

CIVL484 REPAIR AND MAINTENANCE OF CONCRETE													
Department: Civil Engineering													
Program Name: Civil Engineering	Program Code: 22												
Course Number: CIVL484	Credits: 3 CR												
<input type="checkbox"/> Required Course	<input checked="" type="checkbox"/> Elective Course												
Prerequisite(s): CIVL283 & CIVL284													
Catalog Description: Concrete behaviour: embedded metal corrosion, disintegration mechanisms, moisture effects, thermal effects, load effects, faulty workmanship, concrete evaluation: test methods for concrete evaluation, surface repair: analysis strategy & design, material requirements, material selection, surface preparation, reinforcing steel cleaning repair & protection, bond repair materials to existing concrete, placement methods, strengthening & stabilization: techniques/design considerations, beam shear capacity strengthening, shear transfer strengthening between members, stress reduction techniques, column strengthening, flexural strengthening, connection stabilization and strengthening, crack stabilization, protection: strategies, methods.													
Course instructor: Prof. Dr. Khaled MARAR													
Course Web Page: https://staff.emu.edu.tr/khaledmarar/en/teaching/CIVL484													
Textbook(s): Concrete Repair and Maintenance Illustrated, Peter H. Emmons, Reed Construction Data, 1993.													
References: <ol style="list-style-type: none"> 1. Corrosion of Steel in Concrete: Understanding, investigation and repair, John P. Broomfield, E & FN Spon, 1997. 2. Durability of Concrete Structures: investigation, repair, protection, Edited by Geoffrey Mays, Chapman & Hall, 1991. 3. Properties of Concrete, AM Neville, Prentice Hall, Fourth Edition, 2002. 													
Course Outline: <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Week 1</td> <td>Introduction to course (3 Classes) Course objectives, course description, introduction to repair and maintenance of concrete.</td> </tr> <tr> <td>Week 2-3</td> <td>Part one- Concrete Behavior (6 Classes) Embedded metal corrosion, disintegration mechanisms, moisture effect. Thermal effects, load effects, faulty workmanship</td> </tr> <tr> <td>Week 4-5</td> <td>Part two- Concrete Evaluation (9 Classes) Test methods.</td> </tr> <tr> <td>Week 6-10</td> <td>Part three- Surface Repair (6 Classes) Analysis, strategy & design, material requirements, material selection. Surface preparation, reinforced steel cleaning, repair and protection, bonding repair materials to existing concrete, placement methods.</td> </tr> <tr> <td>Week 11-12</td> <td>Part four-Strengthening & Stabilization (6 Classes) Techniques/design considerations, beam shear capacity strengthening, shear transfer strengthening between members. Stress reduction techniques, column strengthening, flexural strengthening, connection stabilization & strengthening, crack stabilization</td> </tr> <tr> <td>Week 13-14</td> <td>Part five-Protection (6 Classes) Strategies and methods</td> </tr> </table>		Week 1	Introduction to course (3 Classes) Course objectives, course description, introduction to repair and maintenance of concrete.	Week 2-3	Part one- Concrete Behavior (6 Classes) Embedded metal corrosion, disintegration mechanisms, moisture effect. Thermal effects, load effects, faulty workmanship	Week 4-5	Part two- Concrete Evaluation (9 Classes) Test methods.	Week 6-10	Part three- Surface Repair (6 Classes) Analysis, strategy & design, material requirements, material selection. Surface preparation, reinforced steel cleaning, repair and protection, bonding repair materials to existing concrete, placement methods.	Week 11-12	Part four-Strengthening & Stabilization (6 Classes) Techniques/design considerations, beam shear capacity strengthening, shear transfer strengthening between members. Stress reduction techniques, column strengthening, flexural strengthening, connection stabilization & strengthening, crack stabilization	Week 13-14	Part five-Protection (6 Classes) Strategies and methods
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Course Learning Outcomes:

At the end of the course the students will be able to develop:

1. Knowledge and understanding of behavior of concrete under different conditions and environments.
2. Knowledge and understanding of testing methods for concrete evaluation.
3. Knowledge and understanding of repair & strengthening of concrete.
4. Knowledge and understanding of protection of concrete.
5. Working in a team for a project related to repair & maintenance of concrete.

Class Schedule:

3 hrs of lectures per week

Laboratory Schedule:

1 hr of tutorial/laboratory per week

Assessment	Method	No	Percentage
	Quiz(es)	3	9%
	Midterm Exam(s)	1	24%
	Term paper	1	20%
	Lab Experiments	6	12%
	Final Examination	1	35%

NG Policy

Attendance is compulsory and absenteeism of more than 70% of classes will cause grade "F". Students with poor interest, poor attendance, and lack of two examination are graded NG. There will be only one make-up exam at the end of semester for students who missed midterm or final examination.

Contribution of Course to Criterion 5

Credit Hours for:

Mathematics & Basic Science : 0

Engineering Topic and Design : 4

General Education : 0

Relationship of Course to Student Outcomes

The course makes significant contributions to the following outcomes:

- 1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics
- 2) an ability to apply engineering design to produce solutions that meet specific needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental, and economic factors
- 3) an ability to communicate effectively with a range of audiences
- 4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
- 5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
- 7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.