08P01.5	4	3
UCE08P01.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

Civil Engineering Estimation & Costing

(UCE08P02**)**

Total Credit: 01 **Contact Periods: 02**

Courses objective:

1) To develop an awareness of those factors that affect the cost of construction work and to analyze the influences that effect change in these factors.
2) To introduce the students in depth knowledge of quantity analysis of construction works like, multistoried structures, water works & sanitary works, irrigation works, road estimates culverts etc.
3) To know about the format for preparation and presentation of an estimate.
4) To identify the main sources of current and forecast labour rates.
5) Preparation of specification of construction items.
6) To list the factors that contribute to the estimation of overhead costs.

Course content:

Sessional works based on complete design, cost analysis and estimation of followings**:**

Unit-1: Buildings (Masonry and R.C.C constructions)

Unit-2 : Roads.

Unit-3: Bridges.

Unit-4: Cross drainage structures.

Unit-5: Water Tanks.

Unit-6 : Urban Drainage systems.

Course outcome:

On completion of the course, the students will be able to:

1) Describe various terms used in estimation work

2) Explain the concept of schedule of rates and the purpose of rate analysis
3) Determine the actual value of any property.
4) The students will be able to understand the procedure to carry out the estimation and steps to prepare reports of construction works.
5) The students will learn the purpose and importance of valuation.

No of course outcome (CO)	Course Outcome
UCE08P02.**1**	Describe various terms used in estimation work
UCE08P02.**2**	Explain the concept of schedule of rates and the purpose of rate analysis
UCE08P02.**3**	Determine the actual value of any property.
UCE08P02.**4**	The students will be able to understand the procedure to carry out the estimation and steps to prepare reports of construction works.
UCE08P02.**5**	The students will learn the purpose and importance of valuation.

Table2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -"-"

CO	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12
UCE08P02.**1**	3	3	3	3	1	1	1	1	1	1	1	3
UCE08P02.**2**	3	3	3	3	1	1	1	1	1	1	1	3
UCE08P02.**3**	3	3	3	3	1	1	1	1	1	1	1	3
UCE08P02.**4**	3	3	3	3	1	1	1	1	1	1	1	3
UCE08P02.**5**	3	3	3	3	1	1	1	1	1	1	1	3
Total	**15**	**15**	**15**	**15**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**15**
Average	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE08B01.1	4	2
UCE08B01.2	3	3
UCE08B01.3	3	4
UCE08B01.4	4	4
UCE08B01.5	4	4
Total	**18**	**17**
Average	**3.6**	**3.4**
Equivalent Avg. Attainment	**4**	**3**

Project: II

(UCE08P03**)**

Total Credit: 03 **Contact Periods: 04**

The Project-II/Thesis work will involve in-depth study/review/evaluation/assessment/ analysis/design/experimental investigation/software development related to civil engineering problems of interest. The findings and results are to be presented appropriately in the form of reports/photographic records/drawings/computer printout and presentation in seminar will be encouraged.

Seminar & Viva-voce (UCE08P04**)**

Total Credit: 02 **Contact Periods: 00**

It is for assessing the candidates overall performances in subject matters related to civil engineering and their ability. Each student will perform presentation in seminar on a topic related to the field of Civil Engineering and at the end of semester they will appear before the departmental viva-voce.

Departmental Elective–II

Project Planning and Management

(UCE08E01)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1. To obtain the concept of PERT and CPM.
2. To understand the network rules.
3. To understand labour laws, arbitration.
4. To understand the tendering, contract.

Course content:

Unit- 1

Project:

Project conception, feasibility study, cost benefit analysis, project appraisal

Unit 2

Planning:

Staff, Materials,Labour,Logistics

Unit – 3

Management:

Network method, Resource management-materials/men/machines/money.Project cost control

Unit – 4

Contacts:

General condition, types/bias. Special condition, Specifications, Measurement,payment types/condition

Unit – 5

Tendering:

Pre-qualification criteria, Tender documents, Tender evaluation, Tender negotiation, Tender pricing strategies

Unit – 6

Personnel:

Personnel management, Staff and Labour welfare, Public Relation

Unit – 7

Quality control:

Organising construction, Inspection and Quality control

Unit – 8

Safety:

Site safety measures, Accident Prevention, First Aid

Course outcome:

1. Students will be able to identify the difference of bar chart and milestone chart.
2. Students will be able to form the network of a project.
3. Students will be able to understand different types of project phases.
4. Students will be to understand the tendering, arbitration
5. Students will be able to understand muster roll
6. Students will be able to understand the critical path

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08E01.1	Students will be able to identify the difference of bar chart and milestone chart.

UCE08E01.2	Students will be able to form the network of a project.
UCE08E01.3	Students will be able to understand different types of project phases.
UCE08E01.4	Students will be to understand the tendering, arbitration
UCE08E01.5	Students will be to understand the muster roll
UCE08E01.6	Students will be to understand the critical path

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E01.1	3	2	3	2	1	-	-	-	-	-	-	1
UCE08E01.2	3	3	2	2	1	-	-	-	-	-	-	1
UCE08E01.3	3	3	2	2	1	-	-	-	-	-	-	1
UCE08E01.4	3	2	3	2	1	-	-	-	-	-	-	2
UCE08E01.5	3	3	2	2	1	-	-	-	-	-	-	1
UCE08E01.6	3	3	2	2	1	-	-	-	-	-	-	1
Total	**15**	**13**	**12**	**10**	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**6**
Average	**3**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E01.1	3	3
UCE08E01.2	3	3
UCE08E01.3	3	3
UCE08E01.4	2	2

UCE08E01.5	3	2
UCE08E01.6	3	2
Total	**14**	**13**
Average	**2.8**	**2.6**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1	Project Planning and Control	Dr. B.C. Punmia	Laxmi Publications(P) With PERT And CPM
2	PERT and CPM Principles	L.S. Srinath	Affiliated East –West Press Pvt. Ltd New Delhi
3	Project Management with PERT and CPM	Dr. D.S. Hira	S.K. Kataria & Sons New Delhi
4	A Management Guide to PERT/ CPM With GERT/PDM/DCPM And other Network**.**	Jerome D. Wiest Ferdinand K. Levy	Prentice Hall of India Pvt. Ltd. New Delhi
5	Construction Planning and Management	P.S. Gahlot B.M. Dhir	New Age International (P) Ltd. New Delhi

Bridge Engineering

(UCE08E02)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1. To provide fundamental understanding of various parts of bridge and various types of bridges.
2. To teach various specifications of bridges that should be considered while designing a railway bridge or a road bridge.
3. To provide a proper understanding on the IRC loadings that should be considered while designing a railway bridge or a road bridge.
4. To design plate girder bridge and various bridge elements like piers, abutments and bearings.

Course content:

Unit- 1

Introduction:

Classification and components of bridges– layout and planning– Structural forms of bridge decks – grillage analysis of slab decks, beam and slab decks, cellular decks.

Unit 2

Standard specifications for bridges:

IRC loadings for road bridges – standards for railway bridges – design of RC slab, skew slab and box culverts. Design of T beam bridges – balanced cantilever bridges – rigid frame bridges – Arch bridges – bow string girder bridges.

Unit – 3

Design of plate girder bridges:

steel trussed bridges – Introduction to long span bridges: cable stayed bridges and suspension bridges –instability.

Unit – 4

Forces on piers and abutments:

Design of piers and abutments – types of wing walls – types of bearings – design of bearings

Course Outcome:

1. Students will learn the aims of site investigation, site and preliminary data collection, bridge importance and failures study.
2. Students will learn the various forces action on bridge and its components and the Standards like IRC used for design purposes.
3. Students will be well versed with various methods to obtain design discharge at site.
4. Students will be able to design bridge components, culverts and bearings.
5. Students will learn the various types of bridges, construction methods and maintenance.

Table 1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08E02.1	Students will learn the aims of site investigation, site and preliminary data collection, bridge importance and failures study.
UCE08E02.2	Students will learn the various forces action on bridge and its components and the Standards like IRC used for design purposes.
UCE08E02.3	Students will be well versed with various methods to obtain design discharge at site.
UCE08E02.4	Students will be able to design bridge components, culverts and bearings.
UCE08E02.5	Students will learn the various types of bridges, construction methods and maintenance.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E02.1	3	2	3	2	1	-	-	-	-	-	-	1
UCE08E02.2	3	3	2	2	1	-	-	-	-	-	-	1

UCE08E02.3	3	3	2	2	1	-	-	-	-	-	-	1
UCE08E02.4	3	2	3	2	1	-	-	-	-	-	-	2
UCE08E02.5	3	3	2	2	1	-	-	-	-	-	-	1
Total	**15**	**13**	**12**	**10**	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**6**
Average	**3**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E02.1	3	3
UCE08E02.2	3	3
UCE08E02.3	3	3
UCE08E02.4	2	2
UCE08E02.5	3	2
Total	**14**	**13**
Average	**2.8**	**2.6**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Book	Author	Publisher
1.	Bridge Engineering	S. Ponnuswamy	Tata McGraw Hill
2.	Concrete Bridges: Inspection, repair, Strengthening, testing and load capacity evaluation	Raina	Tata McGraw Hill
3.	Concrete Bridge Practice: Analysis, design and economics	Raina	Tata McGraw Hill
4.	Essentials of bridge engineering	D. Johnson Victor	Oxford & IBH

5.	Design of bridges	N.Krishna Raju	Oxford & IBH

Design of Hydraulic Structures

(UCE08E03)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1) To obtain fundamental understanding of the design of various hydraulic structures and River Training works.
2) To obtain fundamental understanding of River Engineering.
3) To obtain the knowledge to design of bridge and culvert.

Course content:

Unit- 1

Dams: Investigation Survey, Selection of dam Site, Selection of type of dam, Classification and field exploration.

Earth and Rockfill Dam: Causes of failures and remedial measure, selection of earth Dam, Design considerations, phreatic lines, Seepage loss through earth dams, Stability analysis, Control of seepage through earth dams, Rockfill dams.

Gravity Dams: Forces acting on gravity dam; modes of failures; load combination for design, elementary profile, stability analysis; control of cracking; Galleries.

Unit 2

Spillway: Spillway and energy dissipation below spill way.

Unit 3

Diversion Head works: Selection of site and lay-out; Components of diversion head works; Design of barrage and weirs.

Unit – 4

Cross Drainage Structures: Types of cross drainage structures, design of cross drainage structures, Water way and headway of the stream, Head loss through cross drainage structures, Design of transitions for canal waterway, uplift pressure on trough, Uplift

pressure on culvert floor.

Unit – 5

Hydraulics of Small bridges and culverts: Essential design data: formulae for peak run-off from catchment; estimation of flood discharge; Design
discharge; Alluvial streams and lecey's equations; Linear Water way; calculation of sdepth; Elements of hydraulics of flow through small bridges and culverts; Hydraulic
details of Pipe culverts, R.C. box culverts and slab culverts.

Unit – 6

River Training Works: Types of river training works, Methods, Bank protection works,
Spurs, Guide Banks, Artificial cutoff.

Course outcome:

1. Students will be able to classify the types of dam, design of dam and the stability against overturning and sliding.
2. Students will be able to know the river engineering and design of different river protection works.
3. Students will be able to design earthen dam based on seepage analysis
4. Students will be able to design spillway in a concrete gravity dam
5. Students will be able to know different types of cross drainage structure and design of it
6. Students will be able to design bridge and culvert

Table 1

To establish the correlation between COs & POs

UCE08E03.1	Students will be able to classify the types of dam ,design of dam and the stability against overturning and sliding
UCE08E03.2	Students will be able to know the river engineering and design of different river protection works
UCE08E03.3	Students will be able to know the different river training works
UCE08E03.4	Students will be able to design spillway in a concrete gravity dam

UCE08E03.5	Students will be able to know different types of cross drainage structure and design of it
UCE08E03.6	Students will be able to design bridge and culvert

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
UCE08E03.1	3	3	2	2	1	2	2	2	2	1	1	2
UCE08E03.2	3	3	3	2	2	2	2	2	2	2	2	2
UCE08E03.3	3	3	3	2	1	2	1	1	2	2	2	2
UCE08E03.4	3	3	3	2	2	2	1	2	2	2	2	2
UCE08E03.5	3	3	2	2	2	2	1	2	2	1	2	2
UCE08E03.6	3	3	3	2	2	2	2	2	2	2	2	2
Total	**18**	**18**	**14**	**10**	**10**	**12**	**9**	**11**	**12**	**10**	**11**	**12**
Average	**3**	**3**	**2.33**	**1.67**	**1.67**	**2**	**1.5**	**1.83**	**2**	**1.67**	**1.83**	**2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E03.1	3	2
UCE08E03.2	3	2
UCE08E03.3	3	3
UCE08E03.4	3	2
UCE08E03.5	3	2
UCE08E03.6	3	3

Total	**18**	**14**
Average	**3**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

References:

Sl. No.	Name of Books	Author	Publisher
1	Irrigation and water Resources and Water Power Engineering	P.N.Modi	Standard Book House
2	Irrigation Engineering and Hydraulic Structures	S.K.Garg	Khanna Publishers
3	Irrigation Engineering and Hydraulic Structures	R.K.Sharma	Oxford & IBH

GEOMETRIC DESIGN OF TRANSPORTATION FACILITIES
(UCE08E04)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1) To obtain the knowledge about highway functional aspects and different characteristics.
2) To understand the concept of different geometrical design elements and their functions along with different roads with different terrains.
3) To obtain the idea about different types of intersections, bicycle track, parking lots & terminals and their different design aspects.

Course content:

Unit-1

Highway functional classification; route layout and selection; design controls and criteria:

vehicular characteristics, turning paths; driver performance;

Unit-2

Traffic characteristics; highway capacity; access control; safety.

Unit-3

Elements of design: sight distances, horizontal alignment, transition curves, super elevation and side friction; vertical alignment:grades crest and sag curves; highway cross-sectional elements and their design.

Unit-4

Hill road; Intersections -- at-grade intersections, sight distance consideration and principles of design, channelization, speed change lanes;

Unit-5

Roundabout, mini roundabouts, design of roundabout; Inter-changes, types of interchanges, entrance and exit ramps, ramp metering; Bicycle and pedestrian facility design; Parking layout and design; Terminal layout and design.

Course outcome:

1) Students will be able to know the highway functional classification and vehicular characteristics.
2) Students will be able to understand traffic characteristics, highway capacity and different controls and safety.
3) Students will learn different geometrical design elements along with different types of road with different terrain conditions.
4) Students will get idea about different types of intersection and their design principles.
5) Students will be able to know about maneuverability concept like ramp and design aspects of bicycle & pedestrian facility.
6) Students will be able to understand the layout and design aspects of parking lots and terminals.

Table1

To establish the correlation between COs & POs

UCE08E04.1	Students will be able to know the highway functional

	classification and vehicular characteristics.
UCE08E04.2	Students will be able to understand traffic characteristics, highway capacity and different controls and safety.
UCE08E04.3	Students will learn different geometrical design elements along with different types of road with different terrain conditions.
UCE08E04.4	Students will get idea about different types of intersection and their design principles.
UCE08E04.5	Students will be able to know about maneuverability concept like ramp and design aspects of bicycle & pedestrian facility.
UCE08E04.6	Students will be able to understand the layout and design aspects of parking lots and terminals.

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
UCE08E04.1	3	3	2	2	1	2	2	2	2	1	1	2
UCE08E04.2	3	3	3	2	2	2	2	2	2	2	2	2
UCE08E04.3	3	3	3	2	1	2	1	1	2	2	2	2
UCE08E04.4	3	3	3	2	2	2	1	2	2	2	2	2
UCE08E04.5	3	3	2	2	2	2	1	2	2	1	2	2
UCE08E04.6	3	3	3	2	2	2	2	2	2	2	2	2
Total	**18**	**18**	**14**	**10**	**10**	**12**	**9**	**11**	**12**	**10**	**11**	**12**
Average	**3**	**3**	**2.33**	**1.67**	**1.67**	**2**	**1.5**	**1.83**	**2**	**1.67**	**1.83**	**2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E04.1	3	2
UCE08E04.2	3	2
UCE08E04.3	3	3
UCE08E04.4	3	2
UCE08E04.5	3	2
UCE08E04.6	3	3
Total	**18**	**14**
Average	**3**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

Reference:-

Sl No.	Name of Books	Authors	Publishers
1.	Highway Engineering	Khanna & Justo	NemChand Bros
2.	Highway Engineering, Rogers	Martin	Blackwell Publisher
3.	Principles of Transportation, and HighwayEngineering	Rao, G.V	Tata McGraw Hill

Departmental Elective – III

A. Structural Engineering

Experimental Stress Analysis

(UCE08E05)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1. To understand different methods of strain measurement.
2. To study Photo elasticity, optics of photo elasticity and photo elastic effect.

3. To study on Isoclinics and Isochromatics and fringe constant.
4. To study different methods of stress separation.
5. To study Photo elastic coating and brittle coating.

Course content:

Unit- 1

Introduction to strain measurement, electrical resistance strain gauges, strain gauge circuits.

Unit 2

Photo elasticity, optics of photo elasticity, photo elastic effect.

Unit – 3

Isoclinics and Isochromatics, determination of fringe constant.

Unit – 4

Method of stress separation, Frozen stress method, Moire Technique, Holography.

Unit – 5

Photo elastic coating and brittle coating.

Course outcome:

1. Students will be able to measure strain using different methods.
2. Students will acquire substantial knowledge on photo elasticity, optics of photo elasticity and photo elastic effect.
3. Students will be able to find out Isoclinics and Isochromatics and fringe constant of a specimen.
4. Students will be able use stress separation technique in stress analysis.
5. Students will acquire substantial knowledge on Frozen stress method, Moire Technique and Holography.
6. Students will acquire knowledge on Photo elastic coating and brittle coating.

Table 1

To establish the correlation between Cos & POs

No of course outcome (CO)	Course Outcome
UCE08E05.1	Students will be able to measure strain using different methods.
UCE08E05.2	Students will acquire substantial knowledge on photo elasticity, optics of photo elasticity and photo elastic effect.

UCE08E05.3	Students will be able to find out Isoclinics and Isochromatics and fringe constant of a specimen.
UCE08E05.4	Students will be able use stress separation technique in stress analysis.
UCE08E05.5	Students will acquire substantial knowledge on Frozen stress method, Moire Technique and Holography.
UCE08E05.6	Students will acquire knowledge on Photo elastic coating and brittle coating.

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
UCE08E05.1	3	3	2	2	1	2	2	2	2	1	1	2
UCE08E05.2	3	3	3	2	2	2	2	2	2	2	2	2
UCE08E05.3	3	3	3	2	1	2	1	1	2	2	2	2
UCE08E05.4	3	3	3	2	2	2	1	2	2	2	2	2
UCE08E05.5	3	3	2	2	2	2	1	2	2	1	2	2
UCE08E05.6	3	3	3	2	2	2	2	2	2	2	2	2
Total	**18**	**18**	**14**	**10**	**10**	**12**	**9**	**11**	**12**	**10**	**11**	**12**
Average	**3**	**3**	**2.33**	**1.67**	**1.67**	**2**	**1.5**	**1.83**	**2**	**1.67**	**1.83**	**2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E05.1	3	2
UCE08E05.2	3	2
UCE08E05.3	3	3
UCE08E05.4	3	2

UCE08E05.5	3	2
UCE08E05.6	3	3
Total	**18**	**14**
Average	**3**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

References:

Sl. No.	**Name of Books**	**Author**	**Publisher**
1	Experimental Stress Analysis.	J .W. Dally and W.F. Riley	McGraw Hill
2	Hand Book of Experimental Stress Analysis.	M. Hetenyi	Eastern economy
3	Experimental Stress Analysis and. motion measurement	P.H.Adam & R.C.Dove	Eastern economy

Finite Element Method of Structural Analysis

(UCE08E06)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4 .**

Courses objective:

1. To obtain fundamental understanding of the concepts of Strong and weak formulation. To develop numerical model of discrete element and corresponding load vector.
2. To develop stiffness matrix for 1-D, 2-D and 3-D elements in rectangular coordinates and natural coordinates system.
3. To impart the knowledge about transformation matrix, assemble and develop the system matrix. Technique will be apply to analysis some simple structures likes truss, beam, frame and plate.

4. To obtain an understanding on higher order element, p- vesion and h -version of refinements, error and auto generation of mesh.
5. To understand on the elastic stability of beam- columns with different support conditions, material and geometrical nonlinearity and develop corresponding geometrical stiffness matrix.
6. To give basic idea about dynamic condensation, Eigen value extraction and application of FEM for thermal Analysis.

Course Content:

Unit 1.

INTRODUCTION

Boundary Value Problem - Approximate Solution - Variational and Weighted Residual Methods - Ritz and Galerkin Formulations - Concepts of Piecewise Approximation and Finite Elements - Displacement and Shape Functions - Weak Formulation - Minimum Potential Energy - Generation of Stiffness Matrix and Load Vector.

Unit 2.

STRESS ANALYSIS

Two Dimentional problems - Plane Stress, Plain Strain and Axisymmetric Problems - Triangular and Quadrilateral Elements Natural Coordinates - Isoparametric Formulation - Numerical Integration - Plate Bending and Shell Elements - Brick Elements - Elements for Fracture Analysis.

Unit:3

MESHING AND SOLUTION PROBLEMS

Higher Order Elements - p and h Methods of refinement - IIL conditioned Elements - Discretization Errors -Auto and Adaptive Mesh Generation Techniques - Error Evaluation.

Unit: 4

NONLINEAR AND VIBRATION PROBLEMS

Material and Geometric Nonlinearity - Methods of Treatment - Consistent System Matrices – Dynamic Condensation - Eigen Value Extraction.

Unit:5

THERMAL ANALYSIS

Application to Thermal analysis Problems.

Course outcome:

On completion of the course, the students will be able to:

1. Understand the concepts of Strong and weak formulation and also able develop numerical model of discrete element and corresponding load vector.
2. Develop stiffness matrix for 1-D, 2-D and 3-D elements in rectangular coordinates and natural coordinates system.
3. Generate transformation matrix, assemble and develop the system matrix. Students will be able to analysis some simple structures likes truss, beam, frame and plate by using FEM.
4. Understand on higher order element, p- version and h -version of refinements, error and auto generation of mesh.
5. Compute the stability of beam- columns with corresponding geometrical stiffness matrix.
6. Attain basic idea about dynamic condensation, Eigen value extraction and application of FEM for thermal Analysis.

To establish the correlation between COs & POs

Table 1

UCE08E06.1	Students will Understand the concepts of Strong and weak formulation and also able develop numerical model of discrete element and corresponding load vector.
UCE08E06.2	Students will be able Develop stiffness matrix for 1-D, 2-D and 3-D elements in rectangular coordinates and natural coordinates system.
UCE08E06.3	Students will be able to Generate transformation matrix, assemble and develop the system matrix. Students will be able to analysis some simple structures likes truss, beam, frame and plate by using FEM.
UCE08E06.4	Students will be able to Understand on higher order

	element, p- version and h -version of refinements, error and auto generation of mesh
UCE08E06.5	Students will be able Compute the stability of beam- columns with corresponding geometrical stiffness matrix.
UCE08E06.6	Students will be able to Attain basic idea about dynamic condensation, Eigen value extraction and application of FEM for thermal Analysis

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
UCE08E06.1	3	3	2	2	1	2	2	2	2	1	1	2
UCE08E06.2	3	3	3	2	2	2	2	2	2	2	2	2
UCE08E06.3	3	3	3	2	1	2	1	1	2	2	2	2
UCE08E06.4	3	3	3	2	2	2	1	2	2	2	2	2
UCE08E06.5	3	3	2	2	2	2	1	2	2	1	2	2
UCE08E06.6	3	3	3	2	2	2	2	2	2	2	2	2
Total	**18**	**18**	**14**	**10**	**10**	**12**	**9**	**11**	**12**	**10**	**11**	**12**
Average	**3**	**3**	**2.33**	**1.67**	**1.67**	**2**	**1.5**	**1.83**	**2**	**1.67**	**1.83**	**2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E06.1	3	2
UCE08E06.2	3	2
UCE08E06.3	3	3

UCE08E06.4	3	2
UCE08E06.5	3	2
UCE08E06.6	3	3
Total	**18**	**14**
Average	**3**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

References:

Sl. No.	**Name of Books**	**Author**	**Publisher**
1	Vibrations, Dynamics and Structural system	Mukhopadhyay, M,	Oxford and IBH
2	Finite element method – O.C.,	Zeinkiewicz	Tata Mc Gra Hill,1988.
3	The Finite Element method- Vol 1,	Zienkiewicz & Taylor	Mcgraw-Hill International Editions
4	The Finite Element method- Vol II,	Zienkiewicz & Taylor	Mcgraw-Hill International Editions
5	An Introduction to the Finite Element method	Reddy, J.N.,	Mcgraw-Hill International Editions
6	Finite element Analysis- Theory and programming	Krishna Murthy, C.S.,	Tata Mc Gra Hill.
7	Concepts and Applications of Finite Element Analysis	Cook, R.D.	John Willey

B. Soil Mechanics & Foundation Engineering

Geotechnical Investigation and Practices

(UCE08E07)

Credit: 03 **LTP: 2-1-0**

Courses objective:

1. To learn about objects and stages of site investigation: types of samples and samplers.
2. To know about the different boring methods.
3. To impart knowledge about standard penetration test, static and dynamic cone penetration tests, in-situ vane shear tests, geophysical exploration methods.
4. To learn about location of ground water table, preparation of site investigation report.
5. To access the general suitability of the site.
6. To locate the ground water level and possible corrosive effect of soil and water on foundation material.
7. To know the nature of each of the soil and rock, this may affect the design and mode of construction of proposed structure and foundation.

Course content:

Unit-1

Soil Exploration: Purpose; Method of soil exploration; Boring, sampling; Standard penetration test; Static and dynamic cone test; Correlation between penetration resistance and strength parameters; Plate load test, Stabilization of boreholes.

Unit-2

Planning of Sub soil Investigation; Number of bore holes and depth of exploration; Types of tests to suit soil conditions. In-situ method of determination of different soil properties like shear strength, permeability etc. soundings, pressure-meter. Determination of water table, under water subsoil exploration.

Unit-3

Methods of Geophysical Exploration- Seismic reflection, refraction and electrical resistivity

methods.

Unit-4

Exploration methods in Rocks-investigation, sequence, drilling, sampling and bore hole inspection. Laboratory method of determining the various properties and behavior of soils.

Unit-5

Dynamic testing of soils. Method of Geotechnical study for various civil engineering design and construction. Preparation of necessary report. Instrumentation.

Course outcome:

On completion of the course, the students will be able to:

1. Learn the site specific field investigations including collection of soil samples for testing and observation of soil behavior.
2. Learn the different methods of boring, types of samples and sampling, field tests.
3. Learn the detail topics on in-situ soil testing.
4. Learn the dynamic testing of soils. Method of Geotechnical study for various civil engineering design and construction.
5. Learn the different geophysical methods for indirect assessment subsurface profile.
6. Learn the various method of Geotechnical study for various civil engineering design and construction and p reparation of investigation report.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE08E07.1	Learn the site specific field investigations including collection of soil samples for testing and observation of soil behavior.
UCE08E07.2	To make students understand concepts of methods of boring, types of samples and sampling, field tests.
UCE08E07.3	Learn the detail topics on in-situ soil testing.
UCE08E07.4	Learn the dynamic testing of soils. Method of Geotechnical study for

	various civil engineering design and construction
UCE08E07.5	Learn the different geophysical methods for indirect assessment subsurface profile.
UCE08E07.6	Learn the various method of Geotechnical study for various civil engineering design and construction and p reparation of investigation report.

Table 2

Slight (Low): 1 **Moderate: 2** **Substantial (High):3** **No Correlation: "-"**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E07.1	2	2	2	2	2	1	1	1	1	1	2	2
UCE07E07.2	2	2	2	2	2	1	1	1	2	1	2	2
UCE07E07.3	1	2	2	2	2	1	1	2	1	2	2	3
UCE07E07.4	2	2	2	1	2	2	1	2	2	2	2	3
UCE07E07.5	2	2	3	2	2	2	1	1	2	2	2	3
UCE07E07.6	2	2	2	2	2	2	2	1	2	2	2	2
Total	11	12	13	11	12	9	7	8	10	10	12	15
Average	1.83	2	2.16	1.83	2	1.5	1.16	1.33	1.66	1.66	2	2.5
Eq. Av Attainment	2	2	2	2	2	2	1	1	2	2	2	3

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE07E07.1	2	3
UCE07E07.2	2	3
UCE07E07.3	3	3
UCE07E07.4	2	3
UCE07E07.5	2	3

UCE07E07.6	3	3
Total	14	18
Average	2.33	3
Equivalent Avg. Attainment	2	3

References:

Sl. No.	**Name of Books**	**Author**	**Publisher**
1	Site Investigation N.E. Simons, (2005)	C.R.I. Clayton, M.C. Matthews Science,	Blackwell and Oxford.
2	Geotechnical Engineering – Soil & Foundation Principles & Practice	Richard L. Handy, Merlin G.	Spangler Publ. Jan. 4, 2007.
3	A Short course in Geotechnical site Investigation	N. E. Simons, Bruce Keith Menzies, Marcus Matthews.	
4	Soil Mechanics in Engineering Practice	Karl Terzaghi, Ralph Brazelton Gholamreza Mesri	
5	Geotechnical Investigation Methods: A Field Guide for Geotechnical Engineers	Roy E. Hunt	

Rock Engineering

UCE08E08

Total Credit: 04 **Contact Periods: 3 – 1 - 0**

Courses objective:

This subject will help the undergraduate students to obtain a clear concept of analysis of Rock, construction on difficult conditions of soils and rocks.

Course content:

Unit 1

Composition of Rocks, Geological classification of rocks, rock structures, Pore space in

rock.

Rock coring, Various method of obtaining Rock cores, Engineering classification of Rock masses.

Unit 2

Strength and failure of Rocks.Uni axial strength of Rock Samples, Evaluation of Triaxial strength of Rocks, other shear test on rock sample.

Effect of water on rock strength, Effect of water on rock deformation, flow of water through Rocks.

Unit 3

Structural features of massive rocks ,effect of cracks, faults and folds on engineering behavior of rock masses.

Measurement of stresses in rock masses, various types of stress measuring devices.

Unit 4

Evaluation of properties of rocks in the field, hydraulic fracturing, uses of flat jacks.

Design of structures in rocks, basic design principles of tunnels in rock, design of pressure tunnel in rock, principle of design of rockslopes.

Course outcome (CO):

1. Study the various method of rock obtaining.
2. Study the strength and failure of rock
3. Study the deformation, effect of crack, failure.
4. Study the properties of rock.
5. Study of the stress

6 Study on effect of water on rock

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08E08.1	Students will be able to understand the various method of rock obtaining.

UCE08E08.2	Students will be able to understand the strength and failure of rock
UCE08E08.3	Students will be able to understand deformation of rock
UCE08E08.4	Students will be able to how to fix alignment of any rock
UCE08E08.5	Students will be able to understand the stress in rock
UCE08E08.6	Students will be able to understand effect of water on rock

Table 2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E08.1	2	2	1	1	-	-	-	-	2	-	-	1
UCE08E08.2	2	2	1	1	-	-	-	-	2	-	-	1
UCE08E08.3	2	2	1	1	-	-	-	-	2	-	-	1
UCE08E08.4	2	2	1	1	-	-	-	-	2	-	-	2
UCE08E08.5	2	1	1	1	-	-	-	-	2	-	-	1
UCE08E08.6	2	1	1	1								
Total	**12**	**10**	**6**	**6**	**-**	**-**	**-**	**-**	**10**	**-**	**-**	**6**
Average	**2**	**1.7**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1.2**
Eq. Av Attainment	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Table 3

To establish the correlation between COs and PSOs

CO	PSO1	PSO2
UCE08E08.1	3	2
UCE08E08.2	4	3
UCE08E08.3	4	3
UCE08E08.4	4	4
UCE08E08.5	4	3
UCE08E08.6	3	3
Total	**22**	**18**

Average	**3.66**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl No	**Name of Books**	**Author**	
1	Fundamental of RockMechanics	John Jaeger, N. G. Cook, and Robert Zimmerman	
2	Introduction toRockMechanics	Richard E. Goodman	
3	An Outline of Soil andRock Mechanics	Pierre Habib and Bronwen A. Rees.	
4	Rock Mechanics andtheDesign ExperimentalRockMechanics	L. Obert and W.I.Duvall Kiyoo Mogi	

PAVEMENT ENGINEERING

(UCE08E09)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. Introduction to various types of pavement, construction materials and factors affecting pavement design
2. Concepts of mechanistic empirical methods of flexible and rigid pavements
3. Knowledge of pavement evaluation and the related maintenance activities

Module-1

Pavement Materials: Types of Pavement Materials and their evaluation, Bitumen, Tar, Cutbacks and emulsion.

Module-2

Structural Design of Pavement: Design Factors, Equivalent single wheel load, Repetition of loads, Pavement structure-soil interaction, strength of pavement component materials,

Module-3

Flexible Pavements: Methods of bituminous mix design, Pavement design, Layered system analysis and design.

Module-4

Rigid Pavement: Load and temperature stress, Analysis and design, Design of joints and load transfer devices, Joints, Fillers and sealers.

Module-5

Pavement distress, Overlay design, Pavement performance evaluation

Course outcome:

1. Application of basic principles in pavement design
2. Design methodologies for both rigid and flexible pavements
3. Student will understand appropriate evaluation and maintenance measures for better maintenance of pavements.

Table 1

To establish the correlation between COs & POs

UCE08E09.1	Application of basic principles in pavement design
UCE08E09.2	Design methodologies for both rigid and flexible pavements
UCE08E09.3	Student will understand appropriate evaluation and maintenance measures for better maintenance of pavements

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
UCE08E09.1	3	3	2	2	1	2	2	2	2	1	1	2
UCE08E09.2	3	3	3	2	2	2	2	2	2	2	2	2
UCE08E09.3	3	3	3	2	1	2	1	1	2	2	2	2
Total	9	9	8	6	4	6	5	5	6	5	5	6
Average	3.00	3.00	2.67	2.00	1.33	2.00	1.67	1.67	2.00	1.67	1.67	2.00

Equivalent Avg. Attainment	3	3	2	2	2	1	2	2	2	2	2	2

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E20.1	3	2
UCE08E20.2	3	2
UCE08E20.3	3	3
UCE08E20.4	3	2
UCE08E20.5	3	2
UCE08E20.6	3	3
Total	**18**	**14**
Average	**3**	**2.33**
Equivalent Avg. Attainment	**3**	**2**

Reference:-

Sl No.	Name of Books	Authors	Publishers
1.	Pavement Analysis and Design	Yang H. Hung,	Prentice-Hall
2	Design and Performance of Road Pavements	David Croney	McGraw Hill
3.	Guide for Design of Pavement Structures- I & II	AASHTO	AASHTO

Traffic Engineering

(UCE08E10)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1. To obtain fundamental understanding of the highway traffic parameters and their inter relationships.
2. To study various aspects of traffic operation and management.
3. To understand the insight of parking, accidents and traffic signals.
4. To understand the basic theory and design aspects of various intersections used in traffic operation and management.

Course content:

Unit- 1

Highway traffic Characteristics, Traffic parameters and inter relationship, traffic volume, speed, density, capacity, their relationship.

Unit 2

Traffic studies- Volume, speed, OD, density, parking.

Unit – 3

Traffic operation and management- Traffic congestion, circulation, Planning, control devices, management improvement measures, One way lane and reversible lane, Advantages and Disadvantages of one way lane and reversible lane.

Unit – 4

Speed change Lane- Different type of speed change lane, Design of speed change lane, Street lighting, Level of services.

Unit – 5

Parking- On street parking, parallel parking and angle parking, Off street parking, Advantages and Disadvantages of on street and off street parking.

Unit – 6

Accident- Spot map, Collision Map, Condition diagram.

Unit – 7

Traffic signal- Different type of traffic signal, Design of traffic signal.

Unit – 8

Rotary intersection- Advantages and disadvantages of rotary intersection, Design of rotary intersection.

Course outcome:

1. Students will be able to study highway traffic parameters and their relationships.
2. Students will be able to identify various aspects of traffic operations like traffic congestion, circulation, control devices, management improvement measures, different types of lanes etc.
3. Students will be able to acquire a brief idea regarding level of surface.
4. Students will be able to understand regarding the requirements and implementation of provision for parking in traffic planning.
5. Students will be able to analyze accident study using the knowledge of Spot map, Collision Map, Condition diagram etc. and to understand about traffic signal and rotary intersections.

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08E10.1	Students will be able to study highway traffic parameters and their relationships.
UCE08E10.2	Students will be able to identify various aspects of traffic operations like traffic congestion, circulation, control devices, management improvement measures, different types of lanes etc.
UCE08E10.3	Students will be able to acquire a brief idea regarding level of surface.
UCE08E10.4	Students will be able to understand regarding the requirements and implementation of provision for parking in traffic planning.
UCE08E10.5	Students will be able to analyze accident study using the knowledge of Spot map, Collision Map, Condition diagram etc. and to understand about traffic signal and rotary intersections.

Table 2

To establish the correlation between COs & POs

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E10.1	2	1	1	2	2	2	2	2	3	2	2	2
UCE08E10.2	3	3	3	2	3	3	2	2	2	2	2	3
UCE08E10.3	2	2	2	2	3	2	3	1	2	2	3	2
UCE08E10.4	3	2	2	2	3	2	2	2	3	2	2	3
UCE08E10.5	3	2	2	2	1	2	1	2	2	2	2	2
Total	**16**	**13**	**13**	**12**	**15**	**14**	**12**	**11**	**15**	**12**	**14**	**15**
Average	**3**	**2.17**	**2.17**	**2**	**2.5**	**2.33**	**2**	**1.83**	**2.5**	**2**	**2.33**	**2.5**
Equivalent Avg. Attainment	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E10.1	2	2
UCE08E10.2	4	3
UCE08E10.3	3	3
UCE08E10.4	3	3
UCE08E10.5	3	2
Total	**19**	**16**
Average	**3.17**	**2.67**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Books	Author	Publisher
1	Introduction To traffic Engg.: A manual for data collection & analysis,	Thomas R. Currin	Brooks
2	Traffic Engineering and Transport Planning,	Kadyali, L.R	Khanna Publisher**,**
3	Traffic Engineering	Roger P Roess, Elena S Prassas	Prentice Hall,
4	Traffic Engineering Design principle & Practice,	Mike Slinn, Poter Guest, Paul Matthews	Elsevier,

Geographic Information System And Its Applications

(UCE08E11)

TotalCredit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Course Objectives:

1. To know about satellites, satellite based positioning system, concept of geodesy and augmentation systems
2. To study about the history and components of GIS
3. To study about data types and operations
4. Introduce the basic concepts of GIS and making the students familiar with the spatial data and spatial analysis techniques
5. Understand about the principles of GIS, Spatial Systems, and its applications to Engineering Problems.

Course content:

Module-1

Introduction - Information systems, spatial and non- spatial information, Geographical concepts and terminology, Advantages of GIS.Basic components of GIS, Commercially available GIS hardware & software, organisation of data in GIS.

Module-2

DATA MANAGEMENT:

Input data - Field data, Statistical data, Maps, Aerial photographs, Satellite data, Points, lines and areas features, Vector and Raster data, Advantages and Disadvantages, Data entry through keyboard, digitizers and scanners, Digital data. Preprocessing of data - Rectification and registration, Interpolation techniques.

Module-3

Application of GIS:

Data Management - Data Base Management System (DBMS), Various data models, Run - length encoding, Quad trees, Data Analysis - Data layers, analysis of spatial and non- spatial data, Data overlay and modelling. Data Presentation - Hardcopy devices, softcopy devices.

Applications of GIS in Map Revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology Water Resources, Soil Erosion, Land suitability analysis, Change detection.

Course Outcomes:

1. Analyze the basic components of GIS, coordinate systems and projections
2. Classify the maps, identify and rectify mapping inaccuracies
3. Apply the concepts of DBMS in GIS
4. Analyze raster and vector data and modelling in GIS
5. Analyze spatial and attribute data for solving spatial problems
6. Apply GIS in land use, disaster management, ITS and resource information system

Table1

To establish the correlation between COs & POs

No of course outcome (CO)	Course Outcome
UCE07E11.**1**	Analyze the basic components of GIS, coordinate systems and projections .
UCE07E11.**2**	Classify the maps, identify and rectify mapping inaccuracies.
UCE07E11.**3**	Apply the concepts of DBMS in GIS.
UCE07E11.**4**	Analyze raster and vector data and modeling in GIS .
UCE07E11.**5**	Analyze spatial and attribute data for solving spatial problems.
UCE07E11.**6**	Apply GIS in land use, disaster management, ITS and resource information system.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE07E11.1	3	2	1	2	1	2	1	1	2	1	2	3
UCE07E11.2	3	2	1	2	1	2	1	1	2	1	2	3
UCE07E11.3	3	2	1	2	1	2	1	1	2	1	2	3
UCE07E11.4	3	2	1	2	1	2	1	1	2	1	2	3
UCE07E11.5	3	2	1	2	2	2	2	2	1	1	2	3
UCE07E11.6	3	2	2	2	2	2	2	2	2	1	2	3
Total	18	12	6	12	8	12	8	8	11	6	10	18
Average	3	2	1	2	1.33	2	1.33	1.33	1.83	1	1.67	3
Equivalent Avg. attainment	3	2	1	2	1	2	1	1	2	1	2	3

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE07E11.1	**3**	**2**
UCE07E11.2	**3**	**3**
UCE07E11.3	**3**	**4**
UCE07E11.4	**2**	**4**
UCE07E11.5	**2**	**4**
UCE07E11.6	**2**	**4**
Average	**2.5**	**3.5**
Equivalent Avg. Attainment	**3**	**4**

Reference:

Sl no	Books	Author	Publishers
1	Principles of Geographic Information System for Land ResourcesAssessment	Burrough, P.A	Claredon Press Oxford, 1988
2	Introduction to RemoteSensing	Campbell, J .B.,	The Guilford Press London, 1986.
3	Remote Sensing in Hydrology	Engaman, E.T and Gurney, R.J	Chapman and Hall, London 1991,
4	Remote Sensing & Geographic Information Systems	Legg, C.A., London. 1992	Ellis Horwood

Computational hydraulics

(UCE08E12)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Course Objectives:

1. Equations describing flow and transport processes in free surface flows
2. The methods of characteristics, finite differences, finite elements, and finite volumes
3. Application of the method of finite differences to ordinary and partial differentialequations
4. The analysis of convergence, stability, and accuracy of numerical schemes
5. Code various numerical methods in a modern computer language

Course Content:

Unit I. Introduction:

Basic equations of fluid motion need for their numerical solution.

Unit II. Solution Techniques:

Classification of governing equation – parabolic, elliptic and hyperbolic type, Ordinary and partial differential equations; finite difference schemes - implicit and explicit types; accuracy,

consistency, convergence and stability of schmes; method of characteristics; Crank Nicholson, Penceman- Rachford ADI, Leaffrom, Lax – Wendroff, successive over- relaxation methods.

Unit III. Type of problems:

Analysis of water distribution networks, hydraulic transients in closed conducts, flood routing in stream using Saint- Venant equations, numerical solutions for one – dimensional convection and diffusion equation.Applications to steady and unsteady flows; pollutant dispersion; flood wave propagation; tidal model; applications with computer programming

Course Outcomes:

1. Solve an algebraic or transcendental equation using an appropriate numerical method
2. Use numerical methods to solve engineering problems
3. Understanding the theoretical and practical aspects of the use of numerical methods
4. Implementing numerical methods for a variety of multidisciplinary applications
5. Code a numerical method in a modern computer language
6. Apply well-know numerical techniques to solve engineering problems and evaluate the results

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08E12.1	Solve an algebraic or transcendental equation using an appropriate numerical method
UCE08E12.2	Use numerical methods to solve engineering problems
UCE08E12.3	Understanding the theoretical and practical aspects of the use of numerical methods
UCE08E12.4	Implementing numerical methods for a variety of multidisciplinary applications
UCE08E12.5	Code a numerical method in a modern computer language
UCE08E12.6	Apply well-known numerical techniques to solve engineering problems and evaluate the results

Table2

1: Slight (LOW) 2: Moderate (MEDIUM)3: Substantial (HIGH) and for NO CORELATION-"-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E12.1	3	2	2	2	1	2	2	2	1	2	2	1
UCE08E12.2	2	2	3	2	2	1	1	1	2	2	2	2
UCE08E12.3	3	1	2	1	3	1	2	1	2	2	2	2
UCE08E12.4	3	2	1	2	1	2	2	1	2	2	1	2
UCE08E12.5	2	2	2	2	2	2	2	1	2	2	2	2
UCE08E12.6	3	3	1	1	3	2	1	2	2	1	3	2
Total	16	12	11	10	12	10	10	8	11	11	12	11
Average	2.66	2	1.83	1.66	2	1.66	1.66	1.33	1.83	1.83	2	1.83
Eq. Av Attainment	3	2	2	2	2	2	2	1	2	2	2	2

Table 3

To establish the correlation between COs &PSOs

CO	PSO1	PSO2
UCE08E12.1	**4**	**3**
UCE08E12.2	**2**	**3**
UCE08E12.3	**4**	**2**
UCE08E12.4	**3**	**3**
UCE08E12.5	**3**	**4**
UCE08E12.6	**4**	**3**
Total	**20**	**18**
Average	**3.3**	**3**
Equivalent Avg. Attainment	**3**	**3**

References:

Sl. No.	Name of Books	Author	Publisher
1	Computational Hydraulics	Brebbia, C.A. and Freeante , A.J.	Burrerworth& Company (Publishers)
2	Applied Hydraulics Transien	Chaudhary, M.H.,	VanNostrand Reinhold company, Inc., New york, 1987.
3	Unsteady Flow in Open Channels	Mahmood, K. and Yeyjevich, V	Water Resources Publications, Fort Collins, Colorado, U.S.A, !975

ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING

(UCE08E13)

Total Credit: 03 **Contact Periods: 03 (2L+1T+0P)**

Courses objective:

1. To understand the Role of EIA in Planning and Decision Making Process.
2. To grasp the significance Socioeconomic Impact Assessment.
3. To understand - meaning and objective of EIA.
4. To understand Emerging Global Environmental Issues. Environmental Legislation.
5. To understand ISO 14000 Series—Environmental monitoring and mitigation measures.
6. To understand the Environmental Auditing.

Course content:

Module-1

Environmental Impact:

Environmental inventories, environmental assessment, evaluation.

Module-2

Socioeconomic Impact Assessment:

Financing of capital expenditure, increase in user charges, sociological impacts.

Module-3

Role of EIA in Planning and Decision Making Process, Rapid EIA.

Introduction of EIA—Environmental impact statement (EIS) and Environmental impact

Module-4

Analysis (EIA) - meaning and objective of EIA; Environmental Impact prediction –planning and management of Impact studies—ISO 14000 Series—Environmental monitoring and mitigation measures.

Module-5

Environmental Impact Statement, Environmental Auditing, Post audit reviews of EIA, Concept of ISO and ISO 14000, Government standards for Environmental protection. Emerging Global Environmental Issues. Environmental Legislation. Case-studies.

Course outcome:

1. Students will be able to understand the Role of EIA in Planning and Decision Making Process.
2. Students will be able to understand the significance of Socioeconomic Impact Assessment.
3. Students will be able to understand - meaning and objective of EIA.
4. Students will be able to understand Emerging Global Environmental Issues.
5. Students will be able to understand various Environmental Legislation.
6. Students will be able to understand the importance of Environmental Auditing.

Table 1

To establish the correlation between COs &POs

No. of Curse Outcome(CO)	Course Outcome
UCE08E13.1	Students will be able to analyze characteristics of water.
UCE08E13.2	Students will be able to forecast the population and estimate water demand.
UCE08E13.3	Students will be able to design various water treatment units.
UCE08E13.4	Students will be able to design the distribution network.
UCE08E13.5	Students will be able to analyze characteristics of air.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: -

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E13.1	3	2	3	2	1	-	-	-	-	-	-	1

UCE08E13.2	3	3	2	2	1	-	-	-	-	-	-	1
UCE08E13.3	3	3	2	2	1	-	-	-	-	-	-	1
UCE08E13.4	3	2	3	2	1	-	-	-	-	-	-	2
UCE08E13.5	3	3	2	2	1	-	-	-	-	-	-	1
Total	**15**	**13**	**12**	**10**	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**6**
Average	**3**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.2**
Equivalent Avg. Attainment	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Table 3

To establish the correlation between Cos & PSOs

CO	PSO1	PSO2
UCE08E13.1	3	3
UCE08E13.2	3	3
UCE08E13.3	3	3
UCE08E13.4	2	2
UCE08E13.5	3	2
Total	**14**	**13**
Average	**2.8**	**2.6**
Equivalent Avg. Attainment	**3**	**3**

Reference:-

Sl No.	Name of Books	Authors	Publishers
01.	Introduction to Environmental Engineering and Science	Masters,GM	Prentice Hall of India Pvt. Ltd
02.	Environmental Engineering	Masters, G.M., D.R and Tchobanoglous,G	MC GRAW HILL

Air Pollution and Control measures

(UCE08E14)

Credit: 03 **LTP:2-1-0**

Courses objective:

1. To understand the type of air pollutants.
2. To understand the sources of air pollutants.
3. To understand the air pollution due to industries & automobile exhausts.
4. To study the effects of air pollution.
5. To study the air quality and emission standards.
6. To understand the global effects of air pollution.

Course content:

Module-1

General: An Environmental problem, Definitions.

Type of Air Pollutants & Sources: Particulates, CO, SO_2, NO_X, Hydrocarbons etc. Natural & Man made sources, Emission Factors.

Module-2

Air Pollution due to Industries & Automobile Exhausts

Meteorology: Wind profiles, turbulent diffusion, wind roses, Topographical effects, Inversions, Plume behavior, plume rise, stable and unstable conditions.

Plume Dispersion: Gaussian model, Diffusion coefficients, Inversion effects, Limits to the models.

Particulates: Terminology, Size distribution, Removal mechanisms, particulate collection devices, choice of equipment's, standards.

Sulphur Oxides: SO_X sources, ambient concentrations, Test methods, Control techniques, Standards, Costs, Ambient downwind concentrations.

Nitrogen Oxides: Sources, Ambient concentrations, Test methods, Thermodynamics & kinetics of nitrogen oxides, Control techniques, Standards of performance, costs.

Module-3

Effects of Air Pollution: Plant damage, corrosion, Art treasures, human health-respiratory system, special diseases.

Module-4

Air Quality & Emission Standards: Criteria & Standards, U.S ad Indian Standards, Pollution control laws.

Module-5

Global Effects of Air-Pollution: Greenhouse effect, Acid rain, Ozone layer disruption etc.

Course outcome:

1. Students will be able to understand the type of air pollutants.
2. Students will be able to understand the sources of air pollutants.
3. Students will be given a broad idea regarding the air pollution due to industries & automobile exhausts.
4. Students will be able to understand the effects of air pollution.
5. Students will be able to understand the air quality and emission standards.
6. Students will be given a broad idea regarding the global effects of air pollution.

Table1

To establish the correlation between COs & POs

No. of Course Outcome (CO)	Course Outcome
UCE08E14.1	Students will be able to understand the type of air pollutants.
UCE08E14.2	Students will be able to understand the sources of air pollutants.
UCE08E14.3	Students will be given a broad idea regarding the air pollution due to industries & automobile exhausts.
UCE08E14.4	Students will be able to understand the effects of air pollution.
UCE08E14.5	Students will be able to understand the air quality and emission standards.
UCE08E14.6	Students will be given a broad idea regarding the global effects of air pollution.

Table 2

Slight (Low): 1 Moderate: 2 Substantial (High): 3 No Correlation: "-"

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E14.1	3	3	3	3	3	3	3	-	-	2	2	3
UCE08E14.2	3	3	3	3	3	3	3	-	-	2	2	3
UCE08E14.3	3	3	3	3	3	3	3	-	-	2	2	3
UCE08E14.4	3	3	3	3	3	3	3	-	-	2	2	3
UCE08E14.5	3	3	3	3	3	3	3	3	-	3	2	3
UCE08E14.6	3	3	3	3	3	3	3	3	-	2	2	3

Total	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**6**	**-**	**13**	**12**	**18**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**-**	**2.17**	**2**	**3**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**-**	**2**	**2**	**3**

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE08E14.1	4	3
UCE08E14.2	4	3
UCE08E14.3	4	3
UCE08E14.4	4	3
UCE08E14.5	4	3
UCE08E14.6	4	3
Total	**24**	**18**
Average	**4**	**3**
Equivalent Avg. Attainment	**4**	**3**

Reference:-

Sl No.	Name of Books	Authors	Publishers
01.	Air Pollution	Henry C	McGraw Hill KogakushaLtd Tokyo
02.	Air Pollution	Stern, Arthur C.	Academic Press, New York, USA 1977
03.	Water supply and sanitary Engineering	G.S.Birdie&J.S.Birdie.	Dhanpat Rai publishing Company, New Delhi
04.	Sewage Treatment & Disposal and Wastewater Engineering.	Dr.P.N.Modi	Standard Book House.

Rural water supply and sanitation

(UCE08E15)

Total Credit: 04 **Contact Periods: 3 - 1 – 0 = 4**

Courses objective:

1) To understand the basic and scope of environmental sanitation in rural areas with existing policy.
2) To study the sources of water supply in rural areas and significance of water quality parameters.
3) To study the parameters for designing water supply schemes according to population demand.
4) To understand the treatment units of rural water supply system.
5) To study the various methods of collection and disposal of wastes in rural sanitary system.
6) To study the fundamental principle and their use in rural areas as sustainable waste management.

Course content:

Module-1

General: Concept and scope of Environmental sanitation in rural areas, magnitude and problems of water supply and sanitation in rural areas in India, National Policy.

Module-2

Water Supply: Quality aspects: specific impurities and their significance, Design population, Demand and variations, Planning of water supply schemes in rural areas: individual village and group schemes, Sources of water supply: springs, wells, infiltration wells, radial wells, infiltration galleries and surface water intake.

Module-3

Treatment of water for rural water supply, compact system: multi bottom settler, slow sand filter, diatomaceous earth filter, cloth filter, chlorine diffusion cartridges, pumps, pipe, materials, appurtenances and improvised device for use in rural water supply schemes, Distribution systems for rural water supply.

Module-4

Disposal of Night soil and wastewater: Various methods of collection and disposal of night soil: Sanitary latrines, community latrines, septic tanks, soakage system, anaerobic filter, Imhoff tank, Compact and simple wastewater treatment units: Stabilization ponds, revolving biological surface.

Module-5

Biogas Plants: Quantity of cow dung, required capacity and design.

Disposal of Solid Wastes: Composting, land filling, Incineration.

Course outcome:

1. To understand the basic and scope of environmental sanitation in rural areas with existing policy.
2. To study thesources of water supply in rural areas and significance of water quality parameters.
3. To study theparameters for designing water supply schemes according to population demand.
4. To understand thetreatment units of rural water supply system.
5. To study thevarious methods of collection and disposal of wastes in rural sanitary system.
6. To study thefundamental principle and their use in rural areas as sustainable waste management.

To establish the correlation between COs & POs

Table1

No. of Course Outcome (CO)	Course Outcome
UCE08E15**.1**	Students will be able to understand the basic and scope of environmental sanitation in rural areas with existing policy.
UCE08E15**.2**	Students will be able to know the sources of water supply in rural areas and significance of water quality parameters.
UCE08E15**.3**	Students will be able to know the parameters for designing water supply schemes according to population demand.
UCE08E15**.4**	Students will be able to understand the treatment units of rural water supply system.

UCE08E15**.5**	Students will be able aware about thevarious methods of collection and disposal of wastes in rural sanitary system.
UCE08E15**.6**	Students will be able to know about the fundamental principle and their use in rural areas as sustainable waste management

Table2

1: Slight (LOW) 2: Moderate (MEDIUM) 3: Substantial (HIGH) and '-' for NO CORELATION

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
UCE08E15**.1**	4	3	2	-	-	4	3	-	-	2	-	-
UCE08E15**.2**	2	4	-	3	-	2	3	-	-	-	-	-
UCE08E15**.3**	4	2	4	3	-	2	2	3	3	3	-	-
UCE08E15**.4**	3	3	4	4	3	-	-	-	-	2	-	-
UCE08E15**.5**	-	3	4	3	4	3	2	-	-	2	-	-
UCE08E15**.6**	3	4	4	4	4	3	4	3	3	-	-	-
Total	**16**	**19**	**18**	**16**	**11**	**14**	**14**	**6**	**6**	**9**	**-**	**-**
Average	**2.7**	**3.2**	**3**	**2.7**	**1.8**	**2.3**	**2.3**	**1**	**1**	**1.5**	**-**	**-**
Eq. Av Attainment	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**-**	**-**

Table 3

To establish the correlation between COs & PSOs

CO	PSO1	PSO2
UCE08E15**.1**	3	3
UCE08E15**.2**	4	3
UCE08E15**.3**	4	3
UCE08E15**.4**	4	3
UCE08E15**.5**	3	3
UCE08E15**.6**	4	3
Total	**22**	**18**
Average	**3.7**	**3**
Equivalent Avg. Attainment	**4**	**3**

References:

Sl. No.	**Name of Books**	**Author**	**Publisher**
1	Water supply for Rural areas and small communities	Wagner, E.G and Lanoix, J.N	WHO Monograph series No. 42,1959
2	Rural Water Supply and Sanitation	Wright, F.B.,	
3	3Excreta Disposal for Rural Areas and Small Communities" series No. 39,1977	Wagner, E.G.,	W HO Monograph, and Lanoix, J.N W