Name of the class: Resource Efficient Buildings
Course key: 76977
Type of course: Optative
Approved credits:
Last curriculum revision date: September 2020
Pre-requisite: None

A) NAME OF THE COURSE: RESOURCE EFFICIENT BUILDINGS

Synthetic Program										
Resource Efficient Buildings										
General Information										
Type of curriculum proposal:	New creation	x	Restructuration			Adjustment				
Type of class	Required		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:	Gerardo J. Arista González Jorge Aguillón Robles									
Reviewed by:										
Semester	**Hours of theory per week**		**Hours of practice per week**		**Hours of additional work per week**			**Credits**		
	3		1		1			6		

Synthetic Program		
General objective	Know the criteria to design and plan buildings efficient in resources, understand the energy efficiency and bioclimatic strategies (Architectural Bioclimatic), the conversion of buildings , as well as the automation and control of certain factors and variables of comfort through the application of domotics	
Specific objective	• Know the criteria and understand the reasoning that is applicable for the design and construction of energy efficient buildings in the use of resources. • Understand the strategies to achieve the energy efficiency of the buildings under construction and constructed through the use of bioclimatic techniques applicable to the constructions. • Understand and implement strategies to carry out energy conversion of buildings existing and control of certain variables of comfort through its automation (domotics)	
Specific professional competence (s) for which the class contributes.	• Apply the knowledge acquired as a useful tool in the development of strategies to achieve energy efficiency in buildings, making known its characteristics and advantages. • Recognize programs that facilitate the use of home automation in project buildings.	
Practices of the specific professional competence for which the class contributes	• Find practical solutions to develop buildings by implementing energy efficiency in them in order to reduce urban ecological and environmental problems. • Apply themes and principles of ecological studies, urbanistic and buildings construction.	
Professional transversal (s) competence (s) for which the class contributes	• Propose solutions to the criteria to design and plan resource efficient buildings. • Know different methods for the application of criteria on ecologic, urbanistic and construction studies.	
Units	**Units**	**Content**
	1. Conceptual theoretical framework	The student must know about theoretical concepts related to energy efficiency and resources in buildings, likewise must understand theoretical aspects related to bioclimatic techniques and the physical principles they are based.

Synthetic Program			
	2 . Energy efficiency strategies and bioclimatic techniques	The student must understand different strategies of efficiency and energy saving and the moderate use of resources applicable to the operation of a building, as well as understand and apply bioclimatic techniques for comfort inside the building.	
	3. Methodology of Resource Efficient Buildings	The student will be able to perform an analysis for the evaluation of a resource efficient building as well as the strategies to be carried out for the conversion of building to an efficient.	
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
		20%	Oral presentation on proposed strategies of case study.
		20%	Extensive presentation of proposed strategies for the case study.
		40%	Practical exercise of application for the reconversion of the building case study and presentation of final results.
	Final exam	The ordinary final grade will correspond to the weighted average of two partial evaluations of the 1st. and 2nd. units with a weighting of 30% each and the final work of the 3rd. unit with a weighting of 40% that added together gives 100%.	
	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.	

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		Ciudad de México. Sabag, A. M. A. (2018). Hacia la arquitectura bioambiental: uso racional de recursos hídricos en políticas de ordenación territorial. Influencia de la Norma 26 en el diseño de sistemas para ahorro y reúso de agua en vivienda social. Barrios, L. E. (2018). Techos Verdes: de la teoría a la práctica. Revista Científica OMNES, (3), 136-184. González, L. E. Q., & González, J. R. Q. (2019). Infraestructuras verdes vivas: características tipológicas, beneficios e implementación. Cuadernos de Vivienda y Urbanismo, 12(23). Paredes, J. R., & Ramirez, J. J. (2017). Energías renovables variables y su contribución a la seguridad energética. Banco Interam. Desarro, 62. Zuñiga, I. Y. C., Lona, L. R., & Flores, M. D. R. S. (2018). Tecnologías verdes: energías renovables como una alternativa sustentable para México. Red Internacional de Investigadores en Competitividad, 11, 1557-1575. Toro Osorio, A. F. (2018). Diseño estructural y arquitectónico de edificios sostenibles con tecnologías de optimización de recursos naturales.

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B) CONTENTS AND METHODS BY UNITS AND TOPICS

Unit 1. Conceptual theoretical framework		16 h
Topic 1.1 Energy efficiency and construction		**3h**
Subtopic	1.1.1 Energy efficiency 1.1.2 Energy efficient building: (low energy, ultra low energy, zero energy, energy plus)	
Topic 1.2 Design and construction		**3h**
Subtopic	1.2.1 Bioclimatic architecture 1.2.2 Temperature adaptation 1.2.3 Orientation 1.2.4 Greenhouse effect 1.2.5 Thermal insulation 1.2.6 Cross ventilation 1.2.7 Renewable Energy Integration	
Topic 1.3 Energy Efficient Buildings EEB		**3h**
Subtopic	1.3.1 Temperature adaptation 1.3.2 Exterior treatment of the building	

	1.3.3 Interior treatment of the building 1.3.4 Implementation of energy saving systems		
Topic 1.4 Stages for the construction of an EEB			**3h**
Subtopic	1.4.1 Design and construction 1.4.2 Maintenance and remodeling 1.4.3 Operation and use 1.4.4 Equipment 1.4.5 Domotics		
	Field visits for case analysis		**4h**
Bibliography and digital resources	**Bibliography**	Enrique Gonzalo Guillermo, (s/f) Manual de arquitectura bioclimática, Editorial Nobuko. Garzón Beatriz, (2013) Arquitectura bioclimática, Ediciones de la U Editorial Nobuko Morillón Galvez David, (s/f) Arquitectura bioclimática. Soyinka Wole (s/f) Arquitectura bioclimática extrema, Inst. Monsa de Ediciones. Toro Osorio, A. F. (2018). Diseño estructural y arquitectónico de edificios sostenibles con tecnologías de optimización de recursos naturales Turegano R. J, Antonio (s/f) Arquitectura bioclimática y urbanismo sostenible (Vol. 1) Prensas Universitarias Zaragoza.	

	Digital resources	http://www.ecohabitar.org/conceptos-y-tecnicas-de-la-arquitectura-bioclimatica-2/ https://issuu.com/irvinghoraciomalpicacastaneda/docs/arq._bioclimatica-morillon_460ce6a451a9e3 https://generacionverde.com/blog/arquitectura-sustentable/construccion-con-arquitectura-bioclimatica https://www.ecologiaverde.com/10-claves-para-disenar-una-casa-bioclimatica-361.html
Teaching methods	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 .	
Learning activities	The theoretical concepts discussed during the 1st. nit will serve to understand the multiple strategies of energy efficiency and the various bioclimatic techniques feasible to be applied in a building which will be treated in the 2nd. unit	

Unit 2. Energy efficiency strategies and bioclimatic techniques		**16h**
Topic 2.1 Climate study (Energy use potential)		**3h**
Subtopic	2.1.1 Analysis of climatic data and other conditions 2.1.2 Bioclimatic solutions 2.1.3 Seek maximum efficiency (Minimization of energy consumption)	
Topic 2.2 Factors that determine the energy demand of a building		**2h**
Subtopic	2.2.1 The location 2.2.2 The function 2.2.3 The design 2.2.4 The build quality 2.2.5 User behavior	
Topic 2.3 Objectives of energy efficiency		**2h**
Subtopic	2.3.1 Reduce demand 2.3.2 Increase the performance of sisTopics 2.3.3 Act simultaneously on demand and sisTopics	
Topic 2.4 Demand in buildings		**2h**

Subtopic	2.4.1 Thermal: To meet ACS, heating and cooling requirements 2.4.2 Light: For lighting comfort requirements 2.4.3 Electrical: For applications in various household appliances.	
Topic 2.5 Demand strategies and energy consumption		**3h**
Subtopic	2.5.1 Demand and energy consumption 2.5.2 Heating demand reduction strategies: Direct collection, indirect collection, thermal insulation, infiltration reduction, low emissivity glass, heat recovery systems. 2.5.3 Refrigeration demand reduction strategies: Sun protection, ventilation and cooling (simple and cross), mechanical ventilation. 2.5.4 Lighting demand reduction strategies: Natural lighting, artificial lighting, choice of components, choice of auxiliary equipment, choice of luminaires, regulation and control systems.	
	Field visits for case analysis	**4h**

Bibliography and digital resources	**Bibliography**	Carretero Peña Antonio, García Sánchez J. Manuel (2012) Gestión de eficiencia energética, AMVE Ediciones Dialnet-Fundamentos de climatologia-267903.pdf Fernández Salgado J. María, (2011) Eficiencia energética en los edificios, AMVE Ediciones Quereda Sala José (2005) Curso de climatología general, Editorial Universidad Jaume Paredes, J. R., & Ramirez, J. J. (2017). Energías renovables variables y su contribución a la seguridad energética. Banco Interam. Desarro, 62. Zuñiga, I. Y. C., Lona, L. R., & Flores, M. D. R. S. (2018). Tecnologías verdes: energías renovables como una alternativa sustentable para México. Red Internacional de Investigadores en Competitividad, 11, 1557-1575. Barrios, L. E. (2018). Techos Verdes: de la teoría a la práctica. Revista Científica OMNES, (3), 136-184. González, L. E. Q., & González, J. R. Q. (2019). Infraestructuras verdes vivas: características tipológicas, beneficios e implementación. Cuadernos de Vivienda y Urbanismo, 12(23).

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Teaching methods	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.	
Learning activities	Energy efficiency strategies and bioclimatic techniques discussed during the 2nd. unit, must be analyzed to be applied in the case study selected to develop the process of conversion of the selected building as a case study during the 3rd. unit	

Unit 3. Resource Efficient Buildings Methodology. Case Study Approach		**16h**
Topic 3.1 Analysis and Selection of the Building, case study.		**3 h**
Subtopic	3.1.1 Building Selection case study. 3.1.2 Survey of the physical state of the building.	
Topic 3. General Information of the building		**3 h**
Subtopic	3.2.1 Analysis and description of the building systems of the building. 3.2.2 Analysis and description of facilities and equipment, including resources and waste.	

	3.2.3 Characterization of the Environmental Performance of the Building (Orientation (environment) , a thermal analysis of the envelope , of the natural and artificial light , of the natural and artificial ventilation) 3.2.4 Analysis and characterization of the building: spatial distribution, surfaces, uses of space, etc.	
Topic 3.3 Building Reconversion Approach		**3 h**
Subtopic	3.3.1 Potential for energy use seeking efficiency in the resources. (*Energy demand and energy consumption, heating demand reduction strategies, cooling demand reduction, lighting energy efficiency)* **Consumption = Demand / Performance**	
	3.3.2 Identify and consult NOM and international applicable to the architectural typology as the case may be. 3.3.3 Diagnostic confrontation of improvement strategies through tables. 3.3.4 Reconversion-Adaptation proposals through plants, sections, facades, construction details, etc.	
Topic 3.4 Evaluation and monitoring		**3 h**
Subtopic	3.4.1 Evaluation program, conversion-adaptation monitoring and measuring and identification of its impact. 3.4.2 Evaluation to quantify the magnitude of savings, constant monitoring of the life of the building for efficient operation.	
	Presentation of final works (Practical exercise)	**4 h**

Bibliography and digital resources	**Bibliography**	Jiménez-Pérez, José G. Lineamientos técnicos para el diseño de edificios. PDF Labra-Ayala, Isidro, Reconversión de un edificio de oficinas en Guadalajara para eficientar su consumo de electricidad.PDF Staines Orozco, E., (2014) Proyecto de Reconversión Energética de Bibliotecas UACJ. Universidad Autónoma de Ciudad Juárez. Vaca-López, Miriam E. Sustentabilidad energética para vivienda vertical existente.PDF Velázquez Flores, G. (2017) Reconversión sustentable de edificios. Ilustrado con el edificio M16. Universidad Iberoamericana, Ciudad de México. Sabag, A. M. A. (2018). Hacia la arquitectura bioambiental: uso racional de recursos hídricos en políticas de ordenación territorial. Influencia de la Norma 26 en el diseño de sistemas para ahorro y reúso de agua en vivienda social.

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Teaching methods	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.	
Learning activities	To carry out the process of reconversion of the building, selected as a case study, the energy efficiency strategies and bioclimatic techniques discussed during the 1st and 2nd. Unit. A theoretical evaluation of the saving in the consumption of resources and energy will be carried out that will be achieved from the reconversion of the building in case of study.	

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: Examination of theoretical knowledge	At the end of Unit 1	Unit 1	20 %
Second partial exam: Oral presentation of proposal	At the end of Unit 2	Unit 1 and 2	20 %
Third partial exam: Written submission of proposal	At the end of Unit 3	Unit 1 to 3	20 %
Practical exercise (Case study) Final presentation of results	-	Units 1 to 3	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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