

**HWRM-304**

**APPLIED SOIL MECHANICS (THEORY)**

**(02 Credit hrs)**

**PRE-REQUISITE:** GEN(NS)-101 General Geology

**LEARNING OUTCOMES:**

- This course will provide an introduction to the Applied soil mechanics & soil formation.
- The students will learn about the Classification of Soils.
- They will have the knowledge about Physical Properties of soils.
- Compaction and its techniques and theory will be learnt by the students.
- The students will get used to Permeability and Seepage analysis.
- The students will be equipped with the Vertical Stresses distribution in Soils.
- They will become conversant with Soil Exploration phenomena.

**CONTENTS**

**Unit-1 Soil Formation**

- 1.1. Soil and its Constituents
- 1.2. Weathering of Rocks and Types of Soils
- 1.3. Description and identification of soil

**Unit-II Classification of Soils**

- 2.1. Grain Size Classification
- 2.2. Bureau of Soils
- 2.3. Textural Classification by Triangular Chart
- 2.4. Unified Soil Classification
- 2.5. ASTM
- 2.6. AASHTO

**Unit-III: Physical Properties**

- 3.1. Water Content
- 3.2. Void Ratio, Porosity, Degree of Saturation, Specific Gravity
- 3.3. Unit Weight and their determination
- 3.4. Atterberg limits
- 3.5. Sieve Analysis
- 3.6. Hydrometer and Pipette Analysis
- 3.7. Stoke's Law
- 3.8.** Grain Size distribution

**Unit-IV: Permeability and Seepage**

- 4.1. Definition,
- 4.2. Hydraulic Gradient,
- 4.3. Darcy's Law, Factors affecting Permeability,
- 4.4. Permeability of stratified soils,
- 4.5. Laboratory and Field determination of coefficient of Permeability,
- 4.6. Seepage Force

### Unit-V: Compaction

- 5.1. Purpose and theory of Compaction,
- 5.2. Moisture Content and Dry Density relationship,
- 5.3. Degree of Compaction and its determination in the Field.
- 5.4. Methods of compaction in the field;
- 5.5. Factors affecting compaction of soils.

### Unit-VI: Vertical Stresses in Soils

- 6.1. Definition
- 6.2. Stresses caused by self-weight of soil
- 6.3. Geostatic stresses
- 6.4. Stresses caused by Point Loads and Uniformly distributed Loads.

### Unit-VII: Soil Exploration

- 7.1. Importance of Soil Exploration,
- 7.2. Soil Exploration methods,
- 7.3. Probing, Test Trenches and Pits, Auger boring, wash boring, rotary boring,
- 7.4. Percussion drilling and Geophysical methods,
- 7.5. Soil Samples, Disturbed and Un-disturbed samples.

### ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

### ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

## **RECOMMENDED TEXT BOOKS / SUGGESTED READINGS**

1. Das. B.M, (2019) *Advanced Soil Mechanics*. CRC Press. Taylor & Francis Group.
2. Kaliakin .V. (2017) *Soil Mechanics: Calculations, Principles and Methods*. Butterworth-Heinemann. Elsevier.
3. Garg, S K. (2001) *Soil Mechanics and Foundation Engineering* Fourth Edition.
4. Jumikis, A.R. (1994). *Soil Mechanics*, D. Van Nostrand Company Inc., Princeton, New Jersey.
5. Terzaghi, K. (1997). *Soil Mechanics in Engineering Practice*. John Wiley & Sons, New York.

**HWRM-304**

**APPLIED SOIL MECHANICS (LAB)**

**(01 Credit hr)**

**PRE-REQUISITE:** HYD-104 General Geology

**LEARNING OUTCOMES:**

- This course will provide an introduction to the Identification of different soils.
- The students will learn about the determination of water content of soil.
- They will have the knowledge about Specific Gravity of Soil.
- The Determination of Liquid Limit of Soil will be learned by the students.
- The students will get used to Determination of Plastic Limit and Plasticity Index of Soil.
- The students will be equipped with the Determination of Shrinkage Limit of Soil.
- They will become conversant with Classification of Soil according to AASHTO and USCS standards.

**CONTENTS**

**Unit-1**

- 1.1. Identification of Soil (Visual and Manual)

**Unit-II**

- 2.1. Determination of Moisture Content of Soil

**Unit-III:**

- 3.1. Determination of Specific Gravity of Soil

**Unit-IV:**

- 4.1. Determination of Liquid Limit of Soil

**Unit-V:**

- 5.1. Grain Analysis of Soil (including both Mechanical and Hydrometer Analysis)

**Unit-VI:**

- 6.1. Determination of Plastic Limit and Plasticity Index of Soil

**Unit-VII:**

- 7.1. Determination of Shrinkage Limit of Soil

**Unit-VIII:**

- 8.1. Classification of Soil according to AASHTO and USCS

**Unit-IX:**

- 9.1. Modified/Proctor Compaction Test

**Unit-X:**

- 10.1. Constant Head Permeability Test (Granular Soil)

## Unit-11

### 11.1. Falling Head Permeability (Granular and Fine Grained Soils)

#### ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

#### ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

#### RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Das. B.M, (2019) *Advanced Soil Mechanics*. CRC Press. Taylor & Francis Group.
2. Kaliakin. V. (2017) *Soil Mechanics: Calculations, Principles and Methods*. Butterworth-Heinemann. Elsevier.
3. Garg, S K. (2001) *Soil Mechanics and Foundation Engineering* Fourth Edition.
4. Jumikis, A.R. (1994). *Soil Mechanics*, D. Van Nostrand Company Inc., Princeton, New Jersey.
5. Terzaghi, K. (1997). *Soil Mechanics in Engineering Practice*. John Wiley & Sons, New York.