Course Syllabus

1. **Course Title:** Construction Maintenance, Repair and Upgrade
2. **Course Code:** CMRU421319
3. **Credit Units:** 2 (2/0/4) (2 units of theory/ 0 unit of practice/ 4 units of self-study)
   Duration: 10 weeks (3 hours of theory+0 hours of practice, and 6 hours of self-study per week)
4. **Course Instructors**
   1/ MSc Bùi Phạm Đức Tường
   2/ Dr. Nguyễn Đình Hiển
5. **Course Requirements**
   Prerequisite courses: None
   Previous courses: Construction Technique (COTE340319)
   Parallel courses: None
6. **Course Description**
   This course is an advanced subject for undergraduate student to assemble knowledge and technical skills, equip student ability to evaluate the defect of material, failure in construction, analyze reasons then suggest the solution to repair, strengthen and evaluate structure before and after strengthening. Besides that, student could understand clearly about construction's failure then suggest the precautionary measure.
7. **Course Goals**

Goals	Goal Description	Programme ELOs
G1	Technical knowledge in maintenance, repair, and upgrade the construction	1.3
G2	Ability to analyze, design, explain and solve technical problems in maintenance, repair and upgrading construction	2.1, 2.4, 2.5
G3	Team working skills, communication and ability to read English technical documents	3.1, 3.2, 3.3
G4	Ability to apply knowledge to study operating process of companies specialized in problem solving and upgrading construction	4.5, 4.6

8. **Course Learning Outcomes (CLOs)**

CLOs		CLO Description	Programme ELOs
G1	**G1.1**	Evaluate level of defect in construction	1.3
	G1.2	Based on actual state of construction and owner's requirement to suggest the most suitable solution for the construction	
G2	**G2.1**	Analyze and define the cause of defect, problem for foundation, frame and finishing	2.1
	G2.2	Design and suggest construction solution as well as analyze pros and	2.1

		cons of those solution to repair, solve problems of construction	
	G2.3	Update construction technique, repair and solve problem for construction in Vietnam and all over the world	2.4, 2.5
G3	**G3.1**	Ability to work in team, implement reports and understand English terminology used in contracts, statements, forms, technical drawings and general construction textbooks	3.1, 3.2, 3.3
G4	**G4.1**	Build up process, form required for actual works relating to construction problems and construction upgrade.	4.5
	G4.2	Set up verification solutions and suggest construction techniques to repair for common problems.	4.6

9. Learning Resources

- Textbooks:
  1. Nguyễn Văn Kiểm **Hư hỏng sửa chữa gia cường nền móng**, NXB Xây Dựng – 2009.
  2. Nguyễn Văn Kiểm **Hư hỏng sửa chữa gia cường Công trình** NXB ĐHQG TP.HCM – 2008.
- References:
  1. Vương Hách **Sổ tay xử lý sự cố công trình xây dựng, Tập 1,2,3** NXB Xây Dựng – 2001.
  2. From Internet, megazine or the actual construction.

10. Student Assessment

- Grading scale: **10**
- Assessment plan:

Type	Content	Timeline	Assessment method	CLOs	Rate (%)
Assigments					**70**
BT#1	Identify general construction problems	Week 2	Assignment at class	G1.1	5
BT#2	Foundation problems and solutions	Week 4	Assignment at class	G2.1	5
BT#3	Frame problems and solutions	Week 7	Assignment at class	G2.2	5
BT#4	Problems at finishing stage and solutions	Week 9	Assignment at class	G2.3	5
BT#5	Common requirements in repair and upgrading construction	Week 11	Assignment at class	G4.2	5
Project					**10**
BL#1	Design and build deep excavation	Week 5	Project Evaluation	G2.1	5
BL#2	Common problems caused by wrong design in calculating dynamic load on the building	Week 13	Project Evaluation	G2.1, G4.2	5
Report - Presentation					**15**
	After each class, students are required to read and study about a topic, and each group has	Week 2-	Report -	G2.1, G2.2,	

	presentation in front of class in the next class about their own topic. List of topic as follow: 1. Common problems of construction (foundation, frame, finishing) caused by supervising process 2. The solutions to strengthen construction when change in using purpose	15	Presentation	G3.1	7.5 7.5
Final exam					**50**
	- Content covers all the field of CLOs of the subject - Time limit for the exam in 90 mins	1.3, 4.4, 2.1, 2.2	Writing	G1.1 G1.2 G2.1 G2.2 G4.2	

11. Course Content

Week	Content	CLOs
1	***Chapter 1:*** **Introduction** *(2/0/4)*	
	A/ Content and pedagogical methods in class*:* **Content:** Introduce the course's goals, CLOs, content, pedagogical and assessment methods + Objects and purpose of the subject + The concept of maintenance, repair, strengthening and upgrading construction + Normative Act: TCXDVN 318-2004 in construction maintenance, Decree 15/2013 + Rank the structure in maintenance, repair, strengthening, upgrading 1/ Base 2/ Foundation 3/ Brickwork 4/ Reinforce concrete 5/ Steel structure **Pedagogical methods**: + Presentation of lecture + Group discussion and assignment	G1.1
	B/ Self-study content: *(8h)* + Search picture of actual construction on the internet about the defect of construction. Ranking the defect References: [1], [2], [3], [4]	G1.1
2	***Chapter 2:*** **Overview** *(2,0,4)*	

	A/ Content and pedagogical methods in class*: (4h)* **Content:** + Requirement for construction structure + Distinguish missing and quality problems + Level of defect in construction + Classify problem and major reasons + Survey method to evaluate problem + Characteristic task, necessary condition, principles, process to implement repairing and strengthening construction structure **Pedagogical methods**: + Presentation of lecture + Group discussion	G1.1, G2.1, G2.2.
	B/ Self-study content: *(8h)* + Search picture of actual construction on the internet about the defect of construction. Ranking the defect. Define basically evaluation of reason, discuss and suggest the solution	G1.1, G1.2, G2.1, G2.2.
3	***Chapter 3:*** **Basement problem solving** *(2/0/4)*	
	A/ Content and pedagogical methods in class*:* **Content:** + Overview: characteristic of soil mechanic, failure of strain and stress + Classify the characteristic: strain of basement, unstable basement, unstable slope, unstable artificial basement + Analyze reasons: supervise, design, construct, use, environment + Identify method: observation, site experiment + Note in solving problem **Pedagogical methods**: + Presentation of lecture	G2.1
	B/ Self-study content: *(8h)* + Search picture of actual construction on the internet about the defect of construction. Ranking the defect. Define basically evaluation of reason, discuss and suggest the solution	G2.1, G3.1, G3.2
4	***Chapter 3:*** **Basement problem solving (cont.)** *(2,0,4)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** + Problem solving solutions: unload, decrease load, expand shallow foundation, repair pile foundation; repair the settle and leaning construction + Calculate to expand shallow foundation and add pile **Pedagogical methods**: + Group discussion	G2.1, G4.1, G4.2
	B/ Self-study content: *(4h)* + Search picture of actual construction on the internet about the defect of construction. Ranking the defect. Define basically evaluation of reason, discuss and suggest the solution	G2.1 G3.1 G4.2

5	***Chapter 4:*** **Problem solving in foundation** *(2/0/4)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** + Construction foundation: - Erroneous location - Deformed foundation, cracks in foundation - Pock-marked concrete foundation + Foundation for tools and machine **Pedagogical methods**: + Presentation of lecture + Group working and report results	G2.1, G4.1, G4.2
	B/ Self-study content: *(6h)* + Search picture of actual construction on the internet about the defect of foundation. Ranking the defect. Define basically evaluation of reason, discuss and suggest the solution ***References:*** + [1], [3- section 1]	G2.1, G3.1, G4.2
6	***Chapter 5:*** **Problem solving in block masonry structure**	
	A/ Content and pedagogical methods in class*:* + Analysis and evaluation kinds of defect in block masonry - Cracks - Lack of intensity, hardness and stableness - Partial collapse + Block masonry strengthen techniques 1. Pour - Spraying cement mortar 2. Expand the masonry section 3. Wall clamp reinforced cement panels 4. Wrap the outside with reinforced concrete 5. Add column or shear wall to support 6. Strengthening by outer reinforce 7. Add the buffer beam 8. Change the girder or more columns. 9. Erect column as prestressed element 10. Construct additional steel rod 11. Change the structure plan 12. Reinforcement steel mesh cement mortar **Pedagogical methods**: + Group working	G2.3, G4.2, G4.2
	B/ Self-study content: + Search picture of actual construction on the internet about the defect of block masonry. Ranking the defect. Define basically evaluation of reason, discuss and suggest the solution. + Report self-study content, presentation at class	G2.1, G3.1, G4.2, G4.1

	References: + [1],[3 tập 1]	
7	***Chapter 6: Problem-solving reinforced concrete structure*** *(2/0/4)*	
	A/ Content and pedagogical methods in class*:* **Content:** + Analysis and assessment of concrete damage + Analyzing and assessing the damage of fiber-reinforced + The concrete testing methods + Analysis of cracks in fiber-reinforced concrete structure, evaluate the cause, stating the precautions or reinforcing. + Calculation of reinforcement for fiber-reinforced concrete beams by hard pillows, pillow elastic + Calculation of reinforcement for column by shape steel. + Calculation of reinforcement beams, fiber-reinforced concrete column with increasing section. **Pedagogical methods**: + Presentation of lecture + Group discussion	G2.2, G3.1, G4.2, G4.1
	B/ Self-study content: *(6h)* + Search picture of actual construction on the internet about the defect of fiber-reinforced concrete structure. Ranking the defect. Define basically evaluation of reason, discuss and suggest the solution. Calculate reinforcement of design plan, stating reinforced construction methods ***References:*** + [2],[3 –tập 2]	G2.1, G3.1, G4.2, G4.1
8	***Chapter 6: Problem-solving reinforce concrete structure*** *(2/0/4)*	
	A/ Content and pedagogical methods in class*:* **Content:** Groups present self-studied defect and defend reinforcement measure **Pedagogical methods**: + Group presentation at class + Discussion	G2.2
	B/ Self-study content: *(6h)* + Groups finish reports, implement reinforced structural drawing for submission	G2.1, G3.1, G4.2, G4.1
9	***Chapter 7: Deterioration in the steel structure, causes and remedies*** *(2/0/4)*	
	A/ Content and pedagogical methods in class*:* **Content:** + Pros and cons of steel structure + The common causes of damage: Design, Construction, Use, Environment + The common issues and remedies: 1. Deformation of steel structure, 2.	G2.2

	Incident of cracked and damaged structure links, 3. Incident of rusted steel. **Pedagogical methods**: + Presentation of lecture	
	B/ Self-study content: + Search picture of actual construction on the internet about the incident of steel structure. Ranking the incident. Define basically evaluation of reason, discuss and suggest the solution.	G2.1, G3.1, G4.2, G4.1
10	***Chapter 8: Reinforcing steel structure*** *(2/0/4)*	
	A/ Content and pedagogical methods in class*:* **Content:** + Reinforce steel structures by changing the structure diagram + Reinforce structure by increasing the cross section + Calculate reinforcing for steel beams, steel frame by increasing the cross section. **Pedagogical methods**: + Presentation of lecture	G2.2
	B/ Self-study content: + Search picture of actual construction on the internet about the incident of steel structure. Ranking the incident. Define basically evaluation of reason, discuss and suggest the solution.	G2.1, G3.1, G4.1, G4.2

12. Learning Ethics

Students must do homework by themselves. If plagiarism is found students will get zero point.

13. Date of first approval: August 1st, 2012

14. Approved by

Dean	Head of Department	Instructor
A/Prof. Dr. Nguyễn Trung Kiên	**MSc. Nguyễn Văn Khoa**	**MSc. Bùi Phạm Đức Tường**

15. Date and Up-to-date content

1st time: Date	Instructor: Head of Department:

16. Date and Up-to-date content

1st time: Date: August 25th, 2015 - Update content and structure of the programme adjusted in 2015	Instructor: Head of Department: