



Module (Course Syllabus) Catalogue 2022-2023

College/ Institute	Erbil Technology College	
Department	Department of Material and construction technology	
Module Name	Materials Testing	
Module Code	MAT233	
Degree	Technical Diploma <input type="checkbox"/> Bachelor <input checked="" type="checkbox"/> High Diploma <input type="checkbox"/> Master <input type="checkbox"/> PhD <input type="checkbox"/>	
Semester	3	
Qualification	Doctorate	
Scientific Title	Lecturer	
ECTS (Credits)	7	
Module type	Prerequisite <input type="checkbox"/> Core <input checked="" type="checkbox"/> Assist. <input type="checkbox"/>	
Weekly hours		
Weekly hours (Theory)	(1)hr Class	(.....)Total hrs Workload
Weekly hours (Practical)	(3)hr Class	(.....)Total hrs Workload
Number of Weeks	12	
Lecturer (Theory and Practical)	Dr.Guler Fakhraddin Muhyaddin	
E-Mail & Mobile NO.	guler.muhyaddin@epu.edu.iq (07504480587)	
Websites		

Course Book

<p>Course Description</p>	<p>Introduction to civil engineering materials laboratory and design of experiments, with focus on mechanical and physical properties of construction materials; including measurement of strains using mechanical gauges and electrical resistance strain gauges; experiments on metals, aggregates, Portland cement, cement mortar and concrete block..</p>
<p>Course objectives</p>	<ol style="list-style-type: none"> 1. To give students the background required to pursue further studies in materials processing, design and related engineering fields. 2. To develop an understanding of the differences between engineering materials through the application of laboratory experiments to determine their physical and mechanical behaviour. 3. To introduce students, the failure modes and the use of destructive and 4. nondestructive testing techniques of engineering materials.
<p>Student's obligation</p>	<p>Student's obligation throughout the academic year is attendance, they make assignments at every midterm, moreover, they do an experimental test then they should prepare reports upon the experimental test, finally they should do the final assignment or exam during the academic study.</p> <p>It can be very helpful to study with a group. This type of cooperative learning is encouraged; however, be sure that you have a thorough understanding of the concepts besides the mathematical steps used to solve a problem. You must be able to work through the problems on your own.</p>
<p>Required Learning Materials</p>	<p>In the lecture during the academic study, am using (data show) for giving full detailing, beside that will be using the white board to solution the examples, and giving the students a hard copy of the lecture, finally, I will give the students a take home.</p>

Evaluation	Task	Weight (Marks)	Due Week	Relevant Learning Outcome	
	Paper Review				
	Assignments	Homework	14%		
		Class Activity	2%		
		Report	24%		
		Seminar			
		Essay			
		Project			
	Quiz	4%			
	Lab.				
	Midterm Exam	16%			
	Final Exam	40%			
	Total	100%			
	<p>Specific learning outcome:</p>	<p>One of the main objectives of the course is to familiarize the students with the fundamental concepts of Materials Science and Engineering which will be used as background knowledge for the understanding of specialized courses in the field of Materials Science and Engineering that follow. Thus this course provides an introduction to the type of materials, structure, properties, characteristics and applications, with special emphasis on the relationships between internal structure and properties. At the end of this course the student should be able to:</p> <ol style="list-style-type: none"> 1. Classify the materials 2. Understand the basic properties that characterize the behaviour of materials 3. Understand the type of loadings/environment that materials should withstand 4. Select appropriate type of material for specific application 5. Offer different approaches to modify structure/microstructure in order to get desired properties. 			

Course Reading List and References:	<ol style="list-style-type: none"> 1. American Standards (ASTM). 2. Iraqi Standard Specifications (IQS). 3. NCCLR (sampling manual) the National Center for Laboratories and Structural Research. 4. British Standards (BS EN). 5. IQ-NCCLR sampling Booklet. 6. International Standards Organization (ISO). 7. Iraqi Standards for Roads and Bridges (SORB). 8. Construction Materials Experiments Manual, Khalil Hassan Yunis and Tahseen Taha Hamad, Technical Institutes Authority - Erbil Technical Institute - Civil Technology Department, 2003. 	
Course topics (Theory and Practical)	Week	Learning Outcome
Introduction on the material lab + Normal consistency of hydraulic cement.	Week 1	The students will more familiar with the material and instruments (equipment's) used during the course and find normal consistency of hydraulic cement. by determining the amount of water required to prepare cement pastes for Initial and final time of setting test
Initial and final setting time of cement + Fineness test of cement	Week 2	determination of the time of Setting of cement by means of the Vicat needle plus determination of the finesses of hydraulic cement by means of the 150 μm (No.100) and 75 μm (No.200) sieves.
Density and specific gravity of cement and Compressive strength of cement mortar	Week 3	Find the density of cement and its specific gravity. determination of the compressive strength of cement mortars, using 2 in (50 mm) cube specimens.
Tensile strength of cement mortar + flow test of cement mortar	Week 4	determination of the tensile strength of cement mortars employing. The Briquet specimens plus finding the flow of hydraulic cement mortars, and of mortars containing cementitious materials other than hydraulic cements.
Reducing Field Sample of Aggregate to Test Sample and Sieve Analysis of fine and coarse aggregates	Week 5	To obtain laboratory samples of aggregates from stockpiles plus determination of the particle size distribution the fine and coarse aggregate by sieving.
Specific Gravity and Absorption of Coarse Aggregate	Week 6	determination of Specific Gravity and Absorption of coarse aggregate. The specific gravity may be expressed as bulk specific gravity, bulk specific gravity SSD or apparent specific gravity..
Midterm Exam	Week 7	

Specific Gravity and Absorption of fine Aggregate	Week 8	determine Bulk and Apparent Specific Gravity and Absorption of fine aggregate
Resistance to Degradation of Small-size coarse Aggregate by Abrasion in the Los Angeles Machine	Week 9	cover testing sizes of coarse of (12.5mm) for resistance to degradation using the Los Angeles testing machine
Standard consistency test for gypsum	Week 10	obtain the quantity of water required to obtain a plaster paste with standard consistency, and this quantity of water used for other tests:(setting time and compressive strength tests for gypsum)
Water Absorption Test for concrete Block	Week 11	Obtain percentage of water absorption of concrete blocks.
Compressive strength test for concrete blocks	Week 12	find maximum strength for concrete blocks
Steel bar tension test	Week 13	To study the behavior of reinforcing steel when increasing the force to failure as well as to get the curve of stress and strain.

- Examinations (question design):

Q1: write the purpose of the following tests:

- a. Steel bar tension test
- b. Absorption test for aggregate

Q2: Fill the following blanks:

- a. Fineness (%) of hydraulic cement =
- b. In the water absorption test of concrete block, the pieces of blocks are connected by a cotton thread, and placed in water tank at C° for 24hr.
- c. Is to obtain laboratory samples of aggregates from stockpiles.
- d. According to ASTM C150:
 1. Initial time of setting, not less than min.
 2. Final time of setting, not more than min.
- e. Abrasion (%) in the los Anglos test of coarse aggregate =

Q3: List the apparatus or equipment's used for the followings:

- i. Sieve analysis of fine and coarse aggregate test.
- ii. Standard consistency test for gypsum.

Q4: Write the formula and units of the following:

1. Tensile strength of cement mortar.
2. Absorption of coarse aggregate.

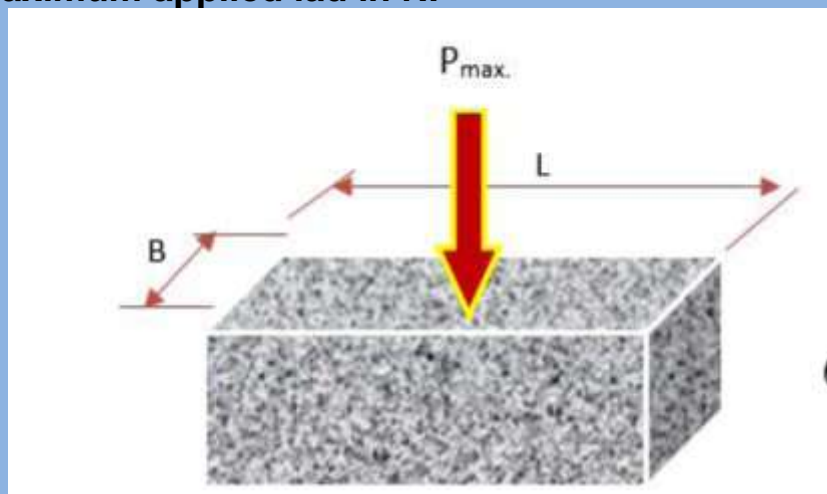
Q5: if the dimension of the concrete blocks is

L= 600 mm

B= 200 mm and

The minimum compressive strength of the solid block Type A is about 13 MPa

What is the maximum applied load in N.



The answer of the questions:

Q1:

- a. To study the behavior of reinforcing steel when increasing the force to failure as well as to get the curve of stress and strain.
- b. This test method covers the determination of Specific Gravity and Absorption of coarse aggregate. The specific gravity may be expressed as bulk specific gravity, bulk specific gravity SSD or apparent specific gravity. The bulk specific gravity and absorption are based on aggregate after 24hour soaking in water.

Q2:

- a. **Fineness (%) of hydraulic cement = Fineness (%) = (Weight of sieve + cement) - Weight of sieve / (Weight of cement) x100.**
- b. **In the water absorption test of concrete block, the pieces of blocks are connected by a cotton thread, and placed in water tank at 15.6- 26.7 C° for 24hr.**
- c. Reducing Field Sample of Aggregate to Test Sample **Is to obtain laboratory samples of aggregates from stockpiles.**
- d. **According to ASTM C150:**
 - 1. **Initial time of setting, not less than 45min.**
 - 2. **Final time of setting, not more than 375 min.**
- e. **Abrasion (%) in the los Anglos test of coarse aggregate = wt of passing sieve (1.7mm) x 100 Wt. of initial sample**

Q3:

i

- 1. Balance: For fine aggregate accurate for 0.5gm. For coarse aggregate accurate for 0.5gm.
- 2. Containers to carry the sample.
- 3. Oven.
- 4. Mechanical Sieve shaker.
- 5. Two sets of sieve: -For fine aggregate [No.4, No.8, No.16, No.30, No.50, No.100] For coarse aggregate [37.5mm, 19mm ,9.5mm, No.4, No.8] In addition to a pan and a cover for each set.

ii.

- 1- A cylindrical mold of non-absorbent and corrosion-resistant material with a height (51mm) and inner diameter (35mm).
- 2- A square glass plate with length of(250mm).
- 3- Metal roller or spatula.
- 4- A clean and dry pot for mixing of non-absorbent and corrosion-resistant material
- 5- Timer with accurately (1) seconds.

Q4:

1.

Tensile strength $\sigma_t = \text{Load causing failure}(P) / \text{Area at the fracture}(A)$

2.

Absorption% = $[(B - A) / A] \times 100$

A=Weight of oven-dry test sample in air,(gm).

B= Weight of S.S.D. sample in air,(gm).

Q5:

Compressive strength (MPa) = $P \text{ max.} / A$

$A = L \times B$

= 200×600

= 1200 mm^2

$13 = P_{\text{max}} / 1200$

$P_{\text{max}} = 13 \times 1200$

= 15600 N .

Extra notes:

A sample of exam paper and its answer will be attached. For the students to be familiar with exam.

External Evaluator

The course book prepared by my colleague is properly arranged and covers the main requirements of the lesson. The lecturing procedures are identified properly. The assessment scheme and forms of teaching are arranged in a way that the student could understand clearly. It can be said that student will be satisfied with this course book and it promises a good outcome.

Approved

Dr. Saad Khalis Essa

