



**UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL**  
**PROGRAMA DE PÓS-GRADUAÇÃO EM ENGENHARIA CIVIL:**  
**CONSTRUÇÃO E INFRAESTRUTURA**

<b>Code:</b>	
<b>Title:</b>	<b>Sustainable Infrastructure Renewal</b>
<b>Credits:</b>	<b>3(45h)</b>
<b>Level:</b>	<b>( x ) Mestrado ( x ) Doutorado</b>

### Course Outline

Innovations and recent advances in inspection and rehabilitation materials and techniques. Durability and lifetime. Residual service life prediction. Innovative sustainable engineering practices on rehabilitation of civil infrastructure. Impact of materials and processes used in rehabilitation applications by life cycle cost assessment.

## Program

Week	Date	Instructor	Topic	Required Readings / Assignments
1		Mônica Garcez	Introduction to Infrastructure Renewal	Discussion: Reading: Activities: Quiz:
2				Discussion: Reading: Activities: Quiz:
3		Mônica Garcez	Durability and lifetime. Residual service life prediction.	Discussion: Reading: Activities: Quiz:
4				Discussion: Reading: Activities: Quiz:
5		Ângela	Innovations and recent advances in inspection and rehabilitation materials and techniques.	Discussion: Reading: Activities: Quiz:
6		Ângela		Discussion: Reading: Activities: Quiz:
7		Ângela		Discussion: Reading: Activities: Quiz:
8		Ângela		Discussion: Reading: Activities: Quiz:
9		Mônica Garcez	Innovative sustainable engineering practices on rehabilitation of civil infrastructure.	Discussion: Reading: Activities: Quiz:
10				Discussion: Reading: Activities: Quiz:
11		Mônica Garcez	Impact of materials and processes used in rehabilitation applications by life cycle cost assessment.	Discussion: Reading: Activities: Quiz:
12				Discussion: Reading: Activities: Quiz:



## Objectives

Introduce students to topics related to assessment, maintenance and repair of civil infrastructure using advanced materials and technologies in a sustainable development context. Contextualize aspects associated to the relation between financial and environmental costs related to the extension of infrastructure life, associated to safety, resiliency and durability issues. Familiarization with software tools.

## Methodology

A problem-based learning approach will be used to develop students' competencies and attributes. Active and cooperative learning strategies will be used through classroom quizzes case studies, and presentations.

Approaches to Teaching and Learning: Lectures, group-based learning, critical reading and reflection.

Mode of delivery: Blended (autonomous student learning 20%, lectures 80%)

## Evaluation

Learning assessments will be graded based on rubric criteria and weighted according to the following breakdown:

Weighting	Assessment / Assignment
10%	Individual Quiz Scores
40%	Case Studies and Presentations
50%	Manuscript

## References

Arvidsson, R., Svanstrom, M., 2015. Integrated Environmental Assessment and Management, 12, 3, 429–436.

Guinée, J.B.; Gorrée, M.; Heijungs, R.; Huppes, G.; Kleijn, R.; Koning, A. de; Oers, L. van; Wegener Sleeswijk, A.; Suh, S.; Udo de Haes, H.A.; Bruijn, H. de; Duin, R. van; Huijbregts, M.A.J., 2002. Handbook on life cycle assessment. Operational guide to the ISO standards. Kluwer Academic Publishers, Dordrecht, Netherlands, 692 pp.

Intelligent Sensing for Innovative Structures Educational Module about FRP, 2007. Educational Module 1 to 4 – Intelligent Sensing for Innovative Structures. Winnipeg: ISIS, 2007.

KPMG International, 2012. Cities Infrastructure: a report on sustainability. Available at: [www.kpmg.com/infrastructure](http://www.kpmg.com/infrastructure)

Meadows, D., 1972. Meadows Report– Limits to Growth. Available at <http://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf>.

Meadows, D., 2005. Limits to growth the 30-year update. Publisher Routledge.

ONU, 1987. Brundtland Report – Our Common Future. Available at: <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>

ISO 13315. Environmental management for concrete and concrete structures. Available at: [www.iso.org](http://www.iso.org)

ISO 15686. Buildings and construction assets – service life planning. Available at: [www.iso.org](http://www.iso.org)

ISO 14040. Environmental management – life cycle assessment – principles and framework. Available at: [www.iso.org](http://www.iso.org)