Soran University

Module Description
(Coursebook)

Basic Information	
University	Soran University
Faculty	Engineering
Department	Civil and Environmental Engineering
Porgram	Civil Engineering
Module Code /Title	SOU20161 / Foundation Engineering
Level/Year	Senior/ Fourth
Semester	Fall 2026
Number of Units/ Credit	6 ECTS
Hours per a week	4 hours (theoretical and tutorial sessions)
Deliver Mode	Face-to-Face
Pre-requisites	Soil Mechanics
Co-requisites	
Type of module	Core
Date of approval by department council	

Basic Instructor Information	
Name of the Instructor (s)	Jamal I. Kakrasul, PhD, Associate Professor
Email Address and Phone number (if permitted)	Jamal.kakrasul@soran.edu.iq
Office Hours	
Preferred Method of Contact	Email
Teaching Assistant Name (if there is one)	Tawrez Shaban Sofy
Contact Information of Teaching Assistant	Tawrez.sofi@soran.edu.iq

Module Overview	
Module Rationale Explain why is this module needed and necessary.	This module describes the applications of soil mechanics principles to design and analyses of foundations, which include the introduction to foundation engineering and foundation types, site exploration and characterization, bearing pressure, bearing Capacity, settlement of shallow foundations, geotechnical design of spread footings, structural design of spread footings, and theory of earth retaining structures.
Module Aims Include the overarching aims of the module.	The goal of this course is to teach the students how to apply the soil mechanics principles and engineering behavior of soils, that they have learned in Soil mechanics course, to the foundation engineering with new topics on design of shallow foundations.
Module Relevance Explain how the module contributes to the program and to students' progression, employability and transferrable skills.	This module bridges academia with society and the marketplace by: 1. Practical Applications: Emphasizing real-world projects like green infrastructure, renewable energy integration, and sustainable building design. 2. Market-Relevant Skills: Equipping students with knowledge on carbon accounting, resource management, and sustainable construction practices, making them valuable in the job market. 3. Community Impact: Addressing local challenges such as urban sustainability and resource management, fostering solutions that benefit society. 4. Global Perspective: Preparing students for careers in a globalized economy by teaching concepts like the water-energy-climate nexus and sustainable development frameworks.
Module pre-requisites (if there is any)	Permission of the instructor

Module Learning Outcomes (MLOs / CLOs)			
MLOs	**By the end of the module, students will be able to…**	**Domain / level**	**PLO(s) mapped**
MLO1	Explain the standard geotechnical investigation procedures (soil borings, sampling, and in-situ testing) required for shallow foundation design	Understand (Level 2)	PLO 1
MLO2	Calculate the ultimate bearing capacity and total settlement of shallow foundation systems using empirical and analytical methods	Apply (Level 3)	PLO 1 and PLO 6
MLO3	Interpret experimental soil test data (e.g., consolidation, direct shear) to determine the relevant geotechnical parameters for design.	Analyze (Level 4)	PLO 6
MLO4	Design a complete shallow foundation (spread footing) to safely support given structural loads within allowable settlement criteria	Create (Level 6)	PLO 1 and PLO 2
MLO5	Justify foundation design choices in a formal technical report, considering site-specific constraints and professional engineering standards.	Evaluate (Level 5)	PLO 3, PLO 4 and PLO 7

Assessment Strategy					
Assessment	**Type**	**Method / evidence**	**Weight**	**Due / timing**	**MLOs**
Assessment 1 : Geotechnical Investigation Report	Formative + Summative	Individual written report based on provided soil investigation data. Draft submitted Week 5 for feedback; final submitted Week 7.	[8 %]	[week 5	MLO1, MLO3
Assessment 2 : Bearing Capacity Problem Set	Summative	Individual homework assignment with step-by-step calculations for ultimate bearing capacity using multiple methods (Terzaghi, Meyerhof, Vesic). Includes comparison of results. Workshop in Week 7.	[6%]	week 7	MLO2

Assessment 3: Settlement Analysis Problem Set	Summative	Individual homework assignment calculating total settlement using consolidation theory and elastic methods. Includes interpretation of laboratory consolidation test data. Workshop in Week 12.	[6 %]	week 9	MLO2, MLO3
Midterm Exam	Summative	Closed-book exam covering MLO1, MLO2, and MLO3 (theory explanations, bearing capacity calculations, settlement analysis, and data interpretation).	15 %	week 8	MLO1, MLO2, MLO3
Assessment 4: Shallow Foundation Design Project	Summative	Individual project: students design a complete spread footing for a real-world building scenario. Includes all calculations, structural drawings, and a formal technical report justifying design choices (safety factors, code references, site constraints, and ethical considerations). Draft submitted Week 11 for peer review; final submitted Week 15.	15%	Week 14	MLO4, MLO5
Final assessment	Summative	Comprehensive closed-book exam. Three sections: • Section A (30%): Calculation problems (bearing capacity, settlement). • Section B (30%): Data interpretation and analysis questions. • Section C (40%): Design scenario requiring students to evaluate alternatives, justify recommendations, and discuss ethical/professional responsibilities.	50%	Week 15	MLO2, MLO3, MLO4, MLO5
Total			100%		

Assessments include quizzes, assignments, problem-based and cases studies.

Assignment 4 (options):

1. Some possible general topics for projects:
2. Design of Shallow Foundations on Complex Soil Conditions
3. Analysis of Foundation Systems for Seismic Zones
4. Impact of Climate Change on Foundation Design
5. Numerical Modeling of Foundation Behavior
6. Retrofitting and Rehabilitation of Existing Foundations
7. Optimized Shallow Foundation Design for Residential Buildings

8. Impact of Groundwater Fluctuations on Shallow Foundation Performance
9. Design of Shallow Foundations for Light-Weight Structures in Low-Strength Soils
10. Settlement Analysis and Mitigation for Shallow Foundations on Loose Sands
11. Comparative Analysis of Isolated vs. Combined Footings
12. Shallow Foundation Design for Sloping Ground
13. Innovative Materials in Shallow Foundation Construction
14. Design of Raft Foundations for Low-Rise Buildings
15. Case Study Analysis of Shallow Foundation Failures
16. Impact of Frost Heave on Shallow Foundation Design in Cold Climates

Weekly Delivery and Alignment Plan

Week	Topic / focus	Description	Teaching and Learning activities	Aligned MLO(s)	Resources
1	Introduction to Foundation Engineering	Overview of module content, assessment structure, and types of foundations (shallow vs. deep). Real-world examples and case studies.	Lecture, Discussion, Case Study Presentation	MLO4 (intro to design context)	Textbook Ch. 1, slides, Case study videos
2	Review of Soil Mechanics	Review of soil classification, compaction, stress-strain behavior, groundwater, and seepage. Essential foundation knowledge.	Lecture, Problem-solving (in-class), Group discussion	MLO1 (foundational knowledge)	Textbook Ch. 2–3, Soil mechanics reference notes
3	Integration of AI in Civil Engineering	Introduction to AI applications in geotechnical engineering: predictive modeling, site characterization, and optimization.	Lecture, Demonstration (AI software/ tools), Discussion	MLO5 (lifelong learning – emerging tech)	AI case studies, Research papers, Software demo
4	Foundation Properties and Performance Requirements	Determination of soil properties for design. Types of failure, ultimate and serviceability limit states. Constructibility and economic factors.	Lecture, Case Study, Group discussion, Demonstration (lab equipment/ video), Fieldwork preparation	MLO1, MLO3, MLO5	Textbook Ch. 4 and 5, Lab manuals, ASTM standards, Field visit plan, Building codes (e.g., Eurocode 7, ACI)
5					

6	Bearing Capacity of Shallow Foundations	Calculation of applied bearing pressure. Estimation of bearing capacity using Terzaghi, Meyerhof, and Vesic methods. Analysis of spread footings.	Lecture, Problem-solving (in-class), Group work	MLO2	Textbook Ch. 6 and Ch. 7 Spreadsheet tools, Example problems
7	Advanced Bearing Capacity and Problem-Solving	Complex scenarios: eccentric loading, inclined loads, water table effects. Workshop: Assessment 2 (Bearing Capacity Problem Set).	Workshop, Problem-solving (individual/ group), Peer discussion	MLO2	Problem set handout, Solution templates
8	Mid-Term Exam	Sitting Exam covering Weeks 1–7 (MLO1, MLO2, MLO3).	Exam (closed-book)	MLO1, MLO2, MLO3	Exam paper, Formula sheet
9	Settlement of Shallow Foundations	Overview of settlement analysis. Laboratory and in-situ test-based methods. Calculation of total, differential, and rate of settlement.	Lecture, Problem-solving, Data interpretation exercise	MLO2, MLO3	Textbook Ch. 8, Consolidation test data, Spreadsheet tools
10	Geotechnical and Structural Design of Footings	Geotechnical and structural design of spread footings: sizing, reinforcement detailing, and code compliance. Introduction to Assessment 4.	Lecture, Design example, Workshop	MLO4, MLO5	Textbook Ch. 9 and Ch. 10, Structural design codes (ACI 318, Eurocode 2), Design software
11					
12					
13	Design Workshop and Draft Submission	Formative Assessment: Students submit a draft of their design project for peer review and instructor feedback. Workshop on detailing and code compliance.	Workshop, Peer review, Instructor consultation	MLO4, MLO5	Draft project submissions, Rubric, Peer review forms
14	Retaining Structures	Classical lateral earth pressure theories (Rankine, Coulomb). Design of retaining structures (gravity, cantilever, and reinforced earth walls).	Lecture, Design example, Group work	MLO4 (extension to retaining walls)	Lecture note Retaining wall design examples
15	Final Assessment	Summative: Comprehensive Final Exam (with design justification section). Submission: Design Project + Technical Report (Assessment 4).	Exam (closed-book), Project submission	MLO2, MLO3, MLO4, MLO5	Exam paper, Project submission portal

ECTS based on Student Workload

Activates	Quantity	Duration (Hrs)	Total Workload (Hrs)
Module Duration	13	2	26
Tutorial	13	2	26
Mid-Term Examination Preparation	1	8	8
Mid-term Examination	1	1	1
Final Examination Preparation	1	12	12
Final Examination	1	2	2
Assessment 1: Investigation Report	1	15	15
Assessment 2: Bearing Capacity Problem Set	1	10	10
Assessment 3: Settlement Problem Set	1	10	10
Assessment 4: Design Project + Report	1	30	30
Self-directed learning / Revision	12	2	24
Total			164

Learning Resources		
Category	**Reference / resource**	**Status**
Core textbook	Coduto, Donald P.; Kitch , William A.; Yeung, Man-chu Ronald; Foundation Design: Principles and Practices, Pearson; 3rd Edition,	[Required]
Recommended reading	Das, Braja M; Principles of Foundation Engineering; Cengage Learning; 7th Edition. Das, Braja M; Principles of Geotechnical Engineering; Cengage Learning; 8 Edition Muni Budhu; Soil Mechanics and Foundations ; Third Edition. Bowles, Joseph E.; Foundation Design and Analysis; The McGraw-Hill Companies, Inc. 5th Edition.	[Recommended]
LMS / online resources	Lecture notes / Case studies / notifications	[Required / Recommended]

Guidelines on grading policy

ECTS Grade	Definition	US Grade	US %	IRQ%	Grade point Average
A – Excellent	Outstanding performance	A	90-100 %	90-100%	5.0
B – Very Good	Above average with some errors	B	80-89 %	80-89%	4.0
C - Good	Sound work with notable errors	C+	75-79 %	70-79%	3.0
D – Satisfactory	Fair but with major shortcomings	C	70-74 %	60-69%	2.0
E – Sufficient	Work meets minimum criteria	D	60-69 %	50-59%	1.0
FX - Fail	More work required but credit awarded			0-49	0.0
F- Fail	Considerable amount of more work required				

University Policies	
University based policies- Academic Integrity	https://main.soran.edu.iq/student-affairs/8
Regulation of Student's Absence Record	https://main.soran.edu.iq/student-affairs/11
Statement on Accommodation	https://main.soran.edu.iq/student-affairs/4
Emergency Response Plan	https://main.soran.edu.iq/student-affairs/10
Codes of misconduct	https://main.soran.edu.iq/student-affairs/6
Important dates, deadlines	

Important Note
❖ *Students are requested to monitor the comprehensive fulfilment of the learning outcomes as outlined in the Module book on a weekly basis. The evaluation of your academic performance is finally aligned with these outcomes, as exam questions will be derived from them. Should you come across any binding item of the learning outcomes that has not adequately addressed, it is incumbent upon you to promptly communicate this to the module lecturer, informing them of your difficulty in achieving the specified outcome.* ❖ *Please note that this Module book serves as a binding academic contract; both lecturers and students are required to sign a form demonstrating their full commitment to adherence to the provisions detailed therein.*

Classroom Code of conduct

All students have the right to learn without interference from others. Instructors have the authority to protect this right by creating and maintaining an environment that is conducive to learning. Meanwhile, students are required and expected to conduct themselves in a safe, mature and considerate manner. Students should conduct and express themselves in a way that is respectful to all individuals. This includes respecting the rights of others to comment and participate fully in class. Classroom misconduct is any behavior which disrupts or interferes with the learning environment.

Student Responsibilities:

1. Don't read a newspaper or other document; don't sleep during class; don't hold side conversations with your neighbor(s); and don't check your e-mail, update your Face Book page, or tweet in class. Remember, you may be called upon to answer a question and if you are not prepared, you will not be given credit for attending that class. This is a participative course.
2. Attend all classes unless an emergency arises. If that occurs, please let me know by e-mail or in person. Remember, the quizzes are based on class discussions. Unexcused absences from the midterm may lead to a grade of zero for that assignment.
3. Do your own work. Cheating will not be tolerated. It is unfair to students who work diligently to get the best grade possible in this course.

4. Using cell phones or other electronic devices that disrupt the learning process or teaching environment. Faculty members have the right to restrict the use of electronic devices in their classrooms.
5. Be a contributing member of your group. Don't let others carry the load for you. The business world revolves around teamwork and a consultative approach to problem solving. This is what I expect of you in class discussions whenever I break you up into groups.
6. If you violate any of these rules, I may ask you to leave class for the day. I don’t want to embarrass anyone but I expect to have your respect and attention throughout the course.

Instructor (my) Responsibilities

1. Model ethical behavior in the classroom and during office hours and in out-of-class discussions.
2. Be respectful towards all students; not to talk down to you.
3. Be diligent and provide interesting and informative lectures and discussions that challenge your intellectual curiosity.
4. Provide a diverse learning experience including using social media and Internet research in class discussions and assignments.
5. Be available during office hours and, when necessary, at other times during the course. Be attentive to your questions and concerns. Feel free to see me if you have a personal issue related to the course that you think I should know about. I do care about your well-being and hope to contribute towards your growth as a person. All of our communication about such matters is on a confidential basis.
6. Assist you in any way that I can to help you learn the course material. This includes meeting outside of office hours at a mutually convenient time and place.
7. Be fair in the grading process including grading quizzes, examinations, term papers, and the group case presentation. My evaluation of your work and grading process simulates the way performance evaluations should be done in the business world. I view the classroom as a learning laboratory to get you ready to be contributing members of society.
8. Be diligent in returning work with a grade and, where appropriate, my explanations of why points were deducted from your grade. See me if you have any questions on your grade but first review my comments to better understand why points have been deducted.

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