الفصل الاول: المادة: geotechnical engineers of soil عدد الساعات النظرية : 2، العملي:1 ساعة

weeks	Subject
(1,2)	characteristics of soils The nature of soils Particle size analysis Plasticity of fine soils Soil description and classification Phase relationships Soil compaction
(3,4,5)	Soil Structure 2.1 Introduction 2.2 Different Scales of Soil Structure 2.3 Pore Sizes Associated with Soil Structure 2.4 Single-Particle Arrangements 2.5 Gouy-Chapman Theory of the Double Layer 2.6 Forces of Interaction Between Clay Particles 2.7 Structure Variations due to Consolidation and Compaction 2.8 Role of Soil Structure in the Engineering Behavior of Soils
(6,7,8)	Seepage Soil water Permeability Seepage theory Flow nets Anisotropic soil conditions Non-homogeneous soil conditions Transfer condition Seepage through embankment dams Grouting
(9,10,11)	Consolidation theory Introduction The oedometer test Consolidation settlement: one-dimensional method Settlement by the Skempton–Bjerrum method The stress path method Degree of consolidation Terzaghi's theory of one-dimensional consolidation Determination of coefficient of consolidation Correction for construction period Numerical solution
(12,13,14)	Ground investigation Introduction Methods of investigation Sampling Borehole logs Geophysical methods Ground contamination
15	exam

الفصل الدراسي الثاني: المادة: soiL Pollution عدد الساعات النظرية :2

weeks	Subject
(1,2)	Flow of Water in Soils Introduction Energy States of Water in Soil Principles of Flow in Saturated Soils Governing Equation for Saturated Flow Special Cases of Saturated Flow Principles of Flow in Unsaturated Soils Governing Equation for Unsaturated Flow Analytical Solutions of Steady and Transient Flow in Soils
(3,4,5)	Mass Transport and Transfer in Soils Introduction Mass Transport Mechanisms Mass Transfer Mechanisms Governing Equation for Mass Transport Solutions for Special Cases of Mass Transport
(6,7)	Nonaqueous-Phase Liquids in Soils Introduction Principles of NAPL Entrapment in Soils Conceptualization of Field-Scale Transport of NAPLs Phase Diagram for Soil-Water-LNAPL-Air Systems Mobilization of Residual NAPLs Mass Transfer Processes
(8)	Pollution isotherm Langumer, frindlinch
(9,10)	Site Contamination Scenarios Characterization of Contaminated Sites Geostatistical Applications Contaminant Release Mechanisms: Vaporization Contaminant Release Mechanisms: Dusting Contaminant Release Mechanisms: Leaching
(11,12)	Principles of Site and Geomaterial Treatment Techniques Treatment Approaches In-Situ Versus Ex-Situ Treatment Basis for Treatment Technology Selection Pump-and-Treat Principles In-Situ Soil Flushing Volatilization and Air Pressurization Principles In-Situ Vitrification Principles In-Situ Chemical Treatment in Reactive Walls Solidification/Stabilization (Ex-Situ) Principles Ex-Situ Chemical Treatment Principles In-Situ Natural Attenuation Principles In-Situ Phytoremediation Principles In-Situ Bioremediation Principles
(13,14)	Configurations of Containment Systems Landfills Slurry Walls Drainage Trenches and Wells Surface Impoundments

	Grout Curtains Composite Systems
15	exam