SOIL MECHANICS & HIGHWAY ENGINEERING

ARC 231-3

TEXTS: Highway Materials, Soils and Concretes - Atkins
Construction Methods and Nanagement - Nunally

REFERENCES:
Foundation Engineering - Peck Hanson and Shrouburn
Soil Mechanics in Engineering Practise - Terzaghi & Peck
Soil Engineering - Spagler
Procedures for Soil Testing - A.S.T.M.
Bituminous Materials - A.S.T.M. et seq.
Measurement of Soil Properties - Bishop & Henkol
Soil Mechanics and Engineering - Scott and Schoustra

Number	Periods	Topic Description	Reference
1	6	Site Investigation	
		Sample recovery	
		Bore Hole Logs	
		Record Keeping of Field Observations	
2	20	Laboratory (Soils)	
		Soil classification - Bore Hole Log	
		- Sample Recovery	
		Specific Gravity Test	
		Grain size analysis	
		Compaction Test	
		Unconfined compression test	
		California Bearing Ratio	
3	8	Highway Layout	
		Horizontal, circular and spiral curves	
		Super elevation theory	
		Profiles, plans & cross-sections	
		Field procedures and practice	
		Vertical curves	
		Plans and specifications	
4	10	Highway Construction	
		Drainage	
		Sub-grade treatment	
		Frost protection	
5	4	Highway Pavements	
		Sub-grade preparation	
		Aggregates	
		Binders	
		Surfacing	
6	8	Bulk Excavation	
		Plan, schedule. equipment selection and estimate a major earth moving project.	
7	4	Field Trips	
		Visits to highway construction sites and to paving constructors batching and mixing plants.	

COURSE OBJECTIVES

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GENERAL OBJECTIVES

1. To relate the nature of the earth's crust to the civil engineering requirements made upon it.
2. To appreciate the technology both current and potential of highway transportation.
3. To understand the attempt at rationalizing storm behaviour.
4. To become skilled in developing, propounding and defending an engineering procedure.

SPECIFIC OBJECTIVES:

Unit 1 - Review

1. Identify the nature and engineering properties of the three classes of rock.
2. Describe the nature and engineering properties of the two classes of subsoil.
3. Identify and illustrate the intent of all laboratory investigations performed in Semester 1.

Unit 2 - Soil Mechanics

1. Identify those topographical features of a site that indicate its subsoil properties.
2. Prepare a schedule of equipment for a typical subsoil investigation.
3. Schedule a procedure for carrying out such an investigation.
4. List the steps necessary to ensure satisfactory sample recovery.
5. Participate in a three man site investigation party.
6. Prepare schedules and procedures of the investigation.

7. Prepare a bore hole log for a site which the student has drilled.

8. Recover at least three bored samples in an "undisturbed" form, and three "disturbed" samples.

9. Submit a written report on the site exercise together with site plan and logs.

10. Using the disturbed samples prepare a soil classification.

11. Determine the Atterberg limits and in-situ moisture content of the sampled soil.

12. Perform an unconfined compression test on at least two undisturbed samples.

13. Calculate the bearing value of the subsoil from experimental data.

14. Maintain both a daily diary and a neat laboratory record of all site investigation work.

Unit 3 - Highway Layout

1. Prepare a detailed cross-section drawing of a single and a divided highway.

2. From a given map prepare a route plan for a highway.

3. Draw the longitudinal section for the highway.

4. Draw cross-sections at 100' chain ages throughout the length of the road.

5. Calculate the volumes of both cut and fill for the initial longitudinal section.

6. From these computations reassess the formation levels for the road.

Unit 4 - Drainage

1. State all factors affecting a site's run-off coefficient.

2. Sketch a typical series of storm-duration curves.

3. From a given storm duration curve and a known site calculate the maximum anticipated run-off.

4. Express Manning's formula for flow in a pipe.

5. Given any three of the following values determine the fourth
   a) pipe construction
   b) pipe gradient
   c) pipe diameter
   d) pipe capacity

6. For a known industrial site calculate, tabulate and sketch a complete storm water drainage system.

7. State the factors affecting the size of sanitary drainage.

8. For a known community, calculate the maximum sewage runoff.

Unit 5 - Earth Moving Project

N.B. The student is supplied with a sketch of a large (4 square miles) of undulating rural site. It is to be prepared for industrial development by levelling. carpeting and draining; the works to be completed in 20 weeks.

1. Draw a detailed schedule for the works.

2. List the equipment required for:

   a) preparing and reinstating the site
   b) the excavation, filling and consolidation of the major earthworks
   c) the development of the gravel quary and the grading and compaction of the finished carpet

3. Sketch the site layout at weeks 1, 4, 12, 16 and 20.

4. Estimate the overall job cost and the unit cost per cubic yard of material excavated.

5. Submit a detailed calculation of all quantities using Simpson's Rule.

6. Submit a written proposal for the work as would be tendered by a contractor.

7. Make an oral presentation to the class of your proposal.

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Criteria used for assessing work. The preparation of a student's total will be allocated as follows:

UNIT	GRADE ALLOCATION %
1. Site Investigation (field work)	10
2. Site Investigation (laboratory work viz grain analysis or Atterberg limits)	10
3. Proctor Test	10
4. Unconfined Compressor Test	10
5. Bearing Value Test	10
6. Highway Alignment	5
7. Highway Pavement Design	10
8. Bulk Excavation Project	25
9. Drainage Design	10
	100