ENGINEERING MATERIALS (SESSIONAL)

CE-204

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&

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No of credit : 1.5 **No of lecture/week : 1**

LECTURE - 1

- GENERAL INSTRUCTION
- EXPERIMENT NO. 01

GENERAL INSTRUCTIONS

- Every student must be regular and active in the class.
- Generally, tests should be completed during the assigned laboratory period.
- Students will be divided into several groups and a group leader will be selected for each group.
- After roll call in each class, the students will submit their previous test reports to the teacher.
- Students should be careful about their own safety & safety of the equipment.
- Care must be taken during handling of hazardous materials, chemicals, electricity, fire, etc. which may be in use during testing.

GENERAL INSTRUCTIONS CONT'D

For proper utilization of the limited time in the laboratory, the students are advised to come prepared in the class.

- A through study on the assigned tests & laboratory procedures;
- Preparation of the proposed data sheet
- Completion of previous test reports for submission to the teacher.

GENERAL INSTRUCTIONS CONT'D

- Care should be taken so that no instrument is misplaced, broken or lost.
- After completion of experiments, the instruments or apparatus are to be **cleaned and returned** to the laboratory technician (Mr. Probodh Chowdhury).
- After the experiment, the data sheet is to be **signed** by the concerned teacher.
- Any breakage, damage or loss of apparatus must be **reported** immediately to the teacher. Damage or loss due to carelessness will be **charged** to the responsible group.
- No student shall handle or operate any **instrument other than those assigned** to his group without prior permission of the teacher.

Report Writing

The arrangement of report should be in the following sequence:

- Objective (Significance of the test)
- Theory/Scope of the Test (Statement of the purpose of the test)
- Equipment's
- Materials used or tested
- Procedure (Briefly)
- Data Sheet
- Calculation
- Graph
- Discussion
- Assignment (If Given)

Calculation & Discussion

Calculation:

- All equations or formulae used should be clearly stated with reference.
- Calculation should be submitted in concise form.

Discussion:

- The test results must be compared with pertinent data given in any books or publications & definite conclusion should be drawn.
- The limitation or drawback or shortcoming of the tests also should be mentioned.

An *Index Sheet* must be provided at top of the report file.

Separate ***Top Sheet*** should be attached with each report. The sheet should include the followings:

- Course No.
- Course Name
- Section & Group No.
- Experiment No.
- Experiment Name
- Date of Performance
- Date of Submission
- Name & Student ID.
- Level, Term.

❖ The report should be hand written by pen in *A4 size paper* (one side).

- The report should be brief but self-explanatory.
- In addition to the subject matter, clarity, conciseness, method of presentation, legibility & neatness of the report will receive consideration in the grading or a report.
- Lack of neatness shall be sufficient cause for rejection of report.
- Copying of any report will result in cancellation of all reports concerned.

LIST OF EXPERIMENTS

Sl. No.	Experiment Name
01	**Sieve Analysis of Fine and Coarse Aggregate**
02	Resistance to Abrasion of Small Size Coarse Aggregate by Using Los Angeles Machine
03	Determination of Aggregate Impact Value (AIV) and Aggregate Crushing Value (ACV)
04	Determination of Normal Consistency of Cement with Vicat Apparatus
05	Determination of Initial Setting Time and Final Setting Time of Cement with Vicat Apparatus
06	Determination of Fineness of Cement by Sieving
07	Direct Compressive Strength of Cement Mortar
08	Compressive Strength of Concrete Cylinders and Cubes
09	Specific Gravity and Absorption Capacity of Fine Aggregate
10	Specific Gravity and Absorption Capacity of Coarse Aggregate
11	Determination of Compressive Strength and Absorption Capacity of Brick

Lecture Plan

Experiment No.	Experiment Name
01	a) Sieve Analysis of Fine Aggregate (FM); b) Gradation Test of Coarse Aggregate
02	a) Resistance to Abrasion of Small Size Coarse Aggregate by Using Los Angeles Machine (AAV) ; b) Determination of Aggregate Impact Value (AIV)
03	a) Unit weight & voids in Aggregate; b)Specific Gravity and Absorption Capacity of Fine Aggregate;
05	a) Specific Gravity and Absorption Capacity of Coarse Aggregate; b) Moisture content (Evaporable moisture & Surface moisture) of aggregate
05	a) Determination of Normal Consistency of Cement with Vicat Apparatus; b) Soundness test of Cement ; c) Determination of Fineness of Cement by Sieving
06	a) Determination of Initial Setting Time and Final Setting Time of Cement with Vicat Apparatus ; b) Specific gravity of Cement
07	a) Compressive Strength of Cement Mortar; b) Tensile Strength of Cement Mortar
08	a) ACI Mix Design ;
09	a) Workability Test of Fresh Concrete; b) Compressive Strength of Concrete Cylinders (Will be conducted in CE-202)
10	a) Salinity test of aggregate; b) Salinity test of Brick; c) Aggregate Crushing Value (ACV) Test
11	a) Determination of Compressive Strength of Brick; b) Absorption Capacity of Brick ; c) Unit Weight of Brick; d) Size, Shape & Color of Brick ; e) Field test of Brick

EXPERIMENT NO.- 1

NAME OF THE EXPERIMENT:

STANDARD TEST METHOD FOR SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES

INTRODUCTION

- The term sieve analysis is given to simple operation of dividing a sample of aggregates into fraction each consisting of particles between specific limits.
- The analysis is conducted to determine the grading of materials proposed for use as aggregates.
- The term *Fineness Modulus* (FM) is a ready index of coarseness or fineness of the material.

INTRODUCTION

- It is an empirical factor obtained by adding the cumulative percentages of aggregates retained on each of the standard sieves and dividing this sum arbitrarily by 100.
- No. 100, No. 50, No. 30, No. 16, No. 8 and No. 4 are the ASTM standard sieves used to test fine aggregate.

REFERENCED STANDARD:
ASTM C 136

APPARATUS

- *Balance:* Sensitive to within 0.1% of weight of the sample
- *Sieves:* ASTM Standard Sieves
- *Mechanical Sieve Shaker*

Fine Aggregate

- The test sample of *Fine Aggregate* (FA), after drying, approximately the following amount:

Aggregate with at least 85% passing a No.4 sieve and more than 5 % retained on a No. 8 sieve.	**500 g**
Aggregate with at least 95 % Passing No. 8 sieve	100 g

REFERENCED STANDARD:
ASTM C 136

Coarse Aggregate

- The weight of the test sample of *Coarse Aggregate* (CA) shall conform to the following requirement:

Aggregate with nominal maximum size of ¾ in	**5 kgs**

The weight of the test sample of CA and FA mixtures shall conform to the following:

Nominal Maximum Size Square Openings , mm (in)	Minimum Weight of Test Sample, kg (lb)
9.5 (3/8)	1 (2)
12.5 (1/2)	2 (4)
19.0 (3/4)	5 (11)
25.0 (1)	10 (22)
37.5 (1.5)	15 (33)
50 (2)	20 (44)
63 (2.5)	35 (77)
75 (3)	60 (130)
90 (3.5)	100 (220)
100 (4)	150 (330)
112 (4.5)	200 (440)
125 (5)	300 (660)
150 (6)	500 (1100)

PROCEDURE

- Dry the sample to constant weight at a temperature of 110±5ºC (generally for 24 hours)
- Nest the sieve in order of decreasing size of opening from top to bottom and place the sample on the top sieve.
- Agitate the sieves by hand or by mechanical apparatus for a sufficient period, say 15 minutes.
- Limit the quantity of material on a given sieve so that all particles have the opportunity to reach sieve openings a number of times during the sieving operation.

PROCEDURE CONT'D

- Continue sieving for a sufficient period and in such manner that, after completion, not more than 1% weight of the residue on any individual sieve will pass than but sieve during 1 minute of continuous hand sieving.
- Determine the weight of each size increment by weighting on a scale or balance to the nearest 0.1 % of total original dry sample weight. The total weight of the material after sieving should check closely with original weight of sample placed on the sieves. If the amount differs by 0.3%, based on the original dry sample weight, the results should not be used for acceptance purposes.

Figure 1.1:
US Standard Sieves

Figure 1.2 Sieve Shaker

CALCULATION

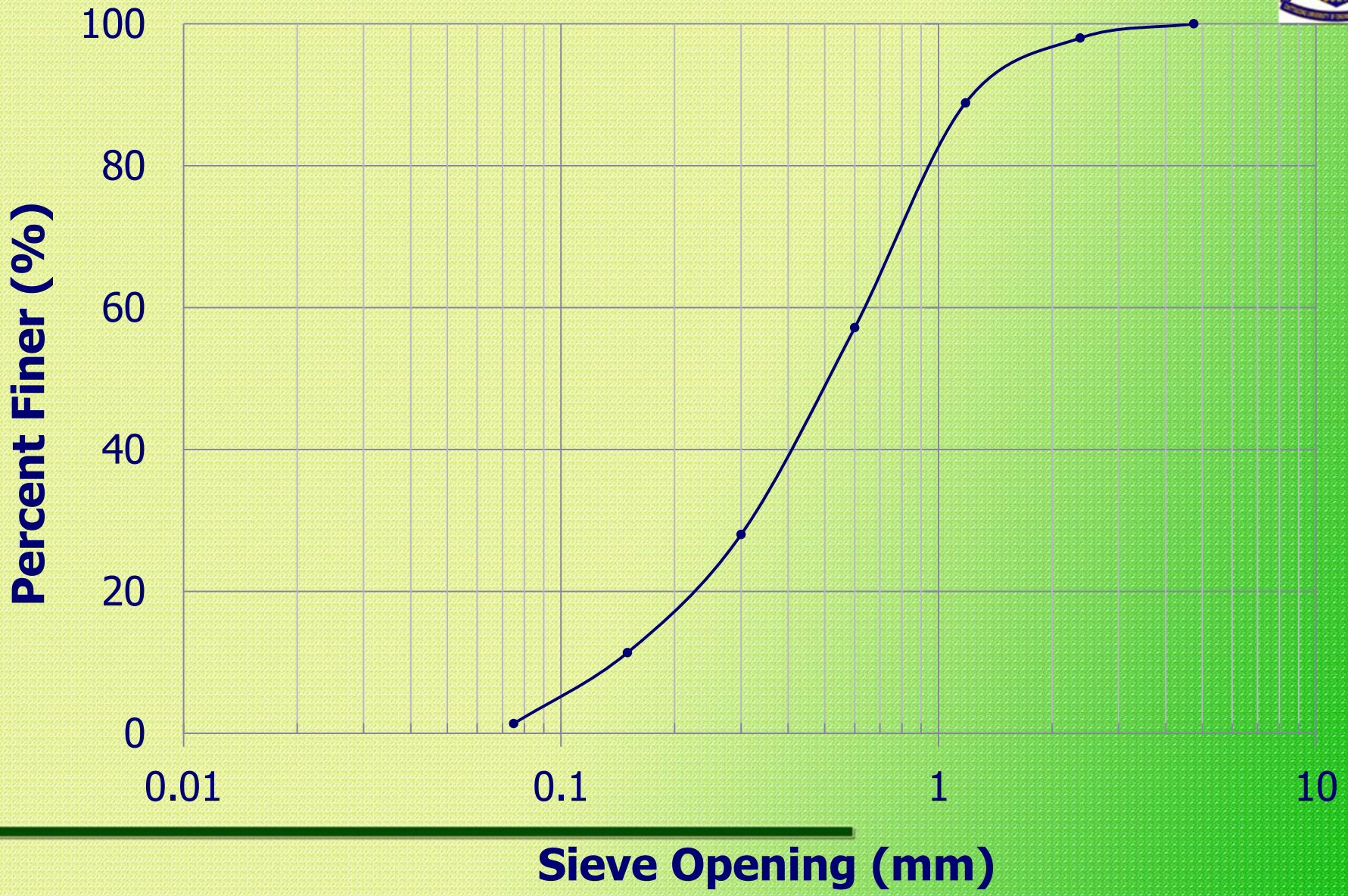
- Calculate *Percentages Passing*, *Total Percentage Retained*, or *Percentages in Various Size Fractions* to the nearest 0.1% on the basis of the total weight of the initial dry sample.
- Calculate the *Fineness Modulus (*when required) by adding the total percentages of material in the sample that is coarser than each of the following sieves (*Cumulative Percentages Retained*), and dividing the sum by 100

REPORT

The report shall include the following:

- Total percentage of material passing each sieve, or
- Total percentage of material retained on each sieve, or
- Cumulative Percentage of material retained on each sieve and Percent Finer on each sieve.
- Calculation of the ***Fineness Modulus (FM)*** to the nearest 0.01 of Fine Aggregate.
- ***Gradation Curve*** (*Percent Finer* vs. *Sieve Opening*) for *Coarse Aggregate* and *Fine Aggregate* on semi-log paper.

SAMPLE GRADATION CURVE



SAMPLE DATA SHEET-FINE

Sieve Number	Sieve Opening (mm)	Materials Retained (gm)	% of Materials Retained	Cumulative % Retained	Percent Finer
No. 4					
No. 8					
No. 16					
No. 30					
No. 50					
No. 100					
No. 200					
Pan					
	TOTAL =				

Fineness Modulus (FM) =

SAMPLE DATA SHEET-COARSE

Sieve Number	Sieve Opening (mm)	Materials Retained (gm)	% of Materials Retained	Cumulative % Retained	Percent Finer
1.5 "					
1.25"					
1"					
0.75"					
0.50"					
0.375"					
No. 4					
Pan					
	TOTAL =				

QUESTIONS

- Define *Fineness Modulus (FM).* What is the significance of *FM*?
- What is meant by Good Grading? Draw qualitative curves for different types of grading.
- What is the practical use of controlling the grading of concrete aggregates?
- How does the fineness modulus of aggregates affect the strength of concrete?
- In what sizes of particles the aggregates are deficient or oversupplied? How might this be remedied in a practical way?