COURSE INFORMATION SHEET

Course code: CE517
Course title: Soil Mechanics Laboratory - I
Pre-requisite(s): Basic knowledge of Soil Mechanics
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 4
Class: M. Tech.
Semester / Level: 1st SEMESTER/ LEVEL 5
Branch: CIVIL ENGINEERING (Soil Mechanics and Foundation Engineering)
Name of Teacher:

Course Objectives

This course enables the students to:

A.	Perform Moisture content, Specific gravity, Atterberg limits tests.
B.	Perform Grain size distribution, Proctor tests.
C.	Perform Unconfined compression, Triaxial tests.
D.	Perform California Bearing Ratio, Vane Shear tests.
E.	Perform Sand replacement, Core cutter, Permeability tests.

Course Outcomes

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

1.	Carry out Moisture content, Specific gravity, Atterberg limits tests.
2.	Carry out Grain size distribution, Proctor tests.
3.	Carry out Unconfined compression, Triaxial tests.
4.	Carry out California Bearing Ratio, Vane Shear tests.
5.	Carry out Sand replacement, Core cutter, Permeability tests.

List of experiments

Experiment 1: Determination of moisture content and specific gravity

Experiment 2: Determination of Atterberg limits

Experiment 3: Determination of Grain size distribution

Experiment 4: Proctor Compaction test

Experiment 5: Unconfined compression test

Experiment 6: Triaxial test

Experiment 7: Determination of California Bearing Ratio

Experiment 8: Vane shear test

Experiment 9: Direct shear test

Experiment 10: Sand replacement and Core cutter test

Experiment 11: Permeability test (constant and variable head)

Text books:

1. Soil Mechanics And Foundations – B.C. Punmia, Laxmi Publications (P) Ltd.
2. Textbook of Soil Mechanics and Foundation Engineering – V.N.S. Murthy, CBS Publishers & Distributors Pvt. Ltd.

Reference books:

1. Geotechnical Engineering – C. Venkatramaiah, New Age International Publishers

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	✓
Tutorials/Assignments	✓
Seminars	
Mini projects/Projects	✓
Laboratory experiments/teaching aids	✓
Industrial/guest lectures	✓
Industrial visits/in-plant training	
Self- learning such as use of NPTEL materials and internets	✓
Simulation	

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation Marks	60
End Examination Marks	40

Assessment Components	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation Marks	✓	✓	✓	✓	✓
End Examination Marks	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student feedback on teaching quality and teaching methods adopted
2. Student feedback on course syllabus and course outcome

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	1	**2**	**3**	**4**	**5**	**6**
1	3	3	3	2	1	3
2	3	3	3	2	1	3
3	3	3	3	2	1	3
4	3	3	3	2	1	3
5	3	3	3	2	1	3

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1, CD2, CD4, CD5, CD6,CD8
CD2	Tutorials/Assignments		CO2	CD1, CD2, CD4, CD5, CD6, CD8
CD3	Seminars		CO3	CD1, CD2, CD4, CD5, CD6, CD8
CD4	Mini projects/Projects		CO4	CD1, CD2, CD4, CD5, CD6, CD8
CD5	Laboratory experiments/teaching aids		CO5	CD1, CD2, CD4, CD5, CD6, CD8
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

COURSE INFORMATION SHEET

Course code: CE 505
Course title: Numerical Analysis Laboratory
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 4
Class: B. Tech
Semester / Level: 1ST SEMESTER / LEVEL 5
Branch: CIVIL ENGINEERING
Name of Teacher:

Course Objectives

This course enables the students to:

1	Develop basic knowledge of numerical analysis so that the students can solve real engineering problems. (K_1, K_2)
2	Understand importance of various numerical tools available for efficiently solving complex problems in civil engineering. (K_1, K_2)
3	Analyse and design safe and sound civil engineering structures. (K_3, K_4)

Course Outcomes

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

1.	Understand various numerical methods and their applications. (K_1, K_2, K_3)
2.	Identify and evaluate various numerical algorithms required to solve a given engineering problem. (K_1, K_2, K_3)
3.	Use a numerical method/tool/software to solve common problems in civil engineering. (K_5)

List of experiments:

1. Introduction to numerical computing tool/software.
2. Finding roots of a quadratic and/or cubic equation in one variable.
3. Finding minima or maxima of a function in one variable.
4. Finding solution for simultaneous linear equations.
5. Finding eigen values and vectors for a given system.
6. Curve Fitting / Nonlinear regression over experimental data.
7. Numerical differentiation up to second degree.
8. Numerical integration using Simpson's 1/3 rule and/or Gauss quadrature.
9. Finding solution for ordinary differential equations: IVP using standard 4th order RK method.
10. Finding solution for ordinary differential equations: BVP using finite difference method.
11. Mini project on any common civil engineering problem requiring advanced numerical methods.

Reference books:

1. Applied Numerical Methods with MATLAB by S. C. Chapra

Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design
POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	✓
Tutorials/Assignments	✓
Seminars	
Mini projects/Projects	✓
Laboratory experiments/teaching aids	
Industrial/guest lectures	
Industrial visits/in-plant training	
Self- learning such as use of NPTEL materials and internets	✓
Simulation	✓

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	**% Contribution during CO Assessment**
Continuous Evaluation	60
End Sem Examination Marks	40

Assessment Components	**CO1**	**CO2**	**CO3**
Continuous Evaluation	✓	✓	✓
End Sem Examination Marks	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes onto Program outcomes

Course Outcome #	Program outcomes					
	1	2	3	4	5	6
1	3	2	3	3	2	2
2	3	2	3	3	2	2
3	3	3	3	3	2	2

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD:1,2,4,8 and 9
CD2	Tutorials/Assignments		CO2	CD:1,2,4,8 and 9
CD3	Seminars		CO3	CD:1,2,4,8 and 9
CD4	Mini projects/Projects			
CD5	Laboratory experiments/teaching aids			
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

COURSE INFORMATION SHEET

Course code: CE 521
Course title: SOIL MECHANICS LABORATORY II
Pre-requisite(s): CE 517 SOIL MECHANICS LABORATORY I
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 4
Class: M.Tech.
Semester / Level: 2ND SEMESTER/ LEVEL 5
Branch: CIVIL ENGINEERING
Name of Teacher:

Course Objectives

This course enables the students to:

A.	To have a practical knowledge and hands on experience of advanced equipments
B.	Determine the CBR value for flexible pavement design
C.	Identify the different layers of soil and determine its thickness up to a certain depth
D.	To evaluate bearing capacity from field tests
E.	To analyse and predict the behavior of soil from the experimental results

Course Outcomes

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

1.	Have familiarity with advanced equipment's
2.	Determine the CBR value and design thickness of different layers of flexible pavement
3.	Evaluate the different types of soil layers and calculate thickness of each layer up to a certain depth
4.	Do field test and calculate bearing capacity of the soil at site
5.	Predict settlement and other properties of soil from the results

List of experiments

1. Consolidation Test
2. California Bearing Ratio
3. Electro-Osmosis
4. Relative Density Apparatus
5. Dynamic Cone Penetrometer

6. Standard Penetration Test
7. North Dakota
8. Plate Load Test
9. Plotting of Phreatic Line (Model)
10. Point Load Test

Text books:

1. Braja.M.Das :Soil Mechanics Laboratory Manual, Oxford University Press, eighth edition
2. 2.B.C.Punmia, Ashok.K.Jain and Arun.K.Jain: Soil Mechanics and Foundation, Laxmi Publications (P) LTD
3. S.K.Garg : Soil Mechanics and Foundation Engineering, Khanna Publishers

Reference books:

Indian Standard Codes for Soil Testing

Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design
POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	
Tutorials/Assignments	
Seminars	
Mini projects/Projects	
Laboratory experiments/teaching aids	✓
Industrial/guest lectures	✓
Industrial visits/in-plant training	✓
Self- learning such as use of NPTEL materials and internets	✓
Simulation	

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	**% Contribution during CO Assessment**
Progressive Evaluation Marks	60
End Examination Marks	40

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Progressive Evaluation Marks	✓	✓	✓	✓	✓
End Examination Marks	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student feedback on teaching quality and teaching methods adopted
2. Student feedback on course syllabus and course outcome

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	1	2	3	4	5	6
1	3	3	3	3	3	2
2	3	3	3	3	3	2
3	3	3	3	3	3	2
4	3	3	3	3	3	2
5	3	3	3	3	3	2

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD5, CD6, CD7,CD8
CD2	Tutorials/Assignments		CO2	CD5, CD6, CD7,CD8
CD3	Seminars		CO3	CD5, CD6, CD7,CD8
CD4	Mini projects/Projects		CO4	CD5, CD6, CD7,CD8
CD5	Laboratory experiments/teaching aids		CO5	CD5, CD6, CD7,CD8
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

COURSE INFORMATION SHEET

Course code: CE 522
Course title: Advance Instrumentation Laboratory
Pre-requisite(s): Basic knowledge of Soil Mechanics and Physics
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 4
Class: M. Tech.
Semester / Level: 2nd SEMESTER
Branch: Civil Engineering (Soil Mechanics and Foundation Engineering)
Name of Teacher:

Course Objectives

This course enables the students to:

A.	Perform Particle size Analysis by particle size analyser
B.	Perform Tri-axial test of soil sample by Static and dynamic method
C.	Perform electro-chemical behaviour and surface morphology analysis
D.	Perform element analysis and pH value of soil sample
E.	Perform strength properties of hard rock by Digital Tri-axial testing machine

Course Outcomes

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

1.	Carry out Particle size Analysis
2.	Carry out strength parameter and liquefaction potential of soil
3.	Carry out to determine surface morphology and electro-chemical behaviour of sample
4.	Carry out Strength properties of hard rock
5.	Carry out element analysis and pH value of soil sample

List of experiments

1. Experiment 1: Determination of particle size and distribution by Laser Particle size analyzer

Experiment 2: Determination of Tensile strength, Bending test, Fatigue test and fatigue crack propagation by Universal Testing Machine-

Experiment 3: Determination of shear strength and liquefaction potential of non-cohesive soil by Dynamic Triaxial Testing system

Experiment 4: Electro-chemical behavior of sample by Electrochemical Analyzer

Experiment 5: Thermal Analysis of soil sample by Simultaneous TGA-DTA-DSC equipment

Experiment 6: Surface morphology of soil particle by Scanning Electron Microscope (SEM)/EDS

Experiment 7: Strength parameter of soil by Digital Tri-axial static test machine

Experiment 8: Determination of pH value of the soil sample by pH meter

Experiment 9: Determination of element analysis of soil by X-Ray Diffraction (XRD)

Experiment 10: Tri-axial testing of intact rock cores by Digital Tri-axial - machine.

Text books:

3. Soil Mechanics and Foundations – B.C. Punmia, Laxmi Publications (P) Ltd.

Reference books:

2. Geotechnical Engineering – Soil Mechanics by Lambe & Whitman

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	✓
Tutorials/Assignments	✓
Seminars	✓
Mini projects/Projects	✓
Laboratory experiments/teaching aids	✓
Industrial/guest lectures	✓
Industrial visits/in-plant training	✓
Self- learning such as use of NPTEL materials and internets	✓
Simulation	

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation Marks	60
End Examination Marks	40

Assessment Components	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation Marks	✓	✓	✓	✓	✓
End Examination Marks	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student feedback on teaching quality and teaching methods adopted
2. Student feedback on course syllabus and course outcome

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	Program Outcomes					
	1	**2**	**3**	**4**	**5**	**6**
1	3	3	3	2	1	3
2	3	3	3	2	1	3
3	3	3	3	2	1	3
4	3	3	3	2	1	3
5	3	3	3	2	1	3

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1, CD2, CD4, CD5, CD6,CD8
CD2	Tutorials/Assignments		CO2	CD1, CD2, CD4, CD5, CD6, CD8
CD3	Seminars		CO3	CD1, CD2, CD4, CD5, CD6, CD8
CD4	Mini projects/Projects		CO4	CD1, CD2, CD4, CD5, CD6, CD8
CD5	Laboratory experiments/teaching aids		CO5	CD1, CD2, CD4, CD5, CD6, CD8
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

COURSE INFORMATION SHEET

Course code: CE524
Course title: Remote Sensing & GIS Laboratory
Pre-requisite(s):
Co- requisite(s):
Credits: 2 L: 0 T: 0 P: 4
Class schedule per week: 4
Class: M.Tech.
Semester / Level: Sem: III / level: Vth
Branch: Civil Engineering
Name of Teacher:

Course Objectives

This course enables the students:

A.	To describe the concept of remote sensing and GIS (K1, K2)
B.	To understand the mechanism of image interpretation (K2)
C.	To interpret and identity features of a satellite data (K2, K3, K4)
D.	To assess the applicability of tools for civil engineering purpose (K5)
E.	To perform and analyse tools for environmental management (K5)

Course Outcomes

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

1.	Explain the concepts of remote sensing and GIS (K1, K2)
2.	Compare different features on a satellite image using multiple image interpretation techniques. (K3,K4)
3.	Identify and apply software tools for civil and urban development (K5)
4.	Identify and apply software tools for environmental sustainability (K5)
5.	Prepare informative maps for multiple purposes (K5)

Syllabus

1. Introduction to Concepts of Remote Sensing, GIS and GPS
2. Introduction to various sensors, satellite and Softwares related to Remote Sensing, & GIS
3. Satellite Image Interpretation of known locations and ground verification
4. Satellite Image Interpretation of unknown locations
5. To create an Area on interest using subset and mosaic tools.
6. To Perform Supervised classification to prepare a LULC Map
7. To Perform UnSupervised classification to prepare a LULC Map
8. To apply Indices for urban and environmental analysis
9. To create point, line and polygon features for Map Generation
10. To add and create attributes for analysing data sets in Arc GIS platform
11. To apply buffering techniques for Urban and Environmental Analysis
12. To apply interpolation techniques for Urban and Environmental Analysis
13. To prepare maps using all map components.

Text books:

1. Remote Sensing of Environment. JR Jenson. 6ed (WSE) by Lillesand Paperback.
2. Remote Sensing: Principles and Applications, Third Edition. Floyd F. Sabins. Waveland press. Illinois.
3. Introduction to Geographic Information Systems (With CD) 4th Edition, Kang-tsung Chang, TMH pub.

Gaps in the syllabus (to meet Industry/Profession requirements)
POs met through Gaps in the Syllabus
Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	✓
Tutorials/Assignments	✓
Seminars	
Mini projects/Projects	
Laboratory experiments/teaching aids	✓
Industrial/guest lectures	
Industrial visits/in-plant training	
Self- learning such as use of NPTEL materials and internets	✓
Simulation	

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	**% Contribution during CO Assessment**
Progressive Evaluation Marks	60
End Examination Marks	40

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Progressive Evaluation Marks	✓	✓	✓	✓	✓
End Examination Marks	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student feedback on teaching quality and teaching methods adopted
2. Student feedback on course syllabus and course outcome

Mapping of Course Outcomes onto Program Outcomes and Program Specific Outcomes

Course Outcome	Program Outcomes					
	1	**2**	**3**	**4**	**5**	**6**
1	1		1		1	2
2	1		1		1	2
3	2		1	1	1	2
4	3	2	2	1	3	3
5	3	2	2	1	3	3

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD5, CD8
CD2	Tutorials/Assignments		CO2	CD5, CD8
CD3	Seminars		CO3	CD5, CD8
CD4	Mini projects/Projects		CO4	CD5, CD8
CD5	Laboratory experiments/teaching aids		CO5	CD5, CD8
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			