Name of the subject: Technology and energy management
Subject key:76971
Type of subject: Optative
No. of credits approved:
Last date of curricular review: September 2020
Subject matter and subject code requirement: None

A) COURSE NAME: TECHNOLOGY AND ENERGY MANAGEMENT

Synthetic Program										
TECHNOLOGY AND ENERGY MANAGEMENT										
General information										
Type of proposal to curriculum:	New	X	Restructuring				Adjustment			
Type of subject:	Obligatory		Optative	x	Complementary		Other			
Matter shared with another EP or academic entity	(x) No ( ) Yes What PE is shared? _____ What semester? _____ What academic entity? _____									
Produced by:										
Reviewed by:										
Semester	**Hours of theory per week**		**Hours of practice per week**		**Hours additional work student per week**		**Credits**			
	3		1		1		6			

Synthetic Program	
Overall objective	Know the technologies for generating electricity using clean sources as well as the basic concepts for generating electricity and its possible uses.
Specific objectives	• Apply knowledge about electric power generation using clean sources to improve the use of energy resources for power generation and electricity. • Apply the knowledge obtained in electric power generation from a multidisciplinary point of view to propose environmentally friendly and economically viable solutions. • Apply the knowledge obtained in electricity generation from a multidisciplinary point of view to propose technologically viable solutions for the generation of electricity with clean sources.
Specific professional competence (s) that the subject develops	The students: • Wiill perform tasks and solve specific problems related to the generation of electricity. • Will formulate arguments, discussions and defend points of view in oral presentations. • Will identify problems and propose environmentally, technically and economically feasible solutions for power generation using clean energy. • Will analyze scientific, academic and dissemination literature. • Will use information and communication technology in the learning process as a tool for the proposal of global solutions.
Performance tasks of the specific professional competence to those which contribute to develop the subject	The students: • Will be responsible according to the criteria of quality and relevance for society and will actively contribute to the identification and solution of energy problems. • Will have organizational and project management skills. • Will carry out technical and social research and carry out field measurements. Graduates know how to work independently, but also as a team.
Transversal professional competence (s) that contribute to the development of the subject	• Students will participate in actions that improve the use of energy, with a responsible approach to care for natural resources related to the generation of electricity. • Students will analyze and discuss the factors and variables on all aspects associated in depth. • Will learn to communicate in a multidisciplinary environment.

Synthetic Program			
Units	**Units**	**Content**	
	1. Basic electrical and magnetic circuits	Theoretical basis for the analysis of systems for the generation and use of electrical energy	
	2. Fundamentals of electric power	Theoretical basis for the efficient use of systems for the generation and use of electrical energy	
	3. The electric power industry	Theoretical basis of the current form of centralized electricity generation to assess its impact and propose improvements	
	4. Distributed generation in electrical systems	The concept of distributed generation of electric energy for application with systems based on clean energy	
	5. Photovoltaic Systems	Technologies based on photovoltaic systems for electric power generation	
	6. Wind systems	Technologies based on Eolic systems for electric power generation	
Method and practice	**Method**	Presentation of topics through videos, PowerPoint presentations and conferences. The course will be developed mainly as a seminar-workshop. The main advantage of this method lies in the possibility of a collective reflection on each of the topics analyzed during the program. The content of the class will be delivered through readings and presentations in class and at home. The course will be dynamic and participatory, based on discussions. Each student must participate actively as part of the discussion and presentation of topics. In preparation for the classes, each student should read each topic and analyze the problem solutions and possible contributions through a report, where they must express their own opinion, experiences and solutions. This text must be delivered the night before the next class. The teacher also provides theoretical presentations and introduces new topics.	
	Practices	To define	
Evaluation method	**Midterm exam**	25 %	Partial exam of units 1 and 2
		25%	Partial exam of units 3 and 4

Synthetic Program			
		25%	Partial exam of units 5 and 6
	Final exam	Final research work 25%	
	Other activities	Class work and discussion topics	

Synthetic Program		
References and digital resources	**References**	Goswami, D. Yogi; Kreith, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015. Kemmerly, Jack E.; Hayt, William H. Análisis de circuitos en ingeniería . McGraw-Hill Companies, Incorporated, 2012. Keyhani, Ali. Design of smart power grid renewable energy systems. John Wiley & Sons, 2016. Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013. Muhammad, R. H. Power Electronics Devices, Circuits and Applications. 2014. Rashid, Muhammad H. (ed.). Power electronics handbook. Butterworth-Heinemann, 2017. Tagare, Digambar M. Electricity power generation: the changing dimensions. John Wiley & Sons, 2011. Teodorescu, Remus; Liserre, Marco; Rodriguez, Pedro. Grid converters for photovoltaic and wind power systems. John Wiley & Sons, 2011.

Synthetic Program		
	Digital resources	**Data base:** IEEE https://ieeexplore.ieee.org Elsevier https://www.sciencedirect.com/ Wiley online library https://onlinelibrary.wiley.com/ Google académico https://scholar.google.com.mx/

B) CONTENTS AND METHODS BY UNITS AND TOPICS

Unit 1. Basic electrical and magnetic circuits		**8h**
Topic 1.1 Fundamental definitions of electrical circuits		**5h**
Subtopic	1.1.1 Load, current and voltage 1.1.2 Electrical resistance 1.1.3 Kirchhoff laws 1.1.4 Ideal sources of voltage and current 1.1.5 Energy and Power 1.1.6 Capacitance and inductance	
Topic 1.2 Magnetic Circuits		**3h**
Subtopic	1.2.1 Electromagnetism 1.2.2 Magnetic Circuits 1.2.3 Transformers	

References and digital resources	**References**	Goswami, D. Yogi; Kreith, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015. Kemmerly, Jack E.; Hayt, William H. Análisis de circuitos en ingeniería . McGraw-Hill Companies, Incorporated, 2012. Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013.
	Digital resources	**Databases:** IEEE https://ieeexplore.ieee.org Elsevier https://www.sciencedirect.com/ Wiley online library https://onlinelibrary.wiley.com/ Google académico https://scholar.google.com.mx/
Teaching methods	The course will be established primarily as a seminar-workshop; The main attraction of this method lies in the possibility of a collective reflection on each of the topics raised in the program, based on certain key concepts derived from class readings and presentations . The experience of personal reading is reinforced by the synergy of collective reflection.	
Learning activities	Pre-reading activity Conference Interactive dialogue Presentation (individual)	

Unit 2. Fundamentals of electrical energy		**8h**
Topic 2.1 AC circuits		**4h**
Subtopic	2.1.1 Effective voltage and current values 2.1.2 Ideal components with sinusoidal excitation	
Topic 2 .2 Energy quality		**4h**
Subtopic	2..2.1 Power Factor 2.2.2 Three-phase systems	

	2.2.3 Power supplies 2.2.4 Energy quality	
References and digital resources	**References**	Kemmerly, Jack E.; Hayt, William H. Análisis de circuitos en ingeniería . McGraw-Hill Companies, Incorporated, 2012. Keyhani, Ali. Design of smart power grid renewable energy systems. John Wiley & Sons, 2016. Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013. Muhammad, R. H. Power Electronics Devices, Circuits and Applications. 2014. Rashid, Muhammad H. (ed.). Power electronics handbook. Butterworth-Heinemann, 2017.
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Learning activities	Pre-reading activity Conference Interactive dialogue Presentation (individual)	

Unit 3 . Electric power industry			8h
Topic 3.1 The electrical industry			**2h**
Subtopic	3.1.1 Overview of the electrical industry 3.1.2 Classification of energy generating companies.		
Topic 1.2 Plants for electric power generation			**6h**
Subtopic	3.2.1 Polyphasic Synchronous Generators 3.2.2 Entropy and heat efficiency in machines 3.2.3 Steam cycle in electric power generating plants 3.2.4 Gas turbines for electric power generation 3.2.5 Combined cycle plants 3.2.6 Transmission and distribution of electrical energy		
References and digital resources	**References**	Goswami, D. Yogi; Kreith, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015. Keyhani, Ali. Design of smart power grid renewable energy systems. John Wiley & Sons, 2016. Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013. Rashid, Muhammad H. (ed.). Power electronics handbook. Butterworth-Heinemann, 2017. Tagare, Digambar M. Electricity power generation: the changing dimensions. John Wiley & Sons, 2011.	

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Learning activities	Pre-reading activity Conference Interactive dialogue Presentation (individual)	

Unit 4. Generation distributed in electrical systems		**5h**
Topic 4 .1 Distributed Generation		**1h**
Subtopic	4 .1.1 Transition of electric power generation 4 .1.2 Distributed generation with fossil fuels	
Unit 4 .2 Electricity generation using clean technologies		**4h**
Subtopic	4.2.1 Solar concentrator technologies 4.2.2 Biomass for electric power generation 4.2.3 Hydroelectric systems for electric power generation 4.2.4 Fuel cells 4.2.5 Economics of distributed systems	

References and digital resources	**References**	Goswami, D. Yogi; Kreith, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015 Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013.
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Learning activities	Pre-reading activity Conference Interactive dialogue Presentation (individual)	

Unit 5 . Photovoltaic systems		**9h**
Topic 5 .1 Solar resource		**1h**
Subtopic	5.1.1 Study of the position of the sun to take advantage of the solar resource 5.1.2 Measurement of solar irradiation 5.1.3 Average measurements of solar radiation	
Topic 5 .2 Photovoltaic materials and electrical characteristics		**4h**
Subtopic	5 .2.1 Physical basic of semiconductor 5 .2.2 Photovoltaic materials	

	5 .2.3 Equivalent circuit of the photovoltaic cell 5 .2.4 Cells, Modules and Photovoltaic Arrangements 5.2.5 V-I curves in photovoltaic cells 5.2.6 Maximum power point tracking	
Topic 5 .3 Photovoltaic systems		**4h**
Subtopic	5.3.1 Inverters for grid connected photovoltaic systems 5.3.2 Requirements for connection to the network of photovoltaic systems 5.3.3 Economia de los sitemas fotovoltaicos 5.3.4 Sistemas fotovoltaicos sin conexión a la red 5.3.5 Bombeo de agua utilizando sistemas fotovoltaicos	
References and digital resources	**References**	Goswami, D. Yogi; Kreith, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015. Keyhani, Ali. Design of smart power grid renewable energy systems. John Wiley & Sons, 2016 Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013. Rashid, Muhammad H. (ed.). Power electronics handbook. Butterworth-Heinemann, 2017. Teodorescu, Remus; Liserre, Marco; Rodriguez, Pedro. Grid converters for photovoltaic and wind power systems. John Wiley & Sons, 2011.

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Learning activities	Pre-reading activity Conference Interactive dialogue Presentation (individual)	
Unit 6 . Wind systems		**10h**
Unit 6 .1 Technology in wind turbines		**3h**
Subtopic	6.1.1 Rotors 6.1.2 Stators 6.1.3 Power curves	
Topic 6 .2 Power converter structures for wind turbines		**4h**
Subtopic	6.2.1 Configuration of turbine wind 6.2.2 Topologies of power converters for wind turbines 6.2.3 Control of wind turbines 6.2.4 Requirements for connection to the wind turbine network	
Unit 6 .3 Generation distributed with wind turbines		**3h**
Subtopic	6.3.1 Wind farms 6.3.2 Economy of wind turbines 6.3.3 Environmental impact of wind turbines	

References and digital resources	**References**	Goswami, D. Yogi; Kreith, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015. Keyhani, Ali. Design of smart power grid renewable energy systems. John Wiley & Sons, 2016. Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013. Rashid, Muhammad H. (ed.). Power electronics handbook. Butterworth-Heinemann, 2017. Teodorescu, Remus; LISERRE, Marco; RODRIGUEZ, Pedro. Grid converters for photovoltaic and wind power systems. John Wiley & Sons, 2011.
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Learning activities	Pre-reading activity Conference Interactive dialogue Presentation (individual)

C) TEACHING AND LEARNING STRATEGIES

The course will be established primarily as a seminar-workshop; The main attraction of this method lies in the possibility of a collective reflection on each of the topics raised in the program, based on certain key concepts derived from class readings and presentations. The experience of personal reading is reinforced by the synergy of collective reflection.

D) EVALUATION AND ACCREDITATION

Preparation and / or presentation of:	**Periodicity**	**Covers**	**Weight of each partial in relation to the ordinary**
First partial exam: Oral essay presentation	At the end of Unit 2	Units 1 to 2	25%
Second partial exam: Written essay presentation	At the end of Unit 4	Units 3 to 4	25%
Third partial exam: Final essay presentation	At the end of Unit 6	Units 5 and 6	25%
Final Research Work			25%
		TOTAL	100%
Ordinary exam	The ordinary final qualification will consist of the 3 partial qualifications and the final research work.		
Other academic activities required			

E) REFERENCES AND DIGITAL RESOURCES

Main texts

Keyhani, Ali. Design of smart power grid renewable energy systems. John Wiley & Sons, 2016.

Masters, Gilbert M. Renewable and efficient electric power systems. John Wiley & Sons, 2013.

Teodorescu, Remus; LISERRE, Marco; RODRIGUEZ, Pedro. Grid converters for photovoltaic and wind

power systems. John Wiley & Sons, 2011.

Complementary texts

Goswami, D. Yogi; KREITH, Frank (ed.). Energy efficiency and renewable energy handbook. CRC Press, 2015.

Kemmerly, Jack E.; HAYT, William H. Análisis de circuitos en ingeniería . McGraw-Hill Companies, Incorporated, 2012.

Muhammad, R. H. Power Electronics Devices, Circuits and Applications. 2014.

Rashid, Muhammad H. (ed.). Power electronics handbook. Butterworth-Heinemann, 2017.

Tagare, Digambar M. Electricity power generation: the changing dimensions. John Wiley & Sons, 2011.

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