

**DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech Civil Engineering		
Course Title	UNSATURATED SOIL MECHANICS		
Course Code	CE 822	No. of Credits	3
Course Code of Pre-requisite subject(s)			
Session	Aug, 2023	Section (if, applicable)	Elective
Name of Faculty	Dr. Jeevan Joseph	Department	Civil Engineering
Email	jeevan@nitt.edu	Telephone No.	9619474630
Name of Course Coordinator(s) (if, applicable)	Dr. K. Muthukkumaran		
E-mail	kmk@nitt.edu	Telephone No.	
Course Type	<input type="checkbox"/> Core course <input checked="" type="checkbox"/> Elective course		
Syllabus (approved in BoS)			
<p>Stresses and strains in soils - stress, strain paths invariants - one-dimensional and isotropic compression of soils and idealisation; state boundary of compression of soils; stress paths and soil tests; critical state line and Roscoe surface; Drained and undrained planes; Critical state line for sands; Behaviour of over-consolidated soils and Hvorslev surface; Behaviour of soils before failure; Interpretation of index tests in the light of critical state concepts; Cam-clay models, Determination of critical state parameters. Identification and classification of expansive and collapsing soils, effective stress concepts, matric and osmotic suction, collapse, heave and strength characteristics of unsaturated soils, flow through unsaturated soils. Laboratory evaluation of swell pressure and swell potential, tests to evaluate collapse potential. Measurements of soil suction.</p> <p>References</p> <ol style="list-style-type: none"> 1. Jean-Louis Briaud, Geotechnical Engineering: Unsaturated and Saturated Soils, John Wiley & Sons, Inc., New Jersey, 2013. 2. Murray E.J, Sivakumar V., Unsaturated Soils: A fundamental interpretation of Soil behaviour, Wiley-Blackwell, 2010. 3. Ng C.W.W and Menzies B, Advanced unsaturated soil mechanics and engineering, CRC Press, 2019. 4. Lu, N. and Likos, W.J., Unsaturated soil mechanics, Wiley, 2004 (2) 5. Fredlund, D. J., Rahardjo, R., and Fredlund, M.D. Unsaturated Soil Mechanics in Engineering Practice, Wiley, 2012. 			
COURSE OBJECTIVES			
1. To understand the basic mechanisms of soil under specific conditions.			

2. To enhance the ability of relating the basic mechanisms of soil to behaviour of the soil under various loading conditions.
3. To understand the application of the theory of elasticity and plasticity to characterize the soil behaviour.
4. To develop the understanding of soil behaviour and apply it to develop elasto-plastic models based on unsaturated soil conditions.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)*										
	a	b	c	d	e	f	g	h	i	j	k
To demonstrate basic mechanisms behind index properties and tests on soil	H	L	L		M	L					
To relate behaviour of soils subjected to various loading and drainage conditions.	H	L	L	M	M	H					
To apply theory of elasticity and plasticity to characterize the stress-strain behaviour of soils.	H	M	H		M	H	M	L	M	L	
To formulate basic elasto-plastic model based on Unsaturated soil mechanics like cam-clay.	H	H	H	M	L	M	M	L	H	M	L

* a: Scholarship of Knowledge; b: Critical Thinking; c: Problem Solving; d: Research Skill; e: Usage of modern tools; f: Collaborative and Multidisciplinary work; g: Project Management and Finance; h: Communication; i: Life-long Learning; j: Ethical Practices and Social Responsibility; k: Independent and Reflective Learning

COURSE PLAN – PART II

COURSE OVERVIEW

The course is designed in such a way to impart the significance of application of unsaturated soil mechanics in contemporary engineering practises.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/ Contact Hours	Topic	Mode of Delivery
1.	Week 1	Stresses and strains in soils, stress, strain paths invariants	Class room Discussions
2.	Week 2	one-dimensional and isotropic compression of soils and idealisation	Class room Discussions
3.	Week 3	state boundary of compression of soils, stress paths and soil tests	Class room Discussions
4.	Week 4	critical state line and Roscoe surface; Drained and undrained planes, Critical state line for sands;	Class room Discussions
5.	Week 5	Behaviour of over-consolidated soils and Hvorslev surface; Behaviour of soils before failure	Class room Discussions
6.	Week 6	Interpretation of index tests in the light of critical state concepts; Cam-clay models,	Class room Discussions
7.	Week 7	Determination of critical state parameters. Identification and classification of expansive and collapsing soils,	Class room Discussions
8.	Week 8	Effective stress concepts, matric and osmotic suction	Class room Discussions
9.		Mid Semester Examination	

10.	Week 10	Collapse, heave and strength characteristics of unsaturated soils	Class room Discussions
11.	Week 11	Flow through unsaturated soils.	Class room Discussions
12.	Week 12	Case study	Class room Discussions
13.	Week 13	Laboratory evaluation of swell pressure and swell potential,	Class room Discussions
14.	Week 14	Tests to evaluate collapse potential.	Class room Discussions
15.	Week 15	Measurements of soil suction.	Class room Discussions
16.	Week 16	Correlation of Suction and Engineering Properties	Class room Discussions

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment-1	3 rd Week of September	1 week time for submission	10
2	MID SEM	3 rd Week of October	2 hr	30
3	Case study	1 st Week of November	10 min/person	20
4	Compensation Assessment*	1 st Week of Dec	2 hour	30
5	Final Assessment *	3 rd week December	3 hours	40

***A minimum of 30 % for the Final assesment and a cumulative of 35 % (summing up all the mode of assesment) is mandatory for passing the subject.**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

It is proposed to take feedback from the students, at the end of the semester to evaluate the execution of the course.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

- Mode of correspondence would be through Email and phone calls
- **COMPENSATION ASSESSMENT POLICY**
- Compensatory assessment shall be given for students providing genuine reasons (reported with in a weeks' time from the actual date of assessment) for their absentia during the regular assessments.
- Written examination for a time duration of 2 hr, covering the entire syllabus would be compensatory assessment policy for students missing Mid Semester.
- Students missing Assessment 1,2, and 3 may have to undergo the same assessment methodology scheduled in the actuals.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**


ACADEMIC DISHONESTY & PLAGIARISM

- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
The above policy against academic dishonesty shall be applicable for all the programmes.


ADDITIONAL INFORMATION

- The Course instructor would be available for discussions, if any, during office hours, at Room No:18; Civil Dept.
- Students are free to post any queries or clarifications to jeevan@nitt.edu.

FOR APPROVAL


Dr. Jeevan Joseph
Course Faculty


Dr. S. Saravanan
CC-Chairperson


Dr. S.T Ramesh
HOD