Name of the class: Resource Efficient Building
Course key: 76990
Type of course: Optative
Approved credits:
Last curriculum revision date: September 2020
Pre-requisite: None

A) NAME OF THE COURSE: RESOURCE EFFICIENT BUILDING

Synthetic Program									
Resource Efficient Building									
General Information									
Type of curriculum proposal:	New creation	x	Restructuration			Adjustment			
Type of class	Mandatory		Optative	x	Complementary		Other		
Class shared with another EP or academic entity	(X) No ( ) Yes ¿With which PE is shared? _____ ¿Which semester? _____ ¿Which academic entity? _____								
Elaborated by:	Madigan Martínez Parga Méndez								
Reviewed by:									
Semester	**Hours of theory per week**		**Hours of practice per week**		**Hours of additional work per week**		**Credits**		
	3		1		1		6		
General objective	The student will be able to define the alternatives to energy consumption in buildings, such as the construction systems of green roofs and walls, to insert into their project and thereby achieve the comfort of users, contributing to improvement of quality of natural environment.								

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Specific objective	The graduate will apply his knowledge to carry out technical or design solutions, to facilitate its development and application in professional activity. The graduate will learn how apply their capacities from the conceptual, methodological and instrumental point of view, analyzing projects and buildings carried out, to tend towards environmental sustainability in architectural production. Also, the student will have the knowledge to consider systemically all the environmental impacts that have occurred throughout the life cycle in a building.	
Specific professional competence (s) for which the class contributes.	• Analyze critically problems of psychophysical relationship between man and the object in different contexts of use. • Specify features of the object and design processes in the physical, perceptual, symbolic and environmental elements. • Innovate the objects and processes of industrial design.	
Practices of the specific professional competence for which the class contributes	• Find practical solutions to develop buildings by implementing energy efficiency in them to reduce urban, ecological and environmental problems. • Apply principles to ecological, urban and construction studies for the development of buildings. • Develop knowledge and skills that allow them to make design and building proposals with the use of bioenvironmental, green, sustainable criteria, oriented to the efficient management of resources such as water, energy, materials and resources, among others.	
Professional transversal (s) competence (s) for which the class contributes	• Propose solutions to the criteria to design and construct resource efficient buildings. • Know different methods to apply criteria in ecological, urban and construction studies. • Integrate into sustainable design and construction proposals with professional and ethical solvency. • Apply the principles of sustainability and habitat use responsibly.	
Units	**Units**	**Content**
	1 . Introduction to resource efficient buildings	The student must know about principles of resource efficient buildings, the methodologies to evaluate the construction considering the environmental point of view, likewise must understand the eco-design principles, sustainable architecture and the pillars of sustainable architecture
	2 . Bioenvironmental Design	The student will know the fundamentals, strategists of passive design an elements that contribute to thermal comfort and energy savings.
	3 . Green roofs and walls	The student will be able to identify criteria, classification, components and details of green roofs and green walls. But also, it's application and costs for their construction.
	4 . Renewable energy	The student must understand current perspective and problem derived from energy consumption. As well as know the application of renewable

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		energy sources: classification, components, feasibility, performance and general costs.	
	5 . Water managemen	The student must understand current perspective and problem about water consumption and wastewater. The student will know basic concepts about water resources, their classification, evaluation, alternatives for water resources, installation, costs and regulations.	
	6 . Materials and resources	The student will know classification and analysis of materials, Ecological Footprint, load capacity and its utility , construction systems and comparative analysis method	
	7 . National Certifications and Standards	National and international certifications. Applicable regulations at national level. Sustainable projects	
Method and practice	**Method**	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of visual audio material (presentations, videos, etc.) . The majority of the presentations will be exhibited by the holder of the subject and in some cases the students of the course will present works related to the corresponding subjects previous commissioned by the holder. The content of the course and the bibliography on the topics to be discussed in each unit will be delivered at the beginning of the course, so that students must have an active participation in the sessions of the same.	
	Practice	Previously selected case studies will serve for a better knowledge and greater understanding of the application of energy efficiency, resource strategies and bioclimatic techniques that are applicable to each of the proposed case studies.	
Evaluation method	**Partial Exam**	20%	Partial exam of Unit 1 and 2
		20%	Partial exam of Unit 3 to 5
		20 %	Partial exam of Unit 6 and 7
		40%	Final presentation about case analysis
	Final exam	The final exam will consist of the elaboration of an investigation where the efficiency of a building will be evaluated according to the topics seen in the course . Such evaluation will have a weighting of 40% of the final grade of the subject.	
	Other activities	Visit to local buildings with diverse uses that, based on the architectural proposal, have deficiencies in climate comfort and habitability, define the most significant problems and, based on a quick analysis, establish bioclimatic and resource saving strategies to improve their operation and savings in its energy consumption.	

Bibliography and digital resources	**Bibliography**	Almusaed, A. (2011). Biophilic and bioclimatic architecture. London: Springer, pp.205-209. Asociación Española del Gas. (2013). Guía Sobre Aplicaciones de la Energía Solar Térmica (p. 53). p. 53. Bastianoni, S., Galli, A., Niccolucci, V., & Pulselli, R. M. (2006). The ecological footprint of building construction. WIT Transactions on Ecology and the Environment. https://doi.org/10.2495/SC060331 Bookchin, M., & Elías, J. (1978). Por una sociedad ecológica. Gustavo Gili. Brinkworth, B. J., & Fontes, R. (1981). Energía solar para el hombre. Retrieved from https://books.google.com.mx/books/about/Energía_solar_para_el_hombre.html?Id=9uwzaaaacaaj&redir_esc=y Cartea, P. Á. . M., & Caride, J. A. (2001). Educación Ambiental y Desarrollo Humano. In Ariel Educación. Retrieved from https://www.academia.edu/14946782/Educación_Ambiental_y_Desarrollo_Humano Çetin, N., Mansuroğlu, S., & Önaç, A. (2018). Xeriscaping Feasibility as an Urban Adaptation Method for Global Warming: A Case Study from Turkey. Polish Journal of Environmental Studies, 27(3), 1009–1018. https://doi.org/10.15244/pjoes/76678 Daniels, F. (1977). Uso directo de la energía solar. Ed. Hermann Blume. Madrid Deffis Caso, Armando, (1998) Arquitectura Ecológica Tropical, Ed. Trillas, México, Deffis Caso, Armando, (2004) Ecoturismo: Arquitectura para la Infraestructura Ecoturística y el Turismo Sostenible, Ed. Trillas, México Deffis Caso, Armando. (1996). La Casa Ecológica Autosuficiente para Climas Cálido Tropical, Ed. Trillas, México. del Valle, F., Obispo, M., Ruiz, J. M., Jiménez, A., Puente, F., Martín, G., & López, M. (2016). Guía sobre Energía Solar Térmica. Ding, G. K. C. (2013). Life cycle assessment (LCA) of sustainable building materials: An overview. In Eco-Efficient Construction and Building Materials: Life Cycle Assessment (LCA), Eco-Labelling and Case Studies.

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B) CONTENTS AND METHODS BY UNITS AND TOPICS

Unit 1. Introduction to resource efficient buildings		7h
Topic 1.1 Construction of environmental knowledge		**2h**
Subtopic	1.1.1 The processes of construction of environmental knowledge	

	1.1.2 Ecodesign 1.1.2.1 Ecodesign currents 1.1.3 Sustainable Method 1.1.4 Differences from traditional buildings 1.1.1 The processes of construction of environmental knowledge	
Topic 1.2 Sustainable Archtecture		**5h**
Subtopic	1.2.1. Sustainable Architecture Definition 1.2.2. The five pillars of sustainable architecture and its indicators 1.2.2.1. Optimization of resources and materials 1.2.2.2. Decrease in energy consumption and promotion of renewable energy 1.2.2.3. Reduction of waste and emissions 1.2.2.4. Decrease in maintenance, operation and use of buildings 1.2.2.5. Increase in the quality of life of building occupants	
Bibliography and digital resources	**Bibliography**	**1.1.1 The processes of construction of environmental knowledge** Bookchin, M., & Elías, J. (1978). For an ecological society. Gustavo Gili Cartea, P. Á. . M., & Caride, JA (2001). Environmental Education and Human Development. In Ariel Education. Retrieved from https://www.academia.edu/14946782/Education_Ambiental_and_Development_Human Edwards, Brian, (2004). Basic guide to sustainability, Gustavo Gili Foladori, Guillermo, (2005) For an alternative sustainability. Cabichui Collection. Latin American Regional Secretariat of the International Union of Food, Agricultural, Hotel, Restaurant, Tobacco and Related Workers. Uruguay. Foladori, Guillermo, (2005) Disagreements on sustainable development. Porrúa, Mexico. Foladori, G. (2001) Sustainability Disputes. The society-nature coevolution. Porrúa, Mexico. United Nations. (1987) BRUNTLAND REPORT: Our common future Ondarza, Raú (1993). Ecology man and his environment. Editorial Trillas, First Edition, Mexico. **1.1.2 Ecodesign** Tudela, Fernando, (1982) Ecodesign, Autonomous Metropolitan University, Mexico.

		1.1.3 Sustainable Method Miceli, A. (2016). Sustainable architecture more than a new trend a necessity. Retrieved from https://www.librosyeditores.com/arquitectura-y-urbanismo/6979-arquitectura-sustentable-mas-que-una-nueva-tendencia-una-necesidad-9789587625455.html Foladori, Guillermo, (2005) For an alternative sustainability. Cabichui Collection. Latin American Regional Secretariat of the International Union of Food, Agricultural, Hotel, Restaurant, Tobacco and Related Workers. Uruguay. **1.1.4 Differences from traditional buildings** Dominguez, L. Á., & Soria, FJ (2004). Design guidelines for sustainable architecture. UPC editions. **1.2.1. Sustainable Architecture Definition** De Garrido, L. (2008). No social housing and 5 sustainable architectures. In Millennium (Ed.), Housing and society: new demands, new instruments (pp. 241-271)
	Digital resources	**1.2 Sustainable architecture** Edwards, Brian (2001): Basic Guide to Sustainability. Editorial Gustavo Gili. Barcelona Gauzin-Müller, Dominique (2003): Ecological Architecture: 29 European examples
Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide bibliography and topics at the beginning of the course.	
Learning activities	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of presentations will be exhibited by the professor and, in some cases, students of the course will present works related to the corresponding subjects previous commissioned by the holder.	

Unit 2. Bioenvironmental Design		**6h**
Topic 2.1 Passive design		**1h**
Subtopic	2.1.1. Fundamentals of passive design 2.1.2. Strategies for passive design	
Topic 2.2. Thermal comfort		**5h**
Subtopic	2.2.1. Building and nature linkage 2.2.2. Climate point of view 2.2.3. Form and orientation	

	2.2.4. Passive heating 2.2.5. Natural lighting	
Bibliography and digital resources	**Bibliography**	**2.1.1. Fundamentals of passive design** Construction Institute, Ministry of Public Works, & Ministry of Education. (2012). Manual of Passive Design and Energy Efficiency in Public Buildings (Innova Chile, Ed.). Santiago of Chile. Monterde M Jiménez V Guillamón I Higón Calve J López Jiménez P et. Al . (2014) Guide to passive design strategies for building , Ed. Valencian Institute of Building , Valencia **2.2. Thermal comfort** Godoy Muñoz, A. (2012). Adaptive thermal comfort. Building application in Spain (Polytechnic University of Catalonia). Retrieved from https://upcommons.upc.edu/bitstream/handle/2099.1/18763/TFM_Alfonso Godoy Munoz.pdf **2.2.1. Building and nature linkage** Deffis Caso, Armando. (nineteen ninety six). The Ecological Self-Sufficient House for Warm Tropical Climate, Ed. Trillas, Mexico. Deffis Caso, Armando, (2004) Ecotourism: Architecture for Ecotourism Infrastructure and Sustainable Tourism, Ed. Trillas, Mexico Deffis Caso, Armando, (1998) Tropical Ecological Architecture , Ed. Trillas, Mexico González, N., & Javier, F. (2004). Bioclimatic architecture in a sustainable environment. Laboratory, 10, 0-4. Konya, Allan, (1981) Designs in hot climates: Practical manual, Ed. Hermann Blume. Madrid **2.2.2. Climate point of view** González, Proyecto, (1996) Climate and Architecture, Ed. Gustavo Gili, Barcelona Olgyay, Victor, (1988) Architecture and climate: bioclimatic design manual for architects and urban planners, Gustavo Gili. Viqueira, (2005) Introduction to Bioclimatic Architecture, Ed. Limusa, Mexico.

	Digital resources	
Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide bibliography and topics at the beginning of the course.	
Learning activities	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of presentations will be exhibited by the professor and, in some cases, students of the course will present works related to the corresponding subjects previous commissioned by the holder.	

Unit 3. Green roofs and walls		**8h**
Topic 3.1. Introduction		**2h**
Subtopic	3.1.1. Sustainability criteria in green roofs and walls 3.1.2. Classification, components and roof details 3.1.2.1. Extensive 3.1.2.2. Intensive 3.1.3. Feasibility and application evaluation 3.1.4. Importance of plant species selection	
Topic 3.2. Xerojardinería		**2h**
Subtopic	3.2.1. Concept 3.2.2. Application 3.2.3. Costs	
Topic 3.3. Green roofs		**2h**
Subtopic	3.3.1. Green roof concept and utilities 3.3.2. Elements that integrate it 3.3.3. Constuctive systems and procedures	
Topic 3.4. Green walls		**2h**
Subtopic	3.4.1. Green wall concept and utilities 3.4.2. Elements and features that integrate it 3.4.3. Constuctive systems and procedures	
Bibliography and digital resources	**Bibliography**	**3.1.1. Sustainability criteria in green roofs and walls** DOF (2013) NMX-AA-164-SCFI-2013 Sustainable Building - Minimum Criteria and Requirements

		Kasten Paredes, K. (2016) Sustainable design attributes and criteria for the development of an extensive / mixed green roof module in Zapopan , Western Institute of Technology and Higher Education University of Melbourne (2014). Growing Green Guide. Retrieved from www.growinggreenguide.org. **3.2. Xerojardinería** Çetin, N., Mansuroğlu, S., & Önaç, A. (2018). Xeriscaping Feasibility as an Urban Adaptation Method for Global Warming: A Case Study from Turkey. Polish Journal of Environmental Studies, 27 (3), 1009-1018. https://doi.org/10.15244/pjoes/76678 Mandă, M., & Salahoru, C. (2018). Xeriscaping Annals or f t he University or f Craiova, XXIII (LIX), 144-149. **3.3. Green roofs** Luckett K. (2009). Green Roof Construction and Maintenance . McGraw-Hill Greensource Series. **3.4. Green walls** Almusaed, A. (2011). Biophilic and bioclimatic architecture. London: Springer, pp. 205-209. Natarajan, M., Rahimi, M., Sen, S., Mackenzie, N. and Imanbayev, Y. (2014). Living wall systems: evaluating life-cycle energy, water and carbon impacts. Urban Ecosystems, 18 (1), p.2. Perini, K. and Rosasco, P. (2013). Cost – benefit analysis for green façades and living wall systems. Building and Environment, 70, p.120. Wood, A., Bahrami, P., & Safarik, D. (2014). Green walls in high-rise buildings: an output of the CTBUH Sustainability Working Group. Retrieved from https://www.researchgate.net/publication/265376113_Green_Walls_in_High-Rise_Buildings
	Digital resources	**3.1.2. Classification, components and roof details** Types of green roofs (2013) Available at: http://vilssa.com/tipos-de-cubiertas-vegetales Classification of plant covers. Available at: https://zinco-cubiertas-ecologicas.es/preguntas_frecuentes/clasificacion.php

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Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide the bibliography and topics from the beginning of the course.	
Learning activities	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of the presentations will be exhibited by the holder of the subject and in some cases the students of the course will present works related to the corresponding subjects previous commissioned by the holder.	

Unit 4. Renewable energies		**8h**
Topic 4.1. Introduction		**1h**
Subtopic	4.1.1. Current situation 4.1.2. Traditional energy sources	
Topic 4.2. Renewable Energy Sources		**7h**
Subtopic	4.2.1. Thermal solar energy 4.2.1.1. Viability in the country and region 4.2.1.2. General components 4.2.1.3. Energy efficiency 4.2.1.4. Costs 4.2.2. Photovoltaic Solar Energy 4.2.2.1. Viability in the country and region 4.2.2.2. General components 4.2.2.3. Energy efficiency 4.2.2.4. Costs 4.2.3. Wind power 4.2.3.1. Viability in the country and region 4.2.3.2. General components 4.2.3.3. Energy efficiency 4.2.3.4. Costs 4.2.4. Geothermal energy 4.2.4.1. Viability in the country and region	

		4.2.4.2. General components 4.2.4.3. Energy efficiency 4.2.4.4. Costs 4.2.5. Energy generated by biogas 4.2.5.1. Viability in the country and region 4.2.5.2. General components 4.2.5.3. Energy efficiency 4.2.5.4. Costs
Bibliography and digital resources	**Bibliography**	**4.2.1. Thermal solar energy** Spanish Gas Association. (2013). Guide on Applications of Solar Thermal Energy (p. 53). p. 53. del Valle, F., Obispo, M., Ruiz, JM, Jiménez, A., Puente, F., Martín, G., & López, M. (2016). Guide on Solar Thermal Energy. **4.2.2. Photovoltaic Solar Energy** Fernández Salgado, JM (2007). Complete guide to photovoltaic solar energy: adapted to the Technical Building Code. Letcher, TM (Trevor M.., & Fthenakis, VM (nd.) A Comprehensive Guide to Solar Energy Systems: With Special Focus on Photovoltaic Systems. **4.2.3. Wind power** Manwell, JF, McGowan, JG, & Rogers, AL (2010). Wind Energy Explained: Theory, Design and Application (2nd ed .; John Wiley & Sons Ltd, Ed.). Wiley **4.2.4. Geothermal energy** Gehringer, M., & Loksha, V. (2002). Geothermal Handbook: Planning and Financing Power Generation. World Bank Technical Report. Energy Sector Management Assistance Program (ESMAP). World Bank Technical Report, 002/12, 1–164. Kagel, A., Bates, D., & Gawell, K. (2007). A Guide to Geothermal Energy and the Environment. Retrieved from www.geo-energy.org **4.2.5. Energy generated by biogas** Peterson, M., Kayser, K., Bonhomme, S., Majewsk, E., & Amrozy, M. (2015). Implementation Guide For Small-Scale Biogas Plants. Retr ieved from www.bioenergyfarm.eu
	Digital resources	**4.1.1. Current situation**

		REN21. (nd) Global Status Report. Retrieved July 2, 2019, from https://www.ren21.net/reports/global-status-report/ **4.2.5. Energy generated by biogas** Energypedia (2018). Planning Guide for Biogas Plants. Retrieved July 2, 2019, from Energypedia website: https://energypedia.info/wiki/Planning_Guide_for_Biogas_Plants
Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide the bibliography and topics from the beginning of the course.	
Learning activities	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of the presentations will be exhibited by the holder of the subject and in some cases the students of the course will present works related to the corresponding subjects previous commissioned by the holder.	

Unit 5. Water management		**7h**
Topic 5.1. Introduction		**1h**
Subtopic	5.1.1. Current water resource problem 5.1.1.1. Global perspective 5.1.1.2. Regional perspective 5.1.1.3. Local perspective	
Topic 5.2. Water as a resource		**1h**
Subtopic	5.2.1. Degree of Availability 5.2.2. Contamination 5.2.3. Water types	
Topic 5.3. Water footprint		**1h**
Subtopic	5.3.1. Water footprint concept 5.3.2. Scope and indicators 5.3.3. Water consumption in building life cycle	
Topic 5.4. Alternatives and eco-technologies		**4h**
Subtopic	5.4.1. Sanitary installation design 5.4.1.1. Saving artifacts 5.4.2. Water recovery and recycling 5.4.2.1. Rainwater Recovery 5.4.2.1.1. Regulations and laws 5.4.2.2. Gray Water Recycling 5.4.2.3. Black Water Recycling 5.4.3. Water treatment 5.4.3.1. Types of water treatments	

	5.4.4. Costs 5.4.4.1. Analysis of the new components 5.4.4.2. performance 5.4.4.3. Costs	
Bibliography and digital resources	**Bibliography**	**5.1.1. Current water resource problem** GreenFacts (1991). Water resources. In Report of the United Nations on the development of water resources in the world. UNESCO (2017). United Nations World Report on the Development of Water Resources 2017. Wastewater.The resource wasted. United Nations Organization for Education, Science and Culture. **5.3. Water footprint** Vázquez del Mercado Arribas, R., & Lambarri Beléndez, J. (2017). Water Footprint in Mexico: analysis and perspectives. In Mexican Institute of Water Technology. Retrieved from https://www.gob.mx/imta/documentos/huella-hidrica-en-mexico-analisis-y-perspectivas **5.4. Alternatives and eco-technologies** Ando Ashijara, LY (2012). Ecotechnology for sustainable use and water saving for sanitary use in urban housing (Universidad Autónoma Metropolitana). Baquero, MT (2013). Water saving and reuse in the building in the city of Cuenca, Ecuador. This Journal of the Faculty of Architecture and Urbanism of the University of Cuenca, 2 (3), 71 - 81. https://doi.org/10.18537/est.v002.n003.06 Khan, S., Khan, MA, Hanjra, MA, & Mu, J. (2009). Pathways to reduce the environmental footprints of water and energy inputs in food production. Food Policy, 34 (2), 141-149. https://doi.org/10.1016/j.foodpol.2008.11.002 Khan, S., & Hanjra, MA (2009). Footprints of water and energy inputs in food production - Global perspectives. Food Policy, 34 (2), 130-140. https://doi.org/10.1016/j.foodpol.2008.09.001 **5.4.3. Water treatment** Crittenden, JC (John C., & Montgomery Watson Harza (Firm). (2012). MWH's water treatment: principles and design. John Wiley and Sons.
	Digital resources	

Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide the bibliography and topics from the beginning of the course.
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Unit 6. Materials and resources		**9 h**
Topic 6.1. Introduction		**2h**
Subtopic	6.1.1. Current Technology Perspective 6.1.2. Analysis and classification of materials 6.1.2.1. Environmental impact 6.1.2.2. Energy consumption 6.1.2.3. Measuring tools	
Topic 6.2. Ecological footprint		**2h**
Subtopic	6.2.1. Ecological footprint concept 6.2.2. Scope and parameters 6.2.3. Causes and consequences 6.2.4. The usefulness of the footprint 6.2.5. Loading capacity	
Topic 6.3. Materials and resources		**3h**
Subtopic	6.3.1. Traditional 6.3.1.1. Life cycle of traditional materials 6.3.1.2. Loads and environmental benefits 6.3.2. Natural 6.3.2.1. Natural materials life cycle 6.3.2.2. Natural Resource Requirements 6.3.3. From waste 6.3.3.1. Life cycle of waste materials 6.3.3.2. Environmental impacts 6.3.4. Healthy 6.3.4.1. Life cycle of healthy materials 6.3.4.2. Loads and environmental benefits 6.3.4.3. Environmental mitigation processes 6.3.4.4. Sick building syndrome and its consequences	
Unit 6. 4 . Construction systems and comparative analysis		**2h**
Subtopic	6.4.1. Construction systems 6.4.2. Comparative analysis	

		6.4.2.1. Thermal capacities 6.4.2.2. Low impact 6.4.2.3. Economic costs 6.4.2.4. Environmental costs 6.4.2.5. Recycling
Bibliography and digital resources	**Bibliography**	**6.2 Ecological Footprint** Bastianoni, S., Galli, A., Niccolucci, V., & Pulselli, RM (2006). The ecological footprint of building construction. WIT Transactions on Ecology and the Environment. https://doi.org/10.2495/SC060331 Solís-Guzmán, J., Marrero, M., & Ramírez-De-Arellano, A. (2013). Methodology for determining the ecological footprint of the construction of residential buildings in Andalusia (Spain). Ecological Indicators https://doi.org/10.1016/j.ecolind.2012.10.008 Teng, J., & Wu, X. (2014). Eco-footprint-based life-cycle eco-efficiency assessment of building projects. Ecological Indicators https://doi.org/10.1016/j.ecolind.2013.12.018 **6.3. Materials and resources** Ding, GKC (2013). Life cycle assessment (LCA) of sustainable building materials: An overview. In Eco-Efficient Construction and Building Materials: Life Cycle Assessment (LCA), Eco-Labelling and Case Studies. https://doi.org/10.1533/9780857097729.1.38 Durmisevic, E. (2009). Conference Proceedings of CIB W115 Construction Material Stewardship. Lim, H., Tae, S., & Roh, S. (2018). Analysis of the primary building materials in support of G-SEED life cycle assessment in South Korea. Sustainability (Switzerland), 10 (8). https://doi.org/10.3390/su10082820 Zabalza Bribián, I., Valero Capilla, A., & Aranda Usón, A. (2011). Life cycle assessment of building materials: Comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential. Building and Environment, 46 (5), 1133–1140. doi: 10.1016 / j.buildenv.2010.12.002
	Digital resources	**6.2 Ecological Footprint** Galli, A., Wiedmann, T., Ercin, E., Knoblauch, D., Ewing, B., & Giljum, S. (2012). Integrating Ecological, Carbon and Water footprint into a

		"footprint Family" of indicators: Definition and role in tracking human pressure on the planet. Ecological Indicators, 16, 100–112. https://doi.org/10.1016/j.ecolind.2011.06.017 Hillier, J., Hawes, C., Squire, G., Hilton, A., Wale, S., & Smith, P. (2009). The carbon footprints of food crop production. International Journal of Agricultural Sustainability, 7 (2), 107-118. https://doi.org/10.3763/ijas.2009.0419 **6.4. Construction systems and comparative analysis** Blender, M. (2015). What is the energy balance of a building? Retrieved June 17, 2019, from Architecture and Energy website: http://www.arquitecturayenergia.cl/home/balance-energetico/ Cype Ingeniros, SA (2011). Software to calculate the ecological footprint generated in the construction of a building. Retrieved from www.cype.es from Buen Rodríguez, O. (2010). Evaluation of Environmental Sustainability in the Construction and Administration of Buildings in Mexico. Retrieved from https://www.gob.mx/cms/uploads/attachment/file/31005/ine-ecov-dt-01-2010.pdf Sola Sánchez, B., Capó Vicedo, J., & Expósito Langa, M. (2005). Feasibility analysis of the application of sustainability criteria in building construction. IX Congress of Organization Engineering, (January 2005).
Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide the bibliography and topics from the beginning of the course.	
Learning activities	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of the presentations will be exhibited by the holder of the subject and in some cases the students of the course will present works related to the corresponding subjects previous commissioned by the holder.	

Unit 7. National certifications and standards		**3h**
Topic 7.1. International certifications		**1h**
Subtopic	7.1.1. International Certifications 7.1.2. Leed Certification (Leadership in Energy & Environmental Design)	

Topic 7.2. National Standards			**1h**
Subtopic	7.2.1. SENER (Ministry of Energy) 7.2.2. SEMARNAT (Ministry of Environment and Natural Resources)		
Topic 7.3. Sustainable projects			**1h**
Subtopic	7.3.1. National context 7.3.2. International context		
Bibliography and digital resources	**Bibliography**	**7.2. National Standards** DOF (2013) NMX-AA-164-SCF1-2013 of Sustainable Building DOF (2014) NMX-AA-171-SCFI-2014 Requirements and Specifications of environmental performance of lodging establishments DOF (2012) NMX-AA-SCFI-157-2012 of Requirements and Specifications of Sustainability for the selection of the Site, Design, Construction, Operation and Abandonment of the Site of Tourist Real Estate Developments in the Coastal Zone of the Yucatan Peninsula	
	Digital resources	**7.1. International certifications** BREAM https://www.breeam.com/ Leadership in Energy and Environmental Design (LEED) https://new.usgbc.org/leed Living Building Challenge of the International Living Future Institute https://living-future.org/ **7.3 Sustainable projects** 5 Mexican projects go for the Living Building Challenge certification. https://obrasweb.mx/arquitectura/2014/04/28/5-proyectos-mexicanos-van-por-la-certificacion -living-building-challenge	
Teaching methods	The teacher's exposure with audiovisual methods, in classrooms equipped with computer hardware and software. The teacher will provide the bibliography and topics from the beginning of the course.		
Learning activities	The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of the presentations will be exhibited by the holder of the subject and in some cases the students of the course will present works related to the corresponding subjects previous commissioned by the holder.		

C) TEACHING AND LEARNING STRATEGIES

The topics to be discussed in each teaching unit will be presented in face-to-face sessions through the use of audiovisual material (presentations, videos, etc.). The majority of the presentations will be exhibited by the holder of the subject and in some cases the students of the course will present works related to the corresponding subjects previous commissioned by the holder.

D) EVALUATION AND ACCREDITATION

Preparation and / or presentation of:	**Periodicity**	**Covers**	**Weighting of each partial in relation to the ordinary**
First partial exam: Oral essay presentation	At the end of Unit 2	Units 1 to 2	20 %
Second partial exam: Written essay presentation	At the end of Unit 5	Units 3 to 5	20 %
Third partial exam: Final essay presentation	At the end of Unit 7	Units 6 to 7	20 %
Practical exercise (Case study) Final presentation of results	-	-	40 %
		TOTAL	100 %
Ordinary exam	The final ordinary grade is composed by three partial ratings (60%) and rating the grade of the practical exercise (40%).		
Other academic activities required	Special non-mandatory activities will not have a value in the partial evaluation. This consists of attending special events on the subject or participation as organizers in events of the discipline, whether from the Faculty or outside it as dissemination and training activities		

E) BIBLIOGRAPHY AND DIGITAL RESOURCES

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