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**Erbil Polytechnic University**

**Building Construction Department**

**Shaqlawa Technical Institution**

**Subject: Concrete Technology**

**Course Book – *2nd Years Students***

**Lecturer's name: Alan Sabah Kako**

**Academic Year: 2021/2022**

**Course Book**

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| **1. Course name** | **Concrete Technology** |
| **2. Lecturer in charge** | **Alan Sabah Kako** |
| **3. Department/ College** | **Dam & Water Resource/College of Engineering** |
| **4. Contact** | **e-mail:** **alan.kako@su.edu.krd****Tel: (0750 339 62 77)** |
| **5. Time (in hours) per week**  | **Theory: 2 hr****Practical: 2 hr**  |
| **6. Office hours** | **As per time table.** |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | **2008 – 2011/ B. Eng (Hons)** Kingston University/ London/ UKFaculty of Civil Engineering**2011 – 2012/ M.Sc** University of Surrey/ Guilford/ London/ UKFaculty of Civil and Structural Engineering.**2006 – 2008 / B. Tech national certificate in Construction**City of Wolverhampton college/ Wolverhampton / UK |
| **9. Keywords** | **Design, Construction, Cement, Aggregate, Admixture, Concrete.** |
| **10. Course overview:** This course provides a comprehensive treatment of the materials and civil engineering principles which results in production and construction of high quality concrete for buildings and infrastructure. By the end of semester, students will be able to successfully design and assess the performance of various cement-based materials including normal and high strength concrete as well as special cement composites. During the semester, students will practice and learn to characterize and predict the behavior of aggregates, portland cement, and concrete products. Other topics covered include: hydration of portland cement, mineral and chemical admixtures, mixture proportioning, properties of concrete in fresh and hardened state, strength and fracture, volume changes due to creep, shrinkage, and thermal dilation, transport of heat, moisture and ions, and durability against corrosion, freezing and thawing. |
| **11. Course objective:**The course will cover the introduction to concrete technology and will be divided into the following sub topics:1. Concrete technology: Properties of concrete raw materials are going to be studied production of concrete, properties of fresh and hardened concrete and methods of mix design will be illustrated to the students.2. Destructive and Non-Destructive test on concrete will be studied.3. Structural Elements The student will be able to deal with the concrete and other construction materials and has a knowledge of construction technologies.  |
| **12. Student's obligation**Students should attend the class every lecture and prepare for quizzes and exams.In practice aspect students must attend the lab and do the lab work and write a report on the experiment that they did in one group or subgroups.  |
| **13. Forms of teaching**Different forms of teaching will be used to reach the objectives of the course; power point presentations for the head titles and definitions and summary of conclusions. A worksheet will be designed to let a chance for practicing in the classroom. Regular home works shall be given to increase the knowledge of students.Virtual tour through internet will be done to illustrate methods of manufacturing cement and other technologies.  |
| **14. Assessment scheme*****Theoretical part:***The students are required to do the following: a. One exam at the end of the first semester has a weight of 30% of the total mark. These exams include (Practical exams).b. Quizzes, Classroom activities, Lab Reports, Home works and class attendance has a weight of 20% of the total marks.c. Final Exam at the end of May having a weight of 50% of the total mark (25% for practical part & 25% for theoretical part).**The final grade will be based upon the following criteria:****Theoretical Part:** **Annual Effort =20%** **Final Exam = 25 %****Practical Part:** **Annual Effort =10%** **Final Exam =25%****Daily Activities:** **Lab report, Homework and Class participation = 20%** Exams and assignments require analytical work and not just memorization of topics or articles.‌ |
| **15. Student learning outcome:** Students will deepen the knowledge of special concrete with accent on the composition, structure, properties and use in construction practice.Students will learn about cement hydration, material properties, and making concrete. |
| **16. Course Reading List and References‌:****Course Material :**Required:1. **A.M. Neville, J.J. Brook, "Concrete Technology",1987**

**Recommended:**1. A.M. Neville, "Properties of concrete", Fourth and Final Edition, 2000
2. D.F. Orchard, "Concrete Technology"
3. Sidney Mindess, J.F.Young "Concrete", 1981
4. F. M. Lea, "The Chemistry of Cement and Concrete"
5. Muaed N. AlKhalaf & Hanaa A. Yousif "Concrete Technology"
6. Riad S. AlRawi " Lectures of material Science"
7. American Standards ASTM
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| **17. The Topics:** | **Lecturer's name** |
|  Week 1:  Introduction to Concrete TechnologyWeek 2:  Concrete IngredientsWeek 3:  Cement/ Compound Compositions, Oxides in cementWeek 4:  Types of Cement (Review)Week 5:  Aggregate/ Physical Properties/GradingWeek 6:  Aggregate/ Physical Properties/Water absorption and  porosity Surface texture, Shape of aggregateWeek 7:  Aggregate/ Physical Properties/ Deleterious Substances percentage, Strength of Aggregate, Soundness, Specific GravityWeek 8: Thermal Properties, Chemical Properties/Aggregate reactivity with Alkalis Percentage of sulphatesWeek 9: Light weight and heavy weight aggregate/ QuizWeek 10: Concrete Production / Preparing, Batching, Mixing, Handling and transport Week 11: Concrete Production / Placing of concrete, Finishing, CuringWeek 12 & 13: **First semester Exams**Week 14: Hardened Concrete introductionWeek 15: Hardened Concrete/ Compressive strength, Tensile strength Week 16: Hardened Concrete/ Modulus of Elasticity, Poisson’s ratio, ShrinkageWeek 17: Hardened Concrete/ Creep, PermeabilityWeek 18: Concrete admixtures / QuizWeek 10: **Newroz Holiday**Week 20: **Newroz Holiday**Week 21: Mix DesignWeek 22: Examples of Mix DesignWeek 23: Destructive tests on concreteWeek 24: Destructive tests for concrete/ QuizWeek 25: Introduction to Structural elementsWeek 26: Examples of Structural elementsWeek27:  General Discussion  | Alan Sabah Kako (2 hrs/ week) 9 / 2020 |
| **18. Practical Topics (If there is any)** |  |
| 1. Slump test of concrete
2. Vebe test of Concrete
3. Compacting factor of Concrete
4. Flow table test
5. Compressive strength of concrete
6. Tensile strength of concrete
 | Alan Sabah Kako (2 hrs / week) |

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| **19. Examinations:****a) Theoretical*****Q1)*** *(****15 Marks)***Draw a flow chart illustrating the sequence of concrete production processes. Explain in details the curing process. ***Q2)******(18 Marks)*** 1. What are the types of voids in concrete, Explain in brief?
2. How can the durability of concrete against cycles of freezing and thawing be enhanced?
3. *Define the following:*

 a) Segregation. b) Durability of Concrete. ***Q3)******(12 Marks)***What are the Factors affecting the workability of concrete? ***Q4)******(15 Marks)***What are the advantages of decreasing the permeability of Concrete? ***Q5)******(40 Marks)***1. The transporting process of Concrete is considered acceptable when:
2. …………………………, b) …………………, c) ………………………
3. Physical Properties of concrete depends on:
4. ………………, b) ………...., c) …….…….., d) ……………, e) ………….
5. Segregation can be decreased by:
6. ………………………, b) …………………….., c) ……………………..
7. Tensile strength of the concrete can be measured by many methods like:
8. ……………………., b) ………………………, c) ……………………..
9. Creep can be increased when:
10. ………………………, b) ………………………, c) ……………………
11. Modulus of Elasticity of concrete depends on :
12. …………………………, b) …………………, c) ………………………

***Q6)*** **[14 Marks]**What are the reasons for widespread of the concrete and being on the top of the list of building materials:***Q7)*** **[24 Marks]**Design a concrete mix to implement a concrete slab exposed to sever conditions moisture and freezing and thawing ) with design compressive strength 30 MPa, a standard deviation equals to 4 and the percentage expected less than minimum strength is 10 %. Ordinary Portland Cement is used. The maximum size of an angular aggregate is 20 mm with apparent density 1500 kg/m3. The available fine aggregate has fineness modulus 2.4. An air entraining agent has been used in the mix. **Q8) [30 Marks]**1) With the same water content of the mix, bleeding decreases when:1. ……………………., b) ………………………, c) ……………………..

2) Compressive strength of a concrete depends on  a) ………………………, b) ………………………, c) ……………………3) Segregation can be decreased by:1. ………………………, b) …………………….., c) ……………………..

4) In the process of mix design two points should be considered cost and specifications, the cost of concrete include: 1. ………………………….. b) …………………………..

C) …………………………… d) …………………………… 5) Voids in concrete can be classified to:1. ………………………….. b) …………………………..

**Q9)** Numerate with drawings the types of clay brick, write about each type: **[10 Marks]*****Q10)******(10 Marks)***Explain the Curing process Concrete.***Q11)******(12 Marks)***Define the following: A) Durability. B) Discontinuous production of Concrete.***Q12)******(10 Marks)***What are the disadvantages of concrete production?***Q13)******(12 Marks)***Draw the following Curves:1. Deflection vs. Time for Creep. b) W/C ratio vs. Strength for concrete.

***Q14)******(44 Marks)***1. Creep can be increased when:
2. ………………………, b) ………………………, c) ……………………
3. Physical Properties of concrete depends on:
4. ………………, b) ………...., c) …….…….., d) ……………, e) ……….
5. The transporting process of Concrete is considered acceptable when:
6. …………………………, b) …………………, c) ………………………
7. Segregation can be decreased by:
8. ………………………, b) …………………….., c) ……………………..
9. With the same water content of the mix, bleeding decreases when:
10. ……………………., b) ………………………, c) ……………………..
11. Mixing time of concrete ingredients depends on:
12. ………………, b) ………...., c) …….…….., d) ……………, e) ……….

**B) Practical questions:*****Q1: (4 marks)*** If the weight of Cement is 1000 g and the mix proportion is 1:1.5:3, Calculate the following:1. The amount of water for W/C = 0.4
2. The amount of water for W/C = 0.5
3. Weight of Coarse aggregate.
4. Weight of Fine aggregate (Sand).

***Q2: (6 marks)***1. What are the types of Slump? Illustrate each type.  ***(3 marks)***
2. What is the meaning of Compacting factor = 0.89 ***(1 marks)***
3. What is the meaning of Compacting factor = 0.80 ***(1 marks)***
4. What is the meaning of Vebe time = 20 Seconds ***(1 marks)***

***Q3: (5 marks)*** Discus in details with drawings the Slump Test of fresh concrete. ***Q4: (5 marks)***1. What is the Procedure of Compacting factor test of fresh concrete? Write it. ***(2 marks)***
2. What is the meaning of Compacting factor = 0.96 ***(1 marks)***
3. What is the meaning of Compacting factor = 0.80 ***(1 marks)***
4. What is the meaning of Vebe time = 3 Seconds ***(1 marks)***
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| **20. Extra notes:** |
| **21. Peer reviewپێداچوونه‌وه‌ی هاوه‌ڵ** This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.*(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).*ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌  |