MENG Sample Study Plan

(Track 1) - Mechatronics

MENG (Track 1) Study Plan (Year 1)

	Semester 1						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENGL 002	**English I**	0	0	50	A minimum score of 500 on the TOEFL. Students will also be required to pass a written NU test (essay).		
MATH 001	**Analytical Geometry & Calculus I**	3	5	125	None		
CSCE 001	**Computer & Information Skills**	3	5	125	None		
ENGR 001	**Introduction to Engineering**	3	5	125	None		
CHEM 001	**Chemical Principles**	3	5	125	None		
PHYS 001	**Physics I**	4	7	175	None		
SSCI 001	**Selected Topics in Social Sciences**	2	3	75	None		
TOTAL		**18**	**30**	**800**			
	Semester 2						
ENGL 003	**English II**	0	0	50	ENGL 002 - English I		
MATH 002	**Calculus II**	3	5	125	MATH 001 - Analytical Geometry & Calculus I		
CSCE 002	**Introduction to Programming**	3	5	125	CSCE 001 - Computer & Information Skills		
ENGR 002	**Introduction to Engineering Design**	3	5	125	ENGR 001 - Introduction to Engineering		
MENG 101	**Engineering Mechanics I - Statics**	2	4	100	MATH 001 - Analytical Geometry & Calculus I		
PHYS 002	**Physics II**	4	7	175	PHYS 001 - Physics I		
SSCI 002	**Selected Topics in World Cultures and Diversity**	2	3	75	None		
TOTAL		**17**	**29**	**775**			

MENG (Track 1) Study Plan (Year 2)

	Semester 3						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENGL 101	**Writing Skills**	3	5	125	ENGL 003 - English II - or IELTS 6.5 or equivalent		
MATH 205	**Differential Equations**	3	5	125	MATH 002 - Calculus II		
MATH 103	**Probability & Statistics for Engineers**	3	5	125	MATH 002 - Calculus II		
MENG 102	**Engineering Mechanics II - Dynamics**	2	4	100	MENG 101 - Engineering Mechanics I - Statics		
MENG 202	**Solid Modeling and Workshop**	3	5	125	ENGR 002 - Introduction to Engineering Design		
MENG 203	**Introduction to Manufacturing Processes**	3	5	125	ENGR 001 - Introduction to Engineering		
MENG 201	**Introduction to Solid Mechanics and Strength of Materials**	2	4	100	MENG 101 - Engineering Mechanics I - Statics		
TOTAL		**19**	**33**	**825**			
	Semester 4						
ENGL 102	**Communication and Presentation Skills**	3	5	125	ENGL 101 - Writing Skills		
MATH 104	**Linear Algebra**	3	5	125	MATH 002 - Calculus II		
ECEN 101	**Electric Circuits**	3	5	125	PHYS 001 - Physics I		
MENG 205	**Economics and Project Management in Mechanical Engineering**	3	5	125	None		
MENG 204	**Mechanical Measurements**	3	5	125	PHYS 002 - Physics II		
MENG 305	**Fluid Mechanics I**	3	5	125	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics	
TOTAL		**18**	**30**	**750**			

MENG (Track 1) Study Plan (Year 3)

	Semester 5						
Code	Title	CH	ECTS	SWL	Prerequisite		
HUMA 001	**Introduction to Scientific & Critical Thinking**	2	3	75	None		
MATH 206	**Nummerical Methods**	3	5	125	MATH 205 - Differential Equations		
MENG 306	**Kinematics and Dynamics of Mechanical Systems**	3	5	125	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics	
MENG 303	**Machine Design**	3	5	125	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 202 - Solid Modeling and Workshop	
MENG 304	**Thermodynamics I**	2	3	75	PHYS 002 - Physics II	CHEM 001 - Chemical Principles	
MENG 301	**Mechanical Behavior of Engineering Materials**	3	5	125	None		
MENG 321	**Electronic devices and applications**	2	3	75	ECEN 101 - Electric Circuits		
TOTAL		**18**	**29**	**725**			
	Semester 6						
MENG 322	**Electric Machines and Drives**	3	5	125	MENG 321 - Electronic devices and applications		
MENG 326	**Computer Programming in Mechatronics Application**	3	5	125	CSCE 002 - Introduction to Programming		
MENG 308	**Heat Transfer I**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I	
MENG 307	**Modeling and Simulation of Dynamic Systems**	3	5	125	MATH 205 - Differential Equations		
MENG 323	**Fundamentals of Mechatronics Engineering**	3	5	125	MATH 205 - Differential Equations		
NSCI 102	**Selected Topics in Environmental Science**	3	5	125	None		
TOTAL		**18**	**30**	**750**			

MENG (Track 1) Study Plan (Year 4)

	Semester 7						
Code	Title	CH	ECTS	SWL	Prerequisite		
MENG 401	**Mechanical Vibrations**	3	5	125	MENG 102 - Engineering Mechanics II - Dynamics	MENG 307 - Modeling and Simulation of Dynamic Systems	
HUMA 002	**Introduction to Ethics**	2	3	75	None		
MENG 421	**Automatic Control Systems**	3	5	125	MENG 307 - Modeling and Simulation of Dynamic Systems		
MENG 324	**Signal Processing & Logic Design**	3	2	0	MENG 321 - Electronic devices and applications	MATH 205 - Differential Equations	
MENG 391	**Practical Training**	3	6	150	After 6th semester		
ENTR 301	**Selected Topics in Entrepreneurship**	3	5	125	NONE		
TOTAL		**17**	**26**	**600**			
	Semester 8						
MENG 422	**Pneumatics and Hydraulics Control Systems**	3	5	125	MENG 421 - Automatic Control Systems		
HUMA 003	**Selected Topics in Humanities & Arts**	2	3	75	None		
MENG 327	**Industrial Data Networks**	3	0	2	MENG 324 - Signal Processing & Logic Design		
MENG 425	**Robotics**	3	5	125	MATH 206 - Nummerical Methods	MENG 306 - Kinematics and Dynamics of Mechanical Systems	MENG 421 - Automatic Control Systems
MENG 325	**Computer Control of Manufacturing Processes**	3	5	125	MENG 203 - Introduction to Manufacturing Processes		
MENG 493	**Graduation Project I**	3	6	180	Senior Standing		
TOTAL		**17**	**24**	**632**			

MENG (Track 1) Study Plan (Year 5)

	Semester 9						
Code	Title	CH	ECTS	SWL	Prerequisite		
MENG 424	**Embedded Systems and Computer Interface**	3	5	125	MENG 324 - Signal Processing & Logic Design	MENG 326 - Computer Programming in Mechatronics Application	
MENG 423	**Digital Control Systems**	3	5	125	MENG 421 - Automatic Control Systems	MENG 324 - Signal Processing & Logic Design	
MENG 426	**Industrial Control Systems**	3	5	125	MENG 324 - Signal Processing & Logic Design		
MENG xxx	**Elective course**	3	5	125			
MENG 495	**Graduation Project II**	3	6	180	MENG 493 - Graduation Project I		
MENG xxx	**Elective course**						
TOTAL		**15**	**26**	**680**			

MENG (Track 1) Electives

	Electives					
Code	Title	CH	ECTS	SWL	Prerequisite	
MENG 430	**MEMS Devices and Systems**	3	5	125	MENG 321 - Electronic devices and applications	
MENG 431	**Advanced Mechatronics**	3	5	125	MENG 323 - Fundamentals of Mechatronics Engineering	
MENG 432	**Modern Control Systems**	3	5	125	MENG 421 - Automatic Control Systems	
MENG 433	**Introduction to Autotronics**	3	5	125	MENG 325 - Computer Control of Manufacturing Processes	MENG 327 - Industrial Data Networks
MENG 434	**Introduction to Autonomous Systems**	3	5	125	MENG 424 - Embedded Systems and Computer Interface	
MENG 435	**Intelligent Control Systems**	3	5	125	MATH 104 - Linear Algebra	MENG 326 - Computer Programming in Mechatronics Application
MENG 436	**Computer Vision & Image processing**	3	5	125	MATH 104 - Linear Algebra	MENG 326 - Computer Programming in Mechatronics Application
IENG 344	**Project Management**	3	5	125	None	
IENG 202	**Operations Research I**	3	5	125	MATH 104 - Linear Algebra	

(Track 2) - Thermal Science and Energy

MENG (Track 2) Study Plan (Year 1)

	Semester 1						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENGL 002	**English I**	0	0	50	A minimum score of 500 on the TOEFL. Students will also be required to pass a written NU test (essay).		
MATH 001	**Analytical Geometry & Calculus I**	3	5	125	None		
CSCE 001	**Computer & Information Skills**	3	5	125	None		
ENGR 001	**Introduction to Engineering**	3	5	125	None		
CHEM 001	**Chemical Principles**	3	5	125	None		
PHYS 001	**Physics I**	4	7	175	None		
SSCI 001	**Selected Topics in Social Sciences**	2	3	75	None		
TOTAL		**18**	**30**	**800**			
	Semester 2						
ENGL 003	**English II**	0	0	50	ENGL 002 - English I		
MATH 002	**Calculus II**	3	5	125	MATH 001 - Analytical Geometry & Calculus I		
CSCE 002	**Introduction to Programming**	3	5	125	CSCE 001 - Computer & Information Skills		
ENGR 002	**Introduction to Engineering Design**	3	5	125	ENGR 001 - Introduction to Engineering		
MENG 101	**Engineering Mechanics I - Statics**	2	4	100	MATH 001 - Analytical Geometry & Calculus I		
PHYS 002	**Physics II**	4	7	175	PHYS 001 - Physics I		
SSCI 002	**Selected Topics in World Cultures and Diversity**	2	3	75	None		
TOTAL		**17**	**29**	**775**			

MENG (Track 2) Study Plan (Year 2)

	Semester 3						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENGL 101	**Writing Skills**	3	5	125	ENGL 003 - English II - or IELTS 6.5 or equivalent		
MATH 205	**Differential Equations**	3	5	125	MATH 002 - Calculus II		
MATH 103	**Probability & Statistics for Engineers**	3	5	125	MATH 002 - Calculus II		
MENG 102	**Engineering Mechanics II - Dynamics**	2	4	100	MENG 101 - Engineering Mechanics I - Statics		
MENG 202	**Solid Modeling and Workshop**	3	5	125	ENGR 002 - Introduction to Engineering Design		
MENG 201	**Introduction to Solid Mechanics and Strength of Materials**	2	4	100	MENG 101 - Engineering Mechanics I - Statics		
MENG 203	**Introduction to Manufacturing Processes**	3	5	125	ENGR 001 - Introduction to Engineering		
TOTAL		**19**	**33**	**825**			
	Semester 4						
ENGL 102	**Communication and Presentation Skills**	3	5	125	ENGL 101 - Writing Skills		
MATH 104	**Linear Algebra**	3	5	125	MATH 002 - Calculus II		
ECEN 101	**Electric Circuits**	3	5	125	PHYS 001 - Physics I		
MENG 205	**Economics and Project Management in Mechanical Engineering**	3	5	125	None		
MENG 204	**Mechanical Measurements**	3	5	125	PHYS 002 - Physics II		
MENG 305	**Fluid Mechanics I**	3	5	125	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics	
TOTAL		**18**	**30**	**750**			

MENG (Track 2) Study Plan (Year 3)

	Semester 5						
Code	Title	CH	ECTS	SWL	Prerequisite		
HUMA 001	**Introduction to Scientific & Critical Thinking**	2	3	75	None		
MENG 301	**Mechanical Behavior of Engineering Materials**	3	5	125	None		
MATH 206	**Nummerical Methods**	3	5	125	MATH 205 - Differential Equations		
MENG 303	**Machine Design**	3	5	125	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 202 - Solid Modeling and Workshop	
MENG 304	**Thermodynamics I**	2	3	75	PHYS 002 - Physics II	CHEM 001 - Chemical Principles	
MENG 306	**Kinematics and Dynamics of Mechanical Systems**	3	5	125	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics	
MENG 321	**Electronic devices and applications**	2	3	75	ECEN 101 - Electric Circuits		
TOTAL		**18**	**29**	**725**			
	Semester 6						
MENG 308	**Heat Transfer I**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I	
MATH 341	**Partial Differential Equations and Simulations Tools**	3	5	125	MATH 104 - Linear Algebra	MATH 206 - Nummerical Methods	
MENG 307	**Modeling and Simulation of Dynamic Systems**	3	5	125	MATH 205 - Differential Equations		
MENG 343	**Heat Transfer II**	3	5	125	MENG 308 - Heat Transfer I		
MENG 342	**Thermodynamics II**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I	
NSCI 102	**Selected Topics in Environmental Science**	3	5	125	None		
TOTAL		**18**	**30**	**750**			

MENG (Track 2) Study Plan (Year 4)

	Semester 7						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENTR 301	**Selected Topics in Entrepreneurship**	3	5	125	NONE		
MENG 421	**Automatic Control Systems**	3	5	125	MENG 307 - Modeling and Simulation of Dynamic Systems		
HUMA 002	**Introduction to Ethics**	2	3	75	None		
MENG 401	**Mechanical Vibrations**	3	5	125	MENG 102 - Engineering Mechanics II - Dynamics	MENG 307 - Modeling and Simulation of Dynamic Systems	
MENG 344	**Fluid mechanics II**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I	MATH 341 - Partial Differential Equations and Simulations Tools
MENG 391	**Practical Training**	3	6	150	After 6th semester		
TOTAL		**17**	**29**	**725**			
	Semester 8						
MENG 441	**Finite Element Method and Applications in Mechanical Engineering**	3	5	125	MATH 205 - Differential Equations	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 305 - Fluid Mechanics I
MENG 445	**Turbomachinery I**	3	5	125	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
MENG 442	**Combustion**	3	5	125	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
MENG 446	**Refrigeration and Air-Conditioning**	3	5	125	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
MENG 422	**Pneumatics and Hydraulics Control Systems**	3	5	125	MENG 421 - Automatic Control Systems		
MENG 493	**Graduation Project I**	3	6	180	Senior Standing		
TOTAL		**18**	**31**	**805**			

MENG (Track 2) Study Plan (Year 5)

	Semester 9						
Code	Title	CH	ECTS	SWL	Prerequisite		
HUMA 003	**Selected Topics in Humanities & Arts**	2	3	75	None		
MENG xxx	**Elective Course**	3	5	125			
MENG 444	**Internal combustion Engines**	3	5	125	MENG 343 - Heat Transfer II	MENG 401 - Mechanical Vibrations	MENG 442 - Combustion
MENG 443	**Powerplant Technology**	3	5	125	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II	
MENG xxx	**Elective Course**	3	5	125			
MENG 495	**Graduation Project II**	3	6	180	MENG 493 - Graduation Project I		
TOTAL		**17**	**29**	**755**			

MENG (Track 2) Electives

	Electives						
Code	Title	CH	ECTS	SWL	Prerequisite		
MENG 451	**Renewable Energy Systems Engineering**	3	5	125	MENG 342 - Thermodynamics II		
MENG 452	**Computational Thermo-Fluid Mechanics**	3	5	125	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
MENG 453	**Introduction to Continuum Mechanics**	3	5	125	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 344 - Fluid mechanics II	
MENG 454	**Water Desalination**	3	5	125	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II	MENG 401 - Mechanical Vibrations
MENG 455	**Turbomachinery II**	3	5	125	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
MENG 456	**Nuclear Powerplant Engineering**	3	5	125	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II	

	Electives					
MENG 457	**Nuclear Powerplant Engineering**	3	5	125	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II
MENG 205	**Economics and Project Management in Mechanical Engineering**	3	5	125	None	
IENG 344	**Project Management**	3	5	125	None	

(Track 3) - Mechanical Design

MENG (Track 3) Study Plan (Year 1)

	Semester 1						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENGL 002	**English I**	0	0	50	A minimum score of 500 on the TOEFL. Students will also be required to pass a written NU test (essay).		
MATH 001	**Analytical Geometry & Calculus I**	3	5	125	None		
CSCE 001	**Computer & Information Skills**	3	5	125	None		
ENGR 001	**Introduction to Engineering**	3	5	125	None		
CHEM 001	**Chemical Principles**	3	5	125	None		
PHYS 001	**Physics I**	4	7	175	None		
SSCI 001	**Selected Topics in Social Sciences**	2	3	75	None		
TOTAL		**18**	**30**	**800**			
	Semester 2						
ENGL 003	**English II**	0	0	50	ENGL 002 - English I		
MATH 002	**Calculus II**	3	5	125	MATH 001 - Analytical Geometry & Calculus I		
CSCE 002	**Introduction to Programming**	3	5	125	CSCE 001 - Computer & Information Skills		
ENGR 002	**Introduction to Engineering Design**	3	5	125	ENGR 001 - Introduction to Engineering		
MENG 101	**Engineering Mechanics I - Statics**	2	4	100	MATH 001 - Analytical Geometry & Calculus I		
PHYS 002	**Physics II**	4	7	175	PHYS 001 - Physics I		
SSCI 002	**Selected Topics in World Cultures and Diversity**	2	3	75	None		
TOTAL		**17**	**29**	**775**			

MENG (Track 3) Study Plan (Year 2)

	Semester 3						
Code	Title	CH	ECTS	SWL	Prerequisite		
MENG 102	**Engineering Mechanics II - Dynamics**	2	4	100	MENG 101 - Engineering Mechanics I - Statics		
ENGL 101	**Writing Skills**	3	5	125	ENGL 003 - English II - or IELTS 6.5 or equivalent		
MATH 103	**Probability & Statistics for Engineers**	3	5	125	MATH 002 - Calculus II		
MATH 205	**Differential Equations**	3	5	125	MATH 002 - Calculus II		
MENG 201	**Introduction to Solid Mechanics and Strength of Materials**	2	4	100	MENG 101 - Engineering Mechanics I - Statics		
MENG 202	**Solid Modeling and Workshop**	3	5	125	ENGR 002 - Introduction to Engineering Design		
MENG 203	**Introduction to Manufacturing Processes**	3	5	125	ENGR 001 - Introduction to Engineering		
TOTAL		**19**	**33**	**825**			
	Semester 4						
ENGL 102	**Communication and Presentation Skills**	3	5	125	ENGL 101 - Writing Skills		
ECEN 101	**Electric Circuits**	3	5	125	PHYS 001 - Physics I		
MENG 204	**Mechanical Measurements**	3	5	125	PHYS 002 - Physics II		
MENG 205	**Economics and Project Management in Mechanical Engineering**	3	5	125	None		
MATH 104	**Linear Algebra**	3	5	125	MATH 002 - Calculus II		
MENG 305	**Fluid Mechanics I**	3	5	125	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics	
TOTAL		**18**	**30**	**750**			

MENG (Track 3) Study Plan (Year 3)

	Semester 5					
Code	Title	CH	ECTS	SWL	Prerequisite	
HUMA 001	**Introduction to Scientific & Critical Thinking**	2	3	75	None	
HUMA 002	**Introduction to Ethics**	2	3	75	None	
MATH 206	**Nummerical Methods**	3	5	125	MATH 205 - Differential Equations	
MENG 301	**Mechanical Behavior of Engineering Materials**	3	5	125	None	
MENG 303	**Machine Design**	3	5	125	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 202 - Solid Modeling and Workshop
MENG 304	**Thermodynamics I**	2	3	75	PHYS 002 - Physics II	CHEM 001 - Chemical Principles
MENG 306	**Kinematics and Dynamics of Mechanical Systems**	3	5	125	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics
TOTAL		**18**	**29**	**725**		
	Semester 6					
NSCI 102	**Selected Topics in Environmental Science**	3	5	125	None	
MATH 341	**Partial Differential Equations and Simulations Tools**	3	5	125	MATH 104 - Linear Algebra	MATH 206 - Nummerical Methods
MENG 307	**Modeling and Simulation of Dynamic Systems**	3	5	125	MATH 205 - Differential Equations	
MENG 308	**Heat Transfer I**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I
MENG 342	**Thermodynamics II**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I
MENG 360 / IENG 213	**Manufacturing Processes 2**	3	5	125	MENG 202 - Solid Modeling and Workshop	
TOTAL		**18**	**30**	**750**		

MENG (Track 3) Study Plan (Year 4)

	Semester 7						
Code	Title	CH	ECTS	SWL	Prerequisite		
ENTR 301	**Selected Topics in Entrepreneurship**	3	5	125	NONE		
MENG 344	**Fluid mechanics II**	3	5	125	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I	MATH 341 - Partial Differential Equations and Simulations Tools
MENG 391	**Practical Training**	3	6	150	After 6th semester		
MENG 401	**Mechanical Vibrations**	3	5	125	MENG 102 - Engineering Mechanics II - Dynamics	MENG 307 - Modeling and Simulation of Dynamic Systems	
MENG 421	**Automatic Control Systems**	3	5	125	MENG 307 - Modeling and Simulation of Dynamic Systems		
MENG 461	**Failure of Mechanical Components and Prevention**	3	5	125	MENG 203 - Introduction to Manufacturing Processes	MENG 303 - Machine Design	
TOTAL		**18**	**31**	**775**			
	Semester 8						
MENG 422	**Pneumatics and Hydraulics Control Systems**	3	5	125	MENG 421 - Automatic Control Systems		
MENG 441	**Finite Element Method and Applications in Mechanical Engineering**	3	5	125	MATH 205 - Differential Equations	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 305 - Fluid Mechanics I
MENG 464	**Design of Engineering Systems**	2	3	75	MENG 203 - Introduction to Manufacturing Processes	MENG 303 - Machine Design	
MENG 465	**Machine Design II**	3	5	125	MENG 303 - Machine Design		
MENG xxx	**Elective Course**	3	5	125			
MENG 493	**Graduation Project I**	3	6	180	Senior Standing		
TOTAL		**17**	**29**	**755**			

MENG (Track 3) Study Plan (Year 5)

	Semester 9						
Code	Title	CH	ECTS	SWL	Prerequisite		
HUMA 003	**Selected Topics in Humanities & Arts**	2	3	75	None		
MENG 425	**Robotics**	3	5	125	MATH 206 - Nummerical Methods	MENG 306 - Kinematics and Dynamics of Mechanical Systems	MENG 421 - Automatic Control Systems
MENG 462	**Selection of Materials and Processes for Design**	3	5	125	MENG 205 - Economics and Project Management in Mechanical Engineering	MENG 301 - Mechanical Behavior of Engineering Materials	MENG 303 - Machine Design
MENG 463 / IENG 314	**Computer-Aided Design and Prototyping**	3	5	125	MENG 202 - Solid Modeling and Workshop		
MENG xxx	**Elective Course**	3	5	125			
MENG 495	**Graduation Project II**	3	6	180	MENG 493 - Graduation Project I		
TOTAL		**17**	**29**	**755**			

MENG (Track 3) Electives

	Electives					
Code	Title	CH	ECTS	SWL	Prerequisite	
MENG 453	**Introduction to Continuum Mechanics**	3	5	125	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 344 - Fluid mechanics II
MENG 466	**Fault Diagnosis utilizing Vibrations Analysis**	3	5	125	MENG 401 - Mechanical Vibrations	MENG 465 - Machine Design II
MENG 469	**Selected Topics in Design**	3	5	125	MENG 344 - Fluid mechanics II	Senior Standing
MENG 451	**Renewable Energy Systems Engineering**	3	5	125	MENG 342 - Thermodynamic s II	MENG 344 - Fluid mechanics II
MENG 443	**Powerplant Technology**	3	5	125	MENG 342 - Thermodynamic s II	MENG 344 - Fluid mechanics II

	Electives						
MENG 454	**Water Desalination**	3	5	125	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II	MENG 401 - Mechanical Vibrations
IENG 202	**Operations Research I**	3	5	125	MATH 104 - Linear Algebra		
IENG 344	**Project Management**	3	5	125	None		

توصيف مقررات برنامج الهندسة الميكانيكية

Color Coding

University Requirements	School Requirements	Program Requirements	Specialization Requirements	Electives Courses

(MENG) - ENTR 301

Course Title	**Selected Topics in Entrepreneurship**	
Course Code	**ENTR 301**	
Prerequisites	NONE	
Classification within the curriculum	Compulsory (All Tracks)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Business	
Topic Level	Specialization Requirements	

Description

In this course, students get an overview about the definition of entrepreneurship, examples of successful innovations, and the prospects of starting a company. The course covers idea generation and identifying opportunities, business model canvas, and an overview of some business fundamentals such as types of businesses and business functions, in addition to communication and presentation skills.

(MENG) - IENG 202

Course Title	**Operations Research I**	
Course Code	**IENG 202**	
Prerequisites	MATH 104 - Linear Algebra	
Classification within the curriculum	Elective (All Tracks)	
Course Position in Study Plan	Fall (Semester 9)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topics Category	Basic Engineering Sciences	
Topics Level	Specialization Requirements	

Description
This course introduces the decision making process criteria to students, and differentiates between different decision making environments. Students are given the knowledge and experience of problem solving techniques through using different operations research modeling and solution techniques, for example linear and integer programing, graphical and analytical solution methods. Through practical applications, assignments and the final projects students learn how to utilize suitable tools at different problem solving situations.

Lab and Tutorials
The course requires practice and problem solving training during tutorials, in addition to training on software to solve general OR problems.

Literature-

- Barry Render, Ralph M. Stair, JR, and Michael E. Hanna, “Quantitative Analysis for Management”, 10th Edition, Pearson Prentice Hall, 2009.
- Frederick S. Hillier and Gerald J. Lieberman, Introduction to Operations Research (8th ed.), McGraw Hill, New York (2005).
- Hamdy A. Taha, Operations Research: An Introduction (6th ed.),

(MENG) - IENG 344

Course Title	**Project Management**	
Course Code	**IENG 344**	
Prerequisites	None	
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall (Semester 9)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	0
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topics Category	Basic Engineering Sciences	
Topics Level	Specialization Requirements	

Description

This course addresses the fundamental of project management, as well as the tools and techniques necessary to manage complex projects. These principles, largely developed and tested on engineering projects, are being successfully applied to projects of all sizes and types within the business world. They are also fully aligned with the industry standard Project Management Book of Knowledge (PMBOK), published by the worldwide Project Management Institute (PMI). The course will enable students to master projects planning, scheduling and estimating; developing approval process, including testing for alternatives; understanding project information and control systems; properly selecting resources, allocation and implementation, and post project evaluation. PERT, CPM

Lab and Tutorials

The course requires practice and problem solving training during tutorials, in addition to software training.

Literature

- Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Harold Kerzner.

(MENG) - MATH 341

Course Title	**Partial Differential Equations and Simulations Tools**	
Course Code	**MATH 341**	
Prerequisites	MATH 104 - Linear Algebra	MATH 206 - Nummerical Methods
Classification within the curriculum	Compulsory (Track 2 and Track 3)	
Course Position in Study Plan	Spring (Semester 6)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Mathematics and Basic Sciences	
Topic Level	Specialization Requirements	

Description

Partial differential equations are mathematical tools used in studying systems and modeling its phenomena. They are widely used in diverse areas of engineering, physical sciences, biology, economics and finance. The aim of this course is to teach the students how to solve partial differential equations and interpret the resulting solutions. The course first discusses the solutions of PDEs using different methods such as separation of variables, integral transforms and Fourier series for both homogeneous and non-homogeneous cases. It also introduces the series solutions of differential equations using Frobenius method. Some theoretical concepts about the Sturm-Liouville problem are discussed. It also provides solutions of partial differential equations using finite difference method. Computer software simulation tool (MATLAB, SciLab or any other suitable software) is used to solve linear and non-linear partial differential equations.

Tutorials

Examples are discussed in detail during the tutorial as well as the software package is covered. Help is provided during the tutorial regarding the course project.

Literature:

- "Advanced Engineering Mathematics," Dennis G. Zill and Warren S. Wright, 5th edition.
- "Applied Partial Differential Equations with Fourier Series and Boundary Value Problems," R. Haberman, 5th edition.
- "Differential Equations with Boundary Value Problems" John Polking, Albert Boggess and David Arnold, 2nd edition.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 201

Course Title	**Introduction to Solid Mechanics and Strength of Materials**	
Course Code	**MENG 201**	
Prerequisites	MENG 101 - Engineering Mechanics I - Statics	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 3)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	
	TOTAL	3
EG Credit Hours	2	
ECTS	4	
Student Workload (SWL)	100	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

Concepts of stress and strain. Mechanical behavior of materials. Internal reactions in rods. Axial deflections in rods due to mechanical and/or thermal loadings. Statically indeterminate rods. Lateral deflections (Poisson's ratio). Generalized Hooke's law. Normal and shear stress in beams. Pure bending. Bending due to eccentric forces (2D and 3D). Torsion of solid and hollow circular members. Combined loading. Transformation of stresses and strains. Yield criteria for ductile materials (Maximum distortion energy criterion, von Mises and Maximum shear stress criterion, Tresca).

Lab and Tutorials

Not Applicable

Literature

- "Mechanics of Materials", F. P. Beer, E. R. Johnston, J. T. DeWolf, and David F. Mazurek. McGraw-Hill, New York, 6th edition.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 202

Course Title	**Solid Modeling and Workshop**	
Course Code	**MENG 202**	
Prerequisites	ENGR 002 - Introduction to Engineering Design	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 3)	
Contact Hours	Lectures	1.5
	Tutorials	
	Labs	3
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Engineering Requirements	

Description
The course is split in two parts; the first is focussing on using 3D CAD package to develop solid models in order to generate assemblies and 2D drawings. The second part (2/3 of the contact hours) is focussing on workshop technology manifested in different machining and forming technologies.This includes (Turning, Milling, Drilling, Grinding, Sheet Metal Works and basic formic operations).

Lab and Tutorials
Students are exposed to basic workshop practice techniques & application of the basic skills to undertake a project.

Literature

1. Course Textbook: Dugan Solid Modeling and Applications: Rapid Prototyping, CAD and CAE Theory. Springer, 2017
2. M. P. Groover , “principles of Modern Technologies”, John Wiley

Additional Resources:

- William E. Howard. Introduction to Solid Modeling Using SolidWorks 2017, McGraw-Hill Education; 13 Ed, 2017
- Donald E. Lacourse. Handbook of Solid Modeling, McGraw-Hill, 1995

(MENG) - MENG 203

Course Title	**Introduction to Manufacturing Processes**	
Course Code	**MENG 203**	
Prerequisites	ENGR 001 - Introduction to Engineering	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 3)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topics Category	Basic Engineering Sciences	
Topics Level	Program Requirements	

Description
This course provides an introduction to basic manufacturing processes such as: casting, metal forming, forging, common welding techniques, hydroforming, friction steer welding, machining, and introduction to mechanics of metal cutting.

Tutorials
Regular weekly lab and machine shop tutorial sessions are conducted.

Literature
Fundamentals of Modern Manufacturing", 2nd edition, John Wiley & Sons Inc., 2004

(MENG) - MENG 204

Course Title	**Mechanical Measurements**	
Course Code	**MENG 204**	
Prerequisites	PHYS 002 - Physics II	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring (Semester 4)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	1.5
	TOTAL	6
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

This course focuses on basics of mechanical measurement systems including static and dynamic characteristics of instruments, static analysis of measurement errors, variable conversion elements and signal conditioning and amplification. Also, it covers metrology and mechanical measuring instruments, and introduces different types of sensors (like strain, force, pressure, flow, power, temperature)

Lab and Tutorials

Regular tutorial sessions are given to cover theory of operation of different physics and labs are conducted as well to show students metrology devices and DAQ process.

Literature

Course Textbook:

- Richard S. Figliola, Donald E. Beasley, “Theory and Design for Mechanical Measurements” 5th edition, John Wiley, 2006

(MENG) - MENG 205

Course Title	**Economics and Project Management in Mechanical Engineering**	
Course Code	**MENG 205**	
Prerequisites	None	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	0
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topics Category	Business	
Topics Level	Program Requirements	

Description:
This course prepares the students to be acquainted with rational meaningful approaches to evaluating economically different (alternatives) investment opportunities while accomplishing given objectives. The course will also provide the students with the required tools and techniques to consider economic and non-economic factors in evaluating a wide range of industrial and business applications. In addition, the course addresses the fundamentals of project management, as well as the tools and techniques necessary to manage complex projects such as CPM and PERT.

Lab and Tutorials
The course requires practice and problem solving training during tutorials, in addition to software training.

Literature

- Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Harold Kerzner.
- Fraser, N. M., Jewkes, E. M., Bernhardt I. & Tajima, M., Global Engineering Economics: Financial Decision Making for Engineers, 4th Edition, Pearson Education, 2009.
- Chan S. Park, Fundamentals of Engineering Economics, 3rd Edition, Pearson Education, ISBN 13:978-0273772910

(MENG) - MENG 301

Course Title	**Mechanical Behavior of Engineering Materials**	
Course Code	**MENG 301**	
Prerequisites	None	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 5)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	1.5
	TOTAL	6
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

Introduction to the science of engineering materials and their properties and behavior. Topics include technical and thermal properties, atomic structure, structure of crystalline solids, imperfections in solids, mechanical behavior of metals, failure, phase diagrams and phase transformations, properties and processing of metals alloys, ceramics, polymers and composites, corrosion and degradation of materials and their environmental effects.

Tutorials

Teach the students the necessary skills of engineering calculations needed for the selection and design of material components.

Demonstration of the materials properties and their behavior under different leading conditions.

Literature

Course Textbook:

- Materials science and Engineering: An Introduction. 8Th edition. William D. Callister, Jr. and David G. Rethwisch, 2010 John Wiley & Sons, Inc.

Additional Resources:

- The Science and Engineering of Materials. 6Th edition. Donald R. Askeland, Pradeep P. Fulay and Wendelin J. Wright, 2011 Cengage Learning.
- Lecture Notes

(MENG) - MENG 303

Course Title	**Machine Design**	
Course Code	**MENG 303**	
Prerequisites	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 202 - Solid Modeling and Workshop
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 5)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

Introduction to design concepts. Engineering materials used for design of mechanical components. Stress concentrations. Design for Different Types of Loading (steady and cyclic loadings). Fasteners, connections, and power screws. Spur gears. Helical gears. Design of shafts. Selection of bearings. Design of helical compression springs. Design of columns and struts. Utilization of interactive computer programs for design of mechanical components and assembly. Project required.

Tutorials

Regular weekly problem solving tutorial sessions are conducted.

Literature

- "Machine Elements in Mechanical Design", Robert L. Mott, Pearson, 5th edition.
- SolidWorks, Users Guide 2016, Dassault Systèmes.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 304

Course Title	**Thermodynamics I**	
Course Code	**MENG 304**	
Prerequisites	PHYS 002 - Physics II	CHEM 001 - Chemical Principles
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 5)	
Contact Hours	Lectures:	1.5
	Tutorials:	1.5
	Labs:	1.5
	TOTAL	4.5
EG Credit Hours	2	
ECTS	3	
Student Workload (SWL)	75	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

The course gives an introduction to the basics concepts of thermodynamics as related to the conversion of heat to mechanical work. Topics include, properties of pure substance, 1st law of thermodynamics for open and closed systems, 2nd law of thermodynamics, entropy and entropy change.

Lab and Tutorials

Teach the students the necessary skills to solve thermodynamics problems.
Demonstrate some of the fundamental concepts tough in the course like the properties of pure substance, the conversion of work and energy.

Literature

Course Textbook:

- Thermodynamics: An Engineering Approach, *8th edition*. Yunus A. Cengel and Michael A. Boles, 2014 McGraw-Hill Education.

Additional Resources:

- Property Tables Booklet for Thermodynamics: An Engineering Approach, *8th edition*. Yunus A. Cengel, 2014 McGraw-Hill Europe.
- Lecture Notes

(MENG) - MENG 305

Course Title	**Fluid Mechanics I**	
Course Code	**MENG 305**	
Prerequisites	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring (Semester 4)	
Contact Hours	Lectures:	3
	Tutorials:	1.5
	Labs:	1.5
	TOTAL:	6
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

The aim of the course is to introduce the students to the topic of fluid mechanics. Topics include the difference between a fluid and a solid, properties of fluids, fluid statics and hydro-static forces, continuity equation and steady flow, jet forces and momentum equations, Bernoulli equation and its applications, pressure losses and pipes and fittings.

Lab and Tutorials

Teach the students the necessary skills to deal with real life problems as related to fluid mechanics.
Demonstrate some of the fundamental concepts tough in the course like the Bernoulli equation and jet forces.

Literature

Course Textbook:

- Fluid Mechanics: Fundamentals and Applications, *4th edition*. Yunus A. Cengel and John M. Cimbala, 2017 McGraw-Hill Education.

Additional Resources:

- Fluid Mechanics, 8th *edition*. Frank White 2015 McGraw-Hill Education
- Munson, Young and Okiishi's Fundamentals of Fluid Mechanics, *8th edition*, Philip M. Gerhart, Andrew L. Gerhart and John I. Hochstein 2016 Wiley
- Lecture Notes

(MENG) - MENG 306

Course Title	**Kinematics and Dynamics of Mechanical Systems**	
Course Code	**MENG 306**	
Prerequisites	PHYS 002 - Physics II	MENG 102 - Engineering Mechanics II - Dynamics
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 5)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

Introduction to linkages, types and classification of joints, mechanisms and machines. Calculation of degrees of freedom (mobility) for planar mechanisms utilizing Gruebler and Kutzbach equations. Grashof and non-Grashof conditions. Paradoxes. Intermittent motion. Toggle. Transmission angle. Compliant mechanisms. Cognates. Function generation. Motion generation. Path generation. Kinematics fundamentals of fourbar linkage mechanisms and inversions. Graphical linkage synthesis including fourbar quick-return mechanism. Analytical position analysis of fourbar, five-bar (ordinary and geared five-bar), and six-bar (Watt and Stephenson) mechanisms using Euler's mathematical notation. Analytical position synthesis of fourbar mechanisms with and without fixed pivots. Velocity and acceleration analyses. Design and analyses of gear trains [simple, compound (ordinary and reverted), and planetary gear trains]. Types of cams. Design of roller-follower cams (*s-v-a-j* diagrams). Dynamic force analysis for fourbar mechanisms and inversions. Project required.

Tutorials

Regular weekly problem solving tutorial sessions are conducted infusing computer based solving and animation software.

Literature

- "Design of Machinery – An Introduction to the Synthesis and Analysis of Mechanisms and Machines", Robert L. Norton. McGraw-Hill, New York, 5th edition.
- MATLAB. User's Guide Release 2009a. The MathWorks, Inc. Natick, Massachusetts, United States.
- ADAMS. Documentation 2017. MSC Software. Newport Beach, California, United States.
- DYNACAM. User's Guide – Student Edition, Robert L. Norton.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 307

Course Title	**Modeling and Simulation of Dynamic Systems**	
Course Code	**MENG 307**	
Prerequisites	MATH 205 - Differential Equations	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring (Semester 6)	
Contact Hours	Lectures	3
	Tutorials	0
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Program Requirements	

Description

The course will also provide students with thorough understanding of the sequence of activities related to computer simulation (problem statement, data acquisition, model design, simulation experiment, verification, techniques and methods in different industrial and research applications. Topics covered: Discrete Event Simulation, Random Number Generators, Analogy between different physical and electrical systems, modeling of electrical systems, modeling of mechanical systems, modeling of electromechanical systems, modeling of hydraulic systems, modeling of pneumatic systems, modeling of thermal systems, transducers functions for different physical systems, state space representations for different physical systems, simulation and sot testing of electromechanical systems (MATLAB with Simulink can be used as a simulation tool).

Lab and Tutorials

Students will be required to complete Tutorial and laboratory assignments and to perform practical projects.

Literature

Course Textbook:

- Katsuhiko Ogata (2003) System Dynamics. Pearson; 4 edition

Additional Resources:

- Devendra K. Chaturvedi (2010) Modeling and Simulation of systems using MATLAB and Simulink, CRC Press Taylor & Francis Group.

(MENG) - MENG 308

Course Title	**Heat Transfer I**	
Course Code	**MENG 308**	
Prerequisites	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring (Semester 6)	
Contact Hours	Lectures:	3
	Tutorials:	1.5
	Labs:	1.5
	TOTAL:	6
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Basic Engineering Sciences	
Topic Level	Program Requirements	

Description

This course is a first course in Heat Transfer. The main goal is to gain a deep physical understanding of the heat transfer process by either conduction or convection. Topics include introduction to the concept of heat transfer, conduction heat transfer equation, steady state heat conduction, transient heat conduction, introduction to convection, forced and free convection.

Lab and Tutorials

Teach the students the necessary skills to solve heat transfer related problems.

Demonstrate some of the fundamental concepts tough in the course like the thermal conductivity of materials and the calculation of the convective heat transfer coefficient,

Literature

Course Textbook:

- Heat and Mass Transfer: Fundamentals and Applications, *5th edition*. Yunus A. Cengel and Afshin J. Ghajar, 2015 McGraw-Hill Education.

Additional Resources:

- Fundamentals of Heat and Mass Transfer. *7Th edition*. Theodore L. Bergman, Adrienne S. Lavine, France P. Incropera and David P. DeWitt, 2011 Wiley.
- Lecture Notes

(MENG) - MENG 321

Course Title	**Electronic devices and applications**	
Course Code	**MENG 321**	
Prerequisites	ECEN 101 - Electric Circuits	
Classification within the curriculum	Compulsory (Track 1 and Track 2)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	1.5
	Tutorials	1.5
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	2	
ECTS	3	
Student Workload (SWL)	75	
Topic Category	Basic Engineering Sciences	
Topic Level	Specialization Requirements	

Description

Crystal structure of semiconductors (electrons, holes, impurities, Fermi level, diffusion, continuity equation), semiconductor diodes (P-N junction, V-I characteristics, forward and reverse bias), diode circuit applications (rectifier and clipping circuits) BJT, MOS, JFET transistors, V-I characteristics, physical construction, signal amplifiers, bias circuits, transistor circuit model, AC and DC analysis.

Lab and Tutorials

In the tutorials the students should be able to solve the problems of semiconductor-based circuits. The students should receive better understanding of the course concepts via a well-defined set of experimental work done at labs using resistors, capacitors in addition to semiconductor elements.

Literature

1. Course Textbook: ***Microelectronics circuits*** by Adel S. Sedra and Kenneth C. Smith, 6th edition
2. Additional Resources:
   - Reference #2: Laboratory notes.
   - Reference #3.

(MENG) - MENG 322

Course Title	**Electric Machines and Drives**	
Course Code	**MENG 322**	
Prerequisites	MENG 321 - Electronic devices and applications	
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Spring	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The course covers the basics electromagnetic fields in electromechanical devices and drives. Which includes Production of magnetic field, Faraday's law (transformer action), production of induced force on a wire (motor action). Types of DC Motors: Separately-excited Motor, Self-excited Motor (shunt, series and compound types) the characteristics, and efficiency of DC motors. Transformers: Single phase transformers, principle of operation, equivalent circuit and efficiency. AC Machine Fundamentals; Synchronous Machines; Induction Motors. Special Machines. Power diodes, Thyristors, Ac voltage controllers and Single phase converters. Dc choppers, the single Thyristors chopper, Two Thyristors Choppers, Inverters. Single phase circuits, Bridge inverter circuits.

Industrial applications: Adjusted speed dc Drives, Induction motor drives, Starting, and electric braking of induction motors.

Lab and Tutorials

Students will be required to complete Tutorial and laboratory assignments and to perform practical projects to understand basic characteristics of different types of electric machines.

Literature

Course Textbook:

Fitzgerald, A. E., Charles Kingsley, Jr., and Stephen D. Umans. Electric Machinery. 6th ed. McGraw-Hill, 2007. ISBN: 9780071230100.

Additional Resources:

- Kirtley Jr., James L. Electric Power Principles: Sources, Conversion, Distribution and Use. Wiley, 2010. ISBN: 9780470686362
- Beaty, H. Wayne, and James L. Kirtley, Jr. Electric Motor Handbook. McGraw-Hill, 1998. ISBN: 9780070359710.

(MENG) - MENG 323

Course Title	**Fundamentals of Mechatronics Engineering**	
Course Code	**MENG 323**	
Prerequisites	MATH 205 - Differential Equations	
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Spring	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Electromechanical system modeling, Control and Applications. Design of Electronic Interfaces and Controllers for Mechanical Devices. Sensor Technology, Signal acquisition, Filtering, and Conditioning.
Microcontroller-based Closed-loop Control. Device Communications Sensor and actuator selection, installation, and application strategies.

Lab and Tutorials

Literature

Course Textbook: Clarence W. de Silva, Farbod Khoshnoud, Maoqing Li, Saman K. Halgamuge, “Mechatronics: Fundamentals and Applications” 2015.

Additional Resources:

- Class notes.

(MENG) - MENG 324

Course Title	**Signal Processing & Logic Design**	
Course Code	**MENG 324**	
Prerequisites	MENG 321 - Electronic devices and applications	MATH 205 - Differential Equations
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

This course introduces mainly the signals in time and frequency domains and its usage for mechatronics field. In addition, the logic gates and Boolean algebra are also covered. The students should be able to understand the combinatorial logic circuits and bistable multivibrator circuits.

Lab and Tutorials

In the tutorials the students should be able to solve the problems of signal processing and logic gates circuit designs.

Literature

Course Textbook: 1- Digital signal processing A computer based approach by S.K.Mitra, 2001.
2- Ramaswamy Palaniappan, “Digital Systems Design” 2011

Additional Resources: Class notes.

(MENG) - MENG 325

Course Title	**Computer Control of Manufacturing Processes**	
Course Code	**MENG 325**	
Prerequisites	MENG 203 - Introduction to Manufacturing Processes	
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Spring	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The student will be introduced to the field of manufacturing as a control's application area with an emphasis on machining systems. The student will be exposed to the issues in manufacturing systems and learn how to model, control, and simulate machining systems. Topics include machine structures, servomechanisms, CNC programming, interpolation, coordinated control, process modeling and control, and manufacturing systems. Upon completion of this course, the student will be able to successfully apply their knowledge to model, control, and simulate manufacturing systems and processes..

Lab and Tutorials

Students will be required to complete Tutorial and laboratory assignments and to perform practical experiments like Computer numerical controller (CNC) demonstration and introduction of the architecture, CNC automated programming, CNC-PLC integration and communication.

Literature

1. Course Textbook: J. Bollinger and N. Duffie, Computer Control of Machines and Processes, Addison-Wesley, 1988..

Additional Resources:

- Ulrich Rembold. Interface Technology for Computer Controlled Manufacturing Processes. CRC Press
- Ken Evans. Programming of CNC Machines 4th Edition. Industrial Press, Inc.; 4 edition (2016)

(MENG) - MENG 326

Course Title	**Computer Programming in Mechatronics Application**	
Course Code	**MENG 326**	
Prerequisites	CSCE 002 - Introduction to Programming	
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Spring	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The course is focused on the development of algorithms that include electromechanical. While the objectives of the course are similar to those of a traditional programming course (flowcharting, algorithm development, loops, logical structures, and data arrays), the course presents these topics using C, C++, and MatLab programming languages and tools.

Lab and Tutorials

In the labs, different mechatronics applications are used to provide the students with immediate, concrete, visual feedback on their programming implementations.

Literature

Course Textbook: 1- Marc E Herniter, “Programming in MATLAB”, 2000

2- Brian W. Kernighan & Dennis M. Ritchie , C Programming Language, 2nd Edition Apr 1, 1988

Additional Resources: Class notes.

(MENG) - MENG 327

Course Title	**Industrial Data Networks**	
Course Code	**MENG 327**	
Prerequisites	MENG 324 - Signal Processing & Logic Design	
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	FALL	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Networks Hierarchy And Switching – Open System Interconnection Model Of ISO – Data Link Control Protocol – Media Access Protocol – Command / Response – Token Passing – TCP/IP; Bridges – Routers – Gateways – Standard ETHERNET; RS 232, RS 485 Configuration Actuator Sensor (AS) – Interface; Fieldbus – Introduction – General Fieldbus Architecture – Basic Requirements Of Fieldbus Standard – Fieldbus Topology – Interoperability – Interchangeability; MODBUS Protocol Structure – Function Codes – Troubleshooting Profibus, Introduction, Profibus Protocol Stack, Profibus Communication Model – Communication Objects – System Operation – Troubleshooting – Review Of Foundation Fieldbus; Industrial Ethernet and wireless communication, 10 Mbps Ethernet, 100 Mbps Ethernet – Radio And Wireless Communication, Introduction, Components Of Radio Link.

Lab and Tutorials

Labs should help students to implement different industrial communication and network protocols.

Literature

Course Textbook:

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation And Troubleshooting' Newnes Publication, Elsevier First Edition, 2004.
2. William Buchanan, Computer Buses, CRC Press, 2000.
3. A. Behrouz Forouzan ,Data Communications & Networking ,3RD Edition, Tata Mc Graw Hill,2006

Additional Resources:

- R. W. Erickson, "Fundamentals of Power Electronics", Kluwer Academic Publications, 1997.
- D. W. Hart, "Introduction to Power Electronics", Prentice Hall International, 1997.

(MENG) - MENG 342

Course Title	**Thermodynamics II**	
Course Code	**MENG 342**	
Prerequisites	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I
Classification within the curriculum	Compulsory (Track 2 and Track 3)	
Course Position in Study Plan	Fall (Semester 7)	
Contact Hours	Lectures	3
	Tutorials	0.75
	Labs	0.75
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Starting with a review of thermodynamics I, then the performance of gas power cycles for which the working fluid remains a gas throughout the entire cycle is covered. The analysis of vapor power cycles in which the working fluid is alternately vaporized and condensed is then considered. Finally, the mixture theory is presented.

Tutorials
More examples are covered during the tutorial and help is provided for the course project.

Literature
- Y. Cengel, M. Boles, Thermodynamics: An engineering Approach,
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 343

Course Title	**Heat Transfer II**	
Course Code	**MENG 343**	
Prerequisites	MENG 308 - Heat Transfer I	
Classification within the curriculum	Compulsory (Track 2)	
Course Position in Study Plan	Fall (Semester 7)	
Contact Hours	Lectures:	3
	Tutorials:	0.75
	Labs:	0.75
	TOTAL:	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
This second course in heat transfer focuses on more advanced topics which include. Phase change heat transfer (Boiling and Condensation), Heat Exchangers, Radiation heat transfer and Mass transfer.

Lab and Tutorials
Teach the students the necessary skills to solve heat transfer related problems.
Demonstrate some of the fundamental concepts taught in the course like the different regimes in pool and flow boiling and heat transfer by radiation.

Literature
Course Textbook: Heat and Mass Transfer: Fundamentals and Applications, *5thedition. Yunus A. Cenel and Afshin J. Ghajar, 2015 McGraw-Hill Education.*
Additional Resources:

- Fundamentals of Heat and Mass Transfer. 7thedition. Theodore L. Bergman, Adrienne S. Lavine, France P. Incropera and David P. DeWitt, 2011 Wiley.
- Lecture Notes

(MENG) - MENG 344

Course Title	**Fluid mechanics II**		
Course Code	**MENG 344**		
Prerequisites	MENG 304 - Thermodynamics I	MENG 305 - Fluid Mechanics I	MATH 341 - Partial Differential Equations and Simulations Tools
Classification within the curriculum	Compulsory (Track 2 and Track 3)		
Course Position in Study Plan	Fall (semester 7)		
Contact Hours	Lectures	3	
	Tutorials	0.75	
	Labs	0.75	
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

Starting with a review of fluid mechanics I, then the fluid kinematics is introduced including the Eulerian and the Lagrangian descriptions. Then the balance laws are derived for a general fluid then types of fluids are presented with emphasis on Newtonian fluids leading to the Navier-Stokes equations. Approximate analytical solutions for incompressible fluids are introduced including the boundary layer approximation. To complete the picture, an introduction to the compressibility effects is presented.

Laboratory and Tutorial:

Teach the students the necessary skills to solve course related problems.

Demonstrate some of the fundamental concepts taught in the course and give support for the course project.

Literature

- Y. Cengel, J. Cimbala, Fluid Mechanics: Fundamentals and Applications, 3rd edition, McGraw-Hill; 2014.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 360

Course Title	**Manufacturing Processes 2**	
Course Code	**MENG 360 / IENG 213**	
Prerequisites	MENG 202 - Solid Modeling and Workshop	
Classification within the curriculum	Compulsory (Track 3)	
Course Position in Study Plan	Spring (Semester 6)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	1.5
	TOTAL	6
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
The course examines material removal, machining operations: turning, milling and drilling, machine tools and machining setups, jigs and fixtures, broaching, sawing, filing, abrasive machining processes, thread and gear manufacturing, additive manufacturing, non traditional processes, mechanical energy processes, electrochemical machining processes, thermal energy processes, chemical machining
powder metallurgy, nems /mems, nanomaterials processes

Lab and Tutorials
The course requires practice in the mechanical workshop

Lab and Tutorials
The course requires practice in the mechanical workshop

(MENG) - MENG 391

Course Title	**Practical Training**	
Course Code	**MENG 391**	
Prerequisites	After 6th semester	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 7)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	
	TOTAL	3
EG Credit Hours	3	
ECTS	6	
Student Workload (SWL)	150	
Topic Category	Projects and Practical Training	
Topic Level	Program Requirements	

Description
A minimum of four weeks of practical training in off-campus sites elected by the department. Students are required to submit a recognition letter from the site where they received their training, in addition, a report and a presentation are submitted as well. Course is a Pass/Fail course.

Lab and Tutorials
Not Applicable

Literature
Not Applicable

(MENG) - MENG 401

Course Title	**Mechanical Vibrations**	
Course Code	**MENG 401**	
Prerequisites	MENG 102 - Engineering Mechanics II - Dynamics	MENG 307 - Modeling and Simulation of Dynamic Systems
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 7)	
Contact Hours	Lectures	3
	Tutorials	1
	Labs	1
	TOTAL	5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Program Requirements	

Description
Free and forced responses of one and two degree of freedom systems. Applications to engineering systems involving vibration isolation, rotating imbalance and vibration absorption. Elements of vibration measuring systems, frequency analysis of mechanical vibration, introduction to condition monitoring fault detection and passive vibration control techniques.

Tutorial:
Textbook problem solving with and without simulation tools (Matlab for example).
Experimental measurement and analysis of frequency response of SDOF system, vibration isolation, vibration modes of SDOF and 2 DOF systems.

Literature
Course Textbook:
- S. S. Rao, Mechanical Vibrations, 6th edition

Additional Resources:
- Lecture notes.

(MENG) - MENG 421

Course Title	**Automatic Control Systems**	
Course Code	**MENG 421**	
Prerequisites	MENG 307 - Modeling and Simulation of Dynamic Systems	
Classification within the curriculum	Compulsory (All Tracks)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The first course in control systems introduces:

Introduction to feedback control systems, Block Diagram Representation , Signal Flow Graph, Analyzing the performance of control systems either in open or closed loops, transient-response analysis and steady state error analysis, basic control actions (PID), tuning methods of PID controller, Steady State Error analysis, stability analysis through the Routh-Hurwitz. Software simulation primarily with MATLAB and laboratory experiments will complement and supplement the theory.

Lab and Tutorials

The labs are used to help students in implementing and designing conventional controller like PID as well as studying the stability of control systems.

Literature

1. Ogata K. Modern Control Engineering. Prentice Hall; 5 edition, 2009.
2. Dorf RC, Bishop RH. Modern Control Systems. Twelfth Edition, Prentice Hall, 2011

(MENG) - MENG 422

Course Title	**Pneumatics and Hydraulics Control Systems**	
Course Code	**MENG 422**	
Prerequisites	MENG 421 - Automatic Control Systems	
Classification within the curriculum	Compulsory (All Tracks)	
Course Position in Study Plan	Spring	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Hydraulics: Basics of fluid power transmission, operating principals of hydraulic systems, advantages and limitations, hydraulic systems elements structure and design considerations (pumps, hydraulic motors, cylinders, directional valves, control valves, auxiliaries, servo elements). Hydraulic system circuit design, power circuits, control and logic circuits, standard circuits, power packs and integrated circuits, piping and related matters, economic considerations, application of hydraulic systems in machinery. Mathematical modeling of hydraulic systems.

Pneumatics: Basics of power transmission by gas, operating principals of pneumatic systems, advantages and limitations, pneumatic systems elements structure and design considerations. Compressed air production technology and related problems, compressed network, piping design, economic considerations. Design of pneumatic circuits, application of pneumatic in special production machines. Mathematical modeling of hydraulic systems.

Lab and Tutorials

Students will be required to complete laboratory assignments and to perform practical projects.

Literature

1. Course Textbook: Andrew Parr. Hydraulics and Pneumatics. 3rd Edition ISBN: 978-0-08-096674-8

Additional Resources:

- Shizurou Konami, Takao Nishiumi (2016) Hydraulic Control Systems: Theory And Practice. Wspc
- Noah D. Manring. Hydraulic Control Systems. Wiley; 1 edition, 2005.

(MENG) - MENG 423

Course Title	**Digital Control Systems**	
Course Code	**MENG 423**	
Prerequisites	MENG 421 - Automatic Control Systems	MENG 324 - Signal Processing & Logic Design
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Introduction, Sampled data systems, Z-transform and its properties, Inverse of Z-transform, closed loop performance and stability, Digital PID control design, Pole placement digital control, Independent regulation and tracking pole placement control; Case Study.

Lab and Tutorials

The labs are used to help students in implementing and designing digital controllers as well as studying the stability of digital control systems

Literature

- Course Textbook: B. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
- K. Ogata, Discrete Time Control Systems, Prentice Hall, 2/e, 1995..

Additional Resources:

1. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.
2. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems,

(MENG) - MENG 424

Course Title	**Embedded Systems and Computer Interface**	
Course Code	**MENG 424**	
Prerequisites	MENG 324 - Signal Processing & Logic Design	MENG 326 - Computer Programming in Mechatronics Application
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Architectural Features of Micro Controllers; The Instruction Set: Instruction format, addressing modes; Interfacing of memory devices; Memory Mapping; Data transfer techniques and I/O ports; Timers; Counters; Programmable Interrupt and DMA controllers; I^2C Interface; General Purpose Input Output (GPIO); Interfacing of keyboard and display devices;

Interfacing of sensors, transducers, actuators, A/D & D/A Converters, Data acquisition systems; Standard Interfaces – RS232, USB; Development aids and troubleshooting techniques; Application examples; Case Study.

Lab and Tutorials

Students use Arduino kit to apply the course topics of Interfacing Basic I/O Devices like LED Display, Keypad. Usage of Timers & USART Peripherals, Multi-Port Device access, Stepper Motor Movement Control, Interfacing various peripherals for embedded applications; Building a complete microcontroller-based system. Introduction to Raspberry Pi kit.

Literature

1. Muhammad Ali Mazidi and Janice Gillispie Mazidi, “The 8051 – Microcontroller and Embedded systems”,7th Edition, Pearson Education , 2004.
2. A.K.Ray and K.M.Bhurchandi, “Advanced Microprocessors and Peripherals”,Tata McGrawHill,2000.
3. PC Interfacing Communications and Windows Programming, William Buchanan, Addison Wesley
4. M. A. Mustafa, Microcomputer Interfacing and Applications, Elsevier. ISBN: 978-0-7506-1752-9

(MENG) - MENG 425

Course Title	**Robotics**		
Course Code	**MENG 425**		
Prerequisites	MATH 206 - Nummerical Methods	MENG 306 - Kinematics and Dynamics of Mechanical Systems	MENG 421 - Automatic Control Systems
Classification within the curriculum	Compulsory (Track 1 and Track 3)		
Course Position in Study Plan	Spring		
Contact Hours	Lectures	3	
	Tutorials		
	Labs	1.5	
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

This is an introductory course in robotics for senior undergraduate and junior graduate students who have had little to no other introductory courses on the topic. The course focuses on topics in robotics that relate to modeling, dynamics, and control of robotic manipulators. Mathematical preliminaries include matrix and vector analysis, basic kinematics and kinetics, and classical (frequency-based) control theory. Some background on more advanced topics such as Lagrangian dynamics, and modern linear and non-linear dynamical system analysis will help. The course will also provide a gentle introduction to the ROS software development environment.

Lab and Tutorials

Students will be required to complete laboratory and tutorial assignments and to perform robotic projects.

Literature

1. Course Textbook: Robot Modeling and Control by Mark M. Spong, Seth Hutchinso, and M. Vidyasagar (ISBN: 9780471649908)

Additional Resources:

1. Bruno Siciliano, Oussama Khatib. Springer Handbook of Robotics 2008th Edition
2. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza. Introduction to Autonomous Mobile Robots. The MIT Press; second edition, 2011.

(MENG) - MENG 426

Course Title	**Industrial Control Systems**	
Course Code	**MENG 426**	
Prerequisites	MENG 324 - Signal Processing & Logic Design	
Classification within the curriculum	Compulsory (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Arithmetic and logic operations, usage of local and global memory locations, flags, comparators, subroutines, loops, labels, analogue module and real time monitoring, Introduction to OPC Servers, DCS and SCADA modules.

Lab and Tutorials
Labs should help students to have hands on practice on the PLC wiring, Interface, programming and control for different applications.

Literature
Course Textbook: Frank D. Petruzella: Programmable Logic Controllers, Mc-Graw Hill, 4th edition, 2011.

(MENG) - MENG 430

Course Title	**MEMS Devices and Systems**	
Course Code	**MENG 430**	
Prerequisites	MENG 321 - Electronic devices and applications	
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Introduction to MEMS technology, Benefits of Miniaturization, Fabrication technologies for MEMS (surface, bulk micromachining, and LIGA). MEMS Material. Basic sensing and actuation principles. Microsystems Design, MEMS packaging, assembly and testing. Clean Rooms and its instruments. Case study..

Lab and Tutorials
Tutorials should help students to implement Computer-aided design in MEMS and Microsystems

Literature
Course Textbook: Tai-Ran Hsu: MEMS and Microsystems: design, manufacture, and nanoscale engineering, John Wiley & Sons, 2nd edition 2008.

(MENG) - MENG 431

Course Title	**Advanced Mechatronics**	
Course Code	**MENG 431**	
Prerequisites	MENG 323 - Fundamentals of Mechatronics Engineering	
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The course is a follow up to the introductory mechatronics course and aims at covering advanced topics that are necessary in developing mechatronic systems. Foundational concepts in mechatronics and mechatronics systems including analog and digital electronis, Basic electronic circuits, Logic gates, Encoders / decoders, Dc and steppers motors, A/D and D/A conversion, Sensors, actuator, microprocessors, Microprocessor interfacing to electromechanical systems, Combining hardware and software into integrated mechatronics, and Hands on laboratory experiments with components and measurement equipment used in the design of mechatronics products

Lab and Tutorials

Students will be required to complete laboratory assignments and to perform an individual project.

Literature

1. Course Textbook: J.E.Carryer, R.M.Ohline, and T.W.Kenny, ” Introduction to Mechatronic design”, Latest Edition, PEARSON.

Additional Resources:

1. C.W. deSilva, " Mechatronics; An Integrated Approach," Latest Edition, CRC Press
2. M.B.Histand & D. G. Alciatore” Introduction to Mechatronics and Measurement Systems”, McGraw-Hill, Latest Edition..

(MENG) - MENG 432

Course Title	**Modern Control Systems**	
Course Code	**MENG 432**	
Prerequisites	MENG 421 - Automatic Control Systems	
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

This course includes the modelling in state space; State Space Representation of Scalar Differential Equations; State Space Representation of Transfer Function; Controllability; Observability; Pole Placement; Solving Pole Placement Problem Using MATLAB; Design of Servo Systems; State Observers; Design of Regulator System with Observer; Design of Control System with Observer; Quadratic Optimal Regulator; Introduction to Robust Control.

Lab and Tutorials

The labs are used to help students in implementing and designing control systems using MATLAB.

Literature

1. Ogata K. Modern Control Engineering. Prentice Hall; 5 edition, 2009.
2. Dorf RC, Bishop RH. Modern Control Systems. Twelfth Edition, Prentice Hall, 2011

(MENG) - MENG 433

Course Title	**Introduction to Autotronics**	
Course Code	**MENG 433**	
Prerequisites	MENG 325 - Computer Control of Manufacturing Processes	MENG 327 - Industrial Data Networks
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Spring/Fall	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The course covers the basics of Electronic systems, Input, Output signals, .Input Devices: Switches , Phototransistors , Hall –Effect Devices , Thermistors , Potentiometers , Photoresistors, Variable Reluctance devices , Piezoelectric Sensors . Input sensors: Position / Speed Sensors Crankshaft Position sensors, camshaft position sensor, Sensors Applications .Electronic control Unit (ECU) parts, memories, principle of operation . Internal Processing, RAMs, ADC and DAC. System outputs: Transistors, Actuators, Fueled injectors, Idle Speed control, ABS actuators. Engine load Sensors, Speed and Position Sensors, Temperature Sensors, O2- Sensors, Knock Sensors, Actuators, Relays, static switches, ignition actuators, and Cold start control, Display Devices, Auxiliary Electron.

Lab and Tutorials

Students will be required to complete Tutorial and laboratory assignments and to perform practical projects.

Literature

Course Textbook: Alma Hillier, Fundamentals of Automotive Electronics first edition, 2014.

Additional Resources: Fundamentals of Automotive Technology

(MENG) - MENG 434

Course Title	**Introduction to Autonomous Systems**	
Course Code	**MENG 434**	
Prerequisites	MENG 424 - Embedded Systems and Computer Interface	
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

This course introduces a various concepts and components of autonomous systems in an autonomous mobile robotics context. The main concepts covered include locomotion, vehicle kinematics, autonomous navigation and intelligent path planning and perception, control of robotic manipulators, machine vision, the dynamics of wheeled, air, space and underwater robots, navigation and localization. System components include various types of sensors and actuators and state-of-the-art technologies.

Lab and Tutorials

This is a project-based learning course.

Literature

Course Textbook:

Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, Introduction to Autonomous Mobile Robots

Additional Resources:

- Mobile Robots: Navigation, Control and Remote Sensing 1st Edition
- Introduction to Mobile Robot Control

(MENG) - MENG 435

Course Title	**Intelligent Control Systems**	
Course Code	**MENG 435**	
Prerequisites	MATH 104 - Linear Algebra	MENG 326 - Computer Programming in Mechatronics Application
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

In the robotics area, the computer vision applies AI techniques to the problem of making devices capable of interacting with the physical world. In this course, the emphasis is on the learning of artificial intelligence and machine learning techniques, which are important for mechatronics applications. Topics include mainly fuzzy logic, genetic algorithms, and neural networks.

Lab and Tutorials

It is a project based learning (PBL) course, and hence it is required to implement the algorithms learnt using Python, MatLab and/or C language. The labs are used to help students in implementing and understanding of the AI and machine learning algorithms.

Literature

Course Textbook:

Giuseppe Ciaburro, "MATLAB for Machine Learning: Practical examples of regression, clustering and neural networks" 2017

Additional Resources:

Class notes.

(MENG) - MENG 436

Course Title	**Computer Vision & Image processing**	
Course Code	**MENG 436**	
Prerequisites	MATH 104 - Linear Algebra	MENG 326 - Computer Programming in Mechatronics Application
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

In this course, an introduction to the theory and practice of computer vision. The students should be able to analyze the patterns in visual images with the view to understanding the objects and processes in the world that generate them. Major topics include image representation, image processing, feature extraction, and object recognition. The emphasis is on the learning of mathematical concepts and techniques for computer vision and its application in robotics area.

Lab and Tutorials

It is a project based learning (PBL) course, and hence it is required to implement the algorithms learnt using MatLab and/or C language. The labs are used to help students in implementing and understanding of the image processing and pattern recognition algorithms.

Literature

Course Textbook: R.C. Gonzalez and R.E. Woods: Digital Image Processing, Prentice-Hall, 3rd edition 2007.

(MENG) - MENG 437

Course Title	**Industrial Data Networks**	
Course Code	**MENG 437**	
Prerequisites	MENG 324 - Signal Processing & Logic Design	
Classification within the curriculum	Elective (Track 1)	
Course Position in Study Plan	Fall	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Networks Hierarchy And Switching – Open System Interconnection Model Of ISO – Data Link Control Protocol – Media Access Protocol – Command / Response – Token Passing – TCP/IP; Bridges – Routers – Gateways – Standard ETHERNET; RS 232, RS 485 Configuration Actuator Sensor (AS) – Interface; Fieldbus – Introduction – General Fieldbus Architecture – Basic Requirements Of Fieldbus Standard – Fieldbus Topology – Interoperability – Interchangeability; MODBUS Protocol Structure – Function Codes – Troubleshooting Profibus, Introduction, Profibus Protocol Stack, Profibus Communication Model – Communication Objects – System Operation – Troubleshooting – Review Of Foundation Fieldbus; Industrial Ethernet and wireless communication, 10 Mbps Ethernet, 100 Mbps Ethernet – Radio And Wireless Communication, Introduction, Components Of Radio Link.

Lab and Tutorials

Labs should help students to implement different industrial communication and network protocols.

Literature

- Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation And Troubleshooting' Newnes Publication, Elsevier First Edition, 2004.
- William Buchanan, Computer Buses, CRC Press, 2000.
- A. Behrouz Forouzan ,Data Communications & Networking ,3RD Edition, Tata Mc Graw Hill,2006

(MENG) - MENG 441

Course Title	**Finite Element Method and Applications in Mechanical Engineering**		
Course Code	**MENG 441**		
Prerequisites	MATH 205 - Differential Equations	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 305 - Fluid Mechanics I
Classification within the curriculum	Compulsory (Track 2 and Track 3)		
Course Position in Study Plan	Fall		
Contact Hours	Lectures	3	
	Tutorials	0.75	
	Labs	0.75	
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

Starting with an introduction to different numerical techniques, then the three basic approaches of the finite element method (FEM) namely; the direct approach, the variational approach and the weighted residual approach, are presented. The direct approach is used in the analysis of simple discrete systems e.g. pipelines, electric circuits, and trusses. Then the weighed residual procedure issued in the analysis of continuous systems. Programming for finite elements is also covered and students are encouraged to design and develop their FEM software. Modeling and simulation using a software package is also covered.

Laboratory and Tutorials

Modeling and simulation of different mechanical systems is covered using a computer software package. Applications covers fluid flow, heat transfer, and stress analysis.

Literature

- Fundamentals of Finite Element Analysis 1st Edition, D. Hutton.
- Class notes prepared by instructor and uploaded on Moodle.
- Help files of the selected software package

(MENG) - MENG 442

Course Title	**Combustion**		
Course Code	**MENG 442**		
Prerequisites	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Compulsory (track 2)		
Course Position in Study Plan	Spring (Semester 8)		
Contact Hours	Lectures	3	
	Tutorials	1.5	
	Labs		
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

Introduction to the topic, Combustion Modes and Flame Types, Combustion and thermochemistry, chemical kinetics, Coupling Chemical and Thermal

Analyses of Reacting Systems. Conservation Equations for Reacting Flows. Laminar premixed flames. Applications including the combustion process in spark and compression internal combustion engines.

Tutorial:

Help is provided for the course project. More examples are solved. Help is provided for the numerical simulation of the combustion process using a computer software package.

Literature

Course Textbook:

Stephen R. Turns, An Introduction to Combustion: Concepts and Applications, McGraw-Hill (2000)

Additional Resources:

- Lecture notes.
- Law C.K., Combustion physics, (2006
- H.N. Gupta "Fundamentals of Internal Combustion Engines", 2009
- J. Warnatz U. Maas R.W. Dibble, Combustion, Physical and Chemical Fundamentals, Modeling and Simulation, Experiments, Pollutant Formation. 4th Edition-Springer (2006)

(MENG) - MENG 443

Course Title	**Powerplant Technology**	
Course Code	**MENG 443**	
Prerequisites	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Compulsory (Track 2), Elective (Track 3)	
Course Position in Study Plan	Fall (Semester 9)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Steam and Gas turbine powerplants. Combined-cycle powerplants. Co-generation. Environmental impacts of powerplants. Circulating water systems. Energy storage. Introduction to Nuclear powerplants.

Tutorial
Help is provided concerning course project. Additionally, examples are solved to clarify concepts covered in the lectures.

Literature
- P. K. Nag, Power Plant Engineering, Tata McGraw-Hill Education, 2002.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 444

Course Title	**Internal combustion Engines**		
Course Code	**MENG 444**		
Prerequisites	MENG 343 - Heat Transfer II	MENG 401 - Mechanical Vibrations	MENG 442 - Combustion
Classification within the curriculum	Compulsory (Track 2)		
Course Position in Study Plan	Fall (Semester 9)		
Contact Hours	Lectures	3	
	Tutorials	0.75	
	Labs	0.75	
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

Starting with an overview of the topic, then description of internal combustion engines is introduced. The air-standard cycles namely the Otto, Diesel and the dual cycles are quickly reviewed followed by a step toward a better modelling for the cycles considering the fuel-air cycles. Then the actual cycles are considered. The heat transfer inside the engine and the cooling system are studied followed by the supercharging technology.

Tutorial:

SciLab program is used to solve all the examples presented in the textbook. More examples are covered during the tutorial and finally help is provided for the course project.

Literature

Course Textbook:

H.N. Gupta, Fundamentals of Internal Combustion Engines, Prentice-Hall of India Pvt. Ltd, 2006.

Additional Resources:

- Lecture notes.
- SciLab codes for the examples presented in the textbook are provided.

(MENG) - MENG 445

Course Title	**Turbomachinery I**		
Course Code	**MENG 445**		
Prerequisites	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Compulsory (Track 2)		
Course Position in Study Plan	Spring (Semester 8)		
Contact Hours	Lectures:	3	
	Tutorials:	1.5	
	Labs:		
	TOTAL:	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

The course aim is to give an introduction to turbomachinery and focuses on hydraulic machines. Topics include, Dimensionless analysis, Hydraulic pumps, Hydraulic turbines, Cavitation, Steam Turbines.

Lab and Tutorials

Teaching the students, the necessary skill for the successful design and operation of hydraulic machinery.

Literature

1. Course Textbook: **Turbomachinery: Design and Theory**. Rama S. R. Gorla and Aijaz A. Khan, 2003 Marcel Dekker, Inc.
2. Additional Resources:
   - **Fluid Mechanics and Thermodynamics of Turbomachinery**, ***7th edition***, S. Larry Dixon and Cesare Hall, 2013, Butterworth_Heinemann
   - Lecture notes

(MENG) - MENG 446

Course Title	**Refrigeration and Air-Conditioning**		
Course Code	**MENG 446**		
Prerequisites	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Compulsory (Track 2)		
Course Position in Study Plan	Spring (Semester 8)		
Contact Hours	Lectures:	3	
	Tutorials:	0.75	
	Labs:	0.75	
	TOTAL:	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

The aim of the course is to give an introduction to refrigeration and air-conditioning systems. Topics include, Fundamentals, Refrigeration cycles, refrigerants compressors, condensers, evaporators, expansion valves, Air – water vapor mixtures, Air treatment cycles, Air-conditioning lead estimation, air movement, Dehumidifiers and Air drying heat pumps and heat recovery.

Lab and Tutorials

Teaching the students, the skills needed for the design and sizing of refrigeration and air-conditioning systems.

Demonstrate the basic concepts learned during the course like the function of different components in a refrigeration and air-conditioning systems.

Literature

Course Textbook:

Refrigeration and Air Conditioning, *4th edition*. G. F. Hundy, A. R. Trott, T. C. Welch, 2008, Butterworth-Heinemann.

Additional Resources:

- Air Conditioning Principles and Systems: An Energy Approach, *4th edition*. Edwards G. Pita, 2001, Pearsons.
- Principles of Regeneration, Roy J. Dossat, 1997, Prentice Hall.
- Lecture notes

(MENG) - MENG 451

Course Title	**Renewable Energy Systems Engineering**	
Course Code	**MENG 451**	
Prerequisites	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Elective (Track 2 and Track 3)	
Course Position in Study Plan	Fall/Spring (Semester 8 or 9)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

This course introduces renewable energy technologies. Emphasizes exploration of principles and concepts as well as the application of renewable energy technologies (RET). Explores topics such as energy consumption, the pros and cons of renewable energy, energy production and cons, energy conversion, environmental issues and concerns, biomass and biofuels, geothermal, wind, power, solar power, nuclear power, and hydropower systems.

Tutorial

Help is provided concerning course project. Additionally, examples are solved to clarify concepts covered in the lectures.

Literature

- Ngo C., Natowitz J. Our Energy Future: Resources, Alternatives and the Environment, 2016.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 452

Course Title	**Computational Thermo-Fluid Mechanics**		
Course Code	**MENG 452**		
Prerequisites	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Elective (Track 2)		
Course Position in Study Plan	Fall/Spring (Semester 8 or 9)		
Contact Hours	Lectures	3	
	Tutorials	0.75	
	Labs	0.75	
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description
This is the third part of a three-part series of courses (Fluid Mechanics II and Heat Transfer II) designed to provide core knowledge of the fundamental principles and engineering applications ofheat transfer and fluid mechanics. These areas collectively make up the field of Thermo-Fluid Mechanics or Thermal Fluid Sciences but are traditionally taught as separate courses. However, in this course, these areas are presented in a more integrated manner. The finite difference method (FDM) is presented in detail and applied to various types of partial differential equations representing the wave equation, heat equation and Laplace equation. Then the upwinding concept is introduced to deal with convected-dominated flows. Then stability analysis is discussed for different finite difference schemes. The domain-based numerical techniques namely the finite volume method (FVM) and finite element method (FEM) are briefly introduced.
In parallel to the theoretical concepts, a computer software package is used for the simulation of different multi-physics applications.

Tutorial:
Help is provided for the course project as well as examples are solved to clarify concepts covered in the lectures.
Lab:
A computer lab is designed to help the students with the selected software package and the physical interpretations of the results.

Literature
Course Textbook:
Klaus A. Hoffmann, Computational Fluid Dynamics for Engineers. Engineering Education System.
Additional Resources:
- Lecture notes.

(MENG) - MENG 453

Course Title	**Introduction to Continuum Mechanics**	
Course Code	**MENG 453**	
Prerequisites	MENG 201 - Introduction to Solid Mechanics and Strength of Materials	MENG 344 - Fluid mechanics II
Classification within the curriculum	Elective (Track 2 and Track 3)	
Course Position in Study Plan	Fall/Spring (Semester 8 or 9)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

The main goal of this course is to present a unified, mathematically rigorous approach to the two classical branches of mechanics problems: the mechanics of fluids and the mechanics of solids. Topics will include Introduction to tensor calculus, kinematics, the general balance equation, balance laws (mass, momentum, and energy), the entropy inequality, and an introduction to the constitutive theory.

Tutorial

Help is provided for the course project. Additionally, examples are solved to clarify concepts covered in the lectures.

Literature

- M. Epstein, The Elements of Continuum Biomechanics, 1st edition.
- E. Tadmor, R. E. Miller, R. S. Elliott, Continuum Mechanics and Thermodynamics: From Fundamental Concepts to Governing Equations, Cambridge University Press, New York, 2012.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 454

Course Title	**Water Desalination**		
Course Code	**MENG 454**		
Prerequisites	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II	MENG 401 - Mechanical Vibrations
Classification within the curriculum	Elective (Track 2 and Track 3)		
Course Position in Study Plan	Fall/Spring (Semester 8 or 9)		
Contact Hours	Lectures	3	
	Tutorials	1.5	
	Labs		
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

Theoretical and practical aspects of seawater/brackish water desalination technologies, including thermal-based, and membrane-based desalination processes; process design and system performance; fouling, scaling and cleaning; product water quality and post-treatment, innovative desalination technologies (Forward Osmosis (FO), Membrane Distillation (MD), Adsorption Desalination (AD))

Tutorial

Help is provided concerning course project. Additionally, examples are solved to clarify concepts covered in the lectures.

Literature

- Mark Wilf, The Guidebook to Membrane Desalination Technology. Balaban Desalination Publications, 2007.
- H.T. El-Dessouky, H.M. Ettouney, Fundamentals of Salt Water Desalination, Elsevier Science B.V. 2002.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 455

Course Title	**Turbomachinery II**		
Course Code	**MENG 455**		
Prerequisites	MENG 342 - Thermodynamics II	MENG 343 - Heat Transfer II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Elective (Track 2)		
Course Position in Study Plan	Fall/Spring (Semester 8 or 9)		
Contact Hours	Lectures:	3	
	Tutorials:	1.5	
	Labs:		
	TOTAL:	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description
The course aim is to give an introduction to turbomachinery and focuses on Aero turbomachinery. Topics include, Dimensionless analysis, Centrifugal Compressors and Fans, Axial flow compressors and fans, Axial and Radial flow gas turbines.

Lab and Tutorials
Teaching the students the necessary skill for the successful design and operation of Aero turbomachinery.

Literature
Course Textbook:
Turbomachinery: Design and Theory. Rama S. R. Gorla and Aijaz A. Khan, 2003 Marcel Dekker, Inc.
Additional Resources:

- Gas turbine Theory, *7th edition*. H.I.H. Saravanamuttoo, G.F.C. Rogers, H. Cohen, Paul Straznicky and Andrew Nix, 2017, Pearson
- Fluid Mechanics and Thermodynamics of Turbomachinery, *7th edition*, S. Larry Dixon and Cesare Hall, 2013, Butterworth_Heinemann

(MENG) - MENG 456

Course Title	**Nuclear Powerplant Engineering**	
Course Code	**MENG 456**	
Prerequisites	MENG 342 - Thermodynamics II	MENG 344 - Fluid mechanics II
Classification within the curriculum	Elective (Track 2 and Track 3)	
Course Position in Study Plan	Fall/Spring (Semester 8 or 9)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Introduction to nuclear engineering principles - the generation, transfer and transmission of energy in nuclear reactor - nuclear powerplant layout and location selection - the pressurized water reactors - boiling water reactors - gas-cooled reactors - fast reactors - the future of nuclear fusion - Nuclear powerplant dynamics and control - Nuclear powerplant safety.

Tutorial

Help is provided concerning course project. Additionally, examples are solved to clarify concepts covered in the lectures.

Literature

- James H. Rust, Nuclear Power Plant Engineering. Haralson Publishing Company.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 457

Course Title	**Advanced Selected Topic in Mechanical Power**	
Course Code	**MENG 457**	
Prerequisites	MENG 441 - Finite Element Method and Applications in Mechanical Engineering	Senior Standing
Classification within the curriculum	Elective (Track 2)	
Course Position in Study Plan	Spring (Semester 8)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Specialized topics in thermal sciences and renewable energy are studied with case studies.

Tutorials
Regular weekly problem solving tutorial sessions are conducted. Help is provided for the course project.

Literature
- Textbooks decided upon topics decided by students and instructor.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 461

Course Title	**Failure of Mechanical Components and Prevention**	
Course Code	**MENG 461**	
Prerequisites	MENG 203 - Introduction to Manufacturing Processes	MENG 303 - Machine Design
Classification within the curriculum	Compulsory (Track 3)	
Course Position in Study Plan	Fall (Semester 7)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Mechanical failure mechanisms. Introduction to fracture mechanics. Encountered modes of failure including: fracture due to fatigue, buckling, impact, thermal shock, corrosion and erosion, wear, and creep. Diagnosis and prevention of component failures with application on case studies. Project required.

Tutorials
Regular weekly problem-solving tutorial sessions are conducted.

Literature
- "Deformation and Fracture Mechanics of Engineering Materials", Richard W. Hertzberg. WILEY, 4th edition.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 462

Course Title	**Selection of Materials and Processes for Design**		
Course Code	**MENG 462**		
Prerequisites	MENG 205 - Economics and Project Management in Mechanical Engineering	MENG 301 - Mechanical Behavior of Engineering Materials	MENG 303 - Machine Design
Classification within the curriculum	Compulsory (Track 3)		
Course Position in Study Plan	Fall (Semester 9)		
Contact Hours	Lectures	3	
	Tutorials	1.5	
	Labs		
	TOTAL	4.5	
EG Credit Hours	3		
ECTS	5		
Student Workload (SWL)	125		
Topic Category	Engineering Applications		
Topic Level	Specialization Requirements		

Description

Effect of material properties and manufacturing processes on component design. Failure of mechanical components and structures in service. Study of economics of materials and manufacturing processes for component design. Decision making for adequate material selection process with application on case studies. Project required.

Tutorials

Regular weekly problem-solving tutorial sessions are conducted.

Literature

- "Materials and Process Selection for Engineering Design", Mahmoud M. Farag. CRC Press, 3rd edition.
- "Materials Selection in Mechanical Design", Michael Ashby. Butterworth-Heinemann, 4th edition.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 463

Course Title	**Computer-Aided Design and Prototyping**	
Course Code	**MENG 463 / IENG 314**	
Prerequisites	MENG 202 - Solid Modeling and Workshop	
Classification within the curriculum	Compulsory (Track 3)	
Course Position in Study Plan	Spring (Semester 9)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Introduction to CAD/CAM software and hardware. Three-dimensional geometric modelling. Study of types of curves and surfaces. Data capturing, surface fitting, and rapid prototyping techniques. Utilization of interactive computer graphics packages. Utilizing CAD/CAM software to generate G-code, 3D LASER digitizer scanner, 3D printer, FARO arm, and other CAD/CAM peripherals. Project required.

Laboratory
Regular weekly conducted laboratory sessions utilizing CAD/CAM software and hardware peripherals.

Literature
- "CAD, 3D Modeling, Engineering Analysis, and Prototype Experimentation", Jeremy Zheng Li. Springer, 1st edition 2015.
- SolidWorks, User's Guide 2016, Dassault Systèmes.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 464

Course Title	**Design of Engineering Systems**	
Course Code	**MENG 464**	
Prerequisites	MENG 203 - Introduction to Manufacturing Processes	MENG 303 - Machine Design
Classification within the curriculum	Compulsory (Track 3)	
Course Position in Study Plan	Spring (Semester 8)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	
	TOTAL	3
EG Credit Hours	2	
ECTS	3	
Student Workload (SWL)	75	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Elements of mechanical system architecture. Holistic view of a mechanical/engineering system and break down from the system level to subsystem level down to component level. Product versus process driven design objectives. Synthesis and analysis in design of systems. This course develops students' skills to conceive, organize, lead, implement, and evaluate successful design. Case studies. A section is dedicated to the design of machine tools.

Laboratory

Not Applicable

Literature

- "System Engineering Analysis, Design, and Development: Concepts, Principles, and Practices", Charles S. Wasson, WILEY, 2nd edition 2015.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 465

Course Title	**Machine Design II**	
Course Code	**MENG 465**	
Prerequisites	MENG 303 - Machine Design	
Classification within the curriculum	Compulsory (Track 3)	
Course Position in Study Plan	Spring (Semester 8)	
Contact Hours	Lectures	3
	Tutorials	0.75
	Labs	0.75
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Design of machine elements used in power transmission such as couplings, gears, brakes and clutches, roller chain drives, and bearings. Stresses and deformations in rotating cylinders and disks. Design factors and theories of failure to design of machine elements. CAD software is extensively utilized. Project required.

Laboratory
Regular weekly problem-solving tutorial sessions are conducted.

Literature
- "Machine Elements in Mechanical Design", Robert L. Mott, Pearson, 5th edition.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 466

Course Title	**Fault Diagnosis utilizing Vibrations Analysis**	
Course Code	**MENG 466**	
Prerequisites	MENG 401 - Mechanical Vibrations	MENG 465 - Machine Design II
Classification within the curriculum	Elective (Track 3)	
Course Position in Study Plan	Spring (Semester 8)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	1.5
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description

Basics of maintenance. Basics of machinery vibration. Data acquisition and signal recording on MATLAB. Signal analysis. Signal processing using MATLAB. Basics of instrumentation and transducers. Vibrations and noise measurements. Faults in rotating machine elements. Faults in bearings and gears, Diagnostic charts. Motor current signature analysis. Wear and debris analysis. Non-destructive test techniques. Case studies.

Laboratory

Regular weekly conducted laboratory sessions utilizing Siemens LMS.

Literature

- "Machinery Condition Monitoring: Principles and Practices", A. R. Mohanty. CRC Press, 2014
- MATLAB. User's Guide Release 2009a. The MathWorks, Inc. Natick, Massachusetts, United States.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 469

Course Title	**Selected Topics in Design**	
Course Code	**MENG 469**	
Prerequisites	MENG 344 - Fluid mechanics II	Senior Standing
Classification within the curriculum	Elective (Track 3)	
Course Position in Study Plan	Fall (Semester 7) or Spring (Semester 8)	
Contact Hours	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL)	125	
Topic Category	Engineering Applications	
Topic Level	Specialization Requirements	

Description
Specialized topics in design are studied with case studies such as advanced solid mechanics and strength of materials, finite-elements method and applications in design, power plant analysis and design, design of manufacturing tools, design of materials-handling equipment, fluid machinery and power systems…etc. Project required.

Tutorials
Regular weekly problem-solving tutorial sessions are conducted.

Literature
- Textbooks decided upon topics decided by students and instructor.
- Class notes prepared by instructor and uploaded on Moodle.

(MENG) - MENG 493

Course Title	**Graduation Project I**	
Course Code	**MENG 493**	
Prerequisites	Senior Standing	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring (Semester 8)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	
	TOTAL	3
EG Credit Hours	3	
ECTS	6	
Student Workload (SWL)	180	
Topic Category	Projects and Practical Training	
Topic Level	Program Requirements	

Description
Application-oriented capstone project to show competence in major academic area, where an independent research project is conducted under the guidance of a faculty member in the MENG Department. The research should contribute to the advancement of knowledge in the field. Written report and formal presentation are required.

Lab and Tutorials
Not Applicable

Literature
Not Applicable

(MENG) - MENG 495

Course Title	**Graduation Project II**	
Course Code	**MENG 495**	
Prerequisites	MENG 493 - Graduation Project I	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Fall (Semester 9)	
Contact Hours	Lectures	3
	Tutorials	
	Labs	
	TOTAL	3
EG Credit Hours	3	
ECTS	6	
Student Workload (SWL)	180	
Topic Category	Projects and Practical Training	
Topic Level	Program Requirements	

Description
Continuation and completion of the capstone project.

Lab and Tutorials
Not Applicable

Literature
Not Applicable

(MENG) - NSCI 102

Course Title	**Selected Topics in Environmental Science**	
Course Code	**NSCI 102**	
Prerequisites	None	
Classification within the curriculum	Compulsory	
Course Position in Study Plan	Spring	
Contact Hours (weekly)	Lectures	3
	Tutorials	1.5
	Labs	
	TOTAL	4.5
EG Credit Hours	3	
ECTS	5	
Student Workload (SWL) / semester	125	
Topic Category	Engineering Culture	
Topic Level	Program Requirements	

Description
A course in any of the fields of environmental sciences related to the discipline it is offered to.