Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Stochastic Processes	**EMÜ439**	Fall/Spring	3	0	0	3	6
Prerequisites	EMÜ321 – Stochastic Operations Research						
Course language	English						
Course type	Elective						
Mode of Delivery							
Learning and teaching strategies	Lectures, discussions, problem solving, and individual studies.						
Instructor (s)							
Course objective	To develop skills to approximate real life stochastic processes under certain assumptions						
Learning outcomes	Upon completion of this course, the students are expected to • Analyze Poisson processes • Recognize renewal processes and apply them for analysis • Analyze queueing systems with continuous time Markov processes and renewal processes						
Course Content	Renewal processes, Poisson processes, Markov Processes with Countable State Spaces, Applications to Queueing system analysis						
References	Pinsky, M.A. and Karlin, S. (2010), *An Introduction to Stochastic Modeling*, 4th Edition, Academic Press Gallager, R. G. (2014), *Stochastic Processes: Theory for Applications*, 1st Edition, Cambridge University Press Shortle, J. F., Thompson, J. M., Gross, D. and Harris, C. M. (2018), *Fundamentals of Queueing Theory*, 5th Edition, Wiley						

Course Outline Weekly

Weeks	Topics
1.	Introduction and Review of Probability
2.	Definition and Properties of Poisson processes
3.	Combining and Splitting Poisson Processes
4.	Non-homogeneous Poisson processes
5.	Definition of renewal processes
6.	Asymptotic behavior of renewal processes
7.	Renewal reward processes
8.	Birth-death processes
9.	Uniformization
10.	Midterm Exam
11.	Little's Law
12.	Simple Markovian Queueing Systems
13.	Simple Markovian Queueing Systems with Capacity Constraints
14.	Advanced Markovian Queueing Systems
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	Number	Percentage
Attendance		
Laboratory		
Application		
Field activities		
Specific practical training		
Assignments	4	10%
Presentation		
Project		
Seminar		
Midterms	1	40%
Final exam	1	50%
Total	6	100%
Percentage of semester activities contributing grade success		50%
Percentage of final exam contributing grade success		50%
Total		100%

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory			
Application			
Specific practical training			
Field activities			
Study Hours Out of Class (Preliminary work, reinforcement, etc.)	14	4	56
Presentation / Seminar Preparation			
Project			
Homework assignment	4	8	32
Midterms (Study duration)	1	20	20
Final Exam (Study duration)	1	30	30
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1					X
2					X
3			X		
4			X		
5		X			
6			X		
7	X				
8	X				
9	X				
10	X				

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Special Topics in Industrial Engineering (Heuristic Methods for Optimization)	**EMÜ492**	Fall/ Spring	3	-	-	3	6
Prerequisites	None						
Course language	English						
Course type	Elective						
Mode of Delivery							
Learning and teaching strategies	Lectures, problem solving, discussions, individual and group studies.						
Instructor (s)	To be determined by the department						
Course objective	• To gain insight about the basic search procedures and the most common basic heuristic methods • To analyze some common modern heuristic methods, such as simulated annealing, genetic algorithms, and tabu search • To give knowledge on developing and comparing performance of heuristic methods						
Learning outcomes	By completion of this course; students will be able to • Explain the most common heuristic methods for solving real world problems • Implement the most common heuristic methods for solving real world problems • Compare and evaluate the performance of the heuristic methods						
Course Content	• Fundamental concepts of heuristics • Basic search methods and heuristics • Swarm intelligence • Simulated annealing • Tabu search • Genetic algorithms • Variable neighborhood search • Performance evaluation and comparison of heuristics						
References	• Reeves, C. R., Modern Heuristic Techniques for Combinatorial Problems, 1993, John Wiley & Sons. • Talbi, E. G., Metaheuristics: from design to implementation, 2009, John Wiley & Sons. • Dréo, J., Pétrowski, A., Siarry, P., & Taillard, E., Metaheuristics for hard optimization: methods and case studies, 2006, Springer Science & Business Media.						

Course Outline Weekly

Weeks	Topics
1.	Fundamental concepts of heuristics
2.	Basic search methods and heuristics
3.	Basic search methods and heuristics
4.	Simulated annealing
5.	Simulated annealing
6.	Tabu search
7.	Tabu search
8.	Genetic algorithms
9.	Genetic algorithms
10.	Swarm intelligence
11.	Swarm intelligence
12.	Variable neighborhood search
13.	Performance evaluation and comparison of heuristics
14.	Project Presentations and Discussions
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	**Number**	**Percentage**
Attendance		
Laboratory		
Application		
Field activities		
Specific practical training		
Assignments	5	% 20
Presentation	1	% 10
Project	1	% 30
Seminar		
Midterms		
Final exam	1	% 40
Total	8	% 100
Percentage of semester activities contributing grade success		% 60
Percentage of final exam contributing grade success		% 40
Total		% 100

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory			
Application			
Specific practical training			
Field activities			
Study Hours Out of Class (Preliminary work, reinforcement, etc.)	14	3	42
Presentation / Seminar Preparation	1	10	10
Project	1	40	40
Homework assignment			
Midterms (Study duration)	1	18	18
Final Exam (Study duration)	1	28	28
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1			X		
2			X		
3		X			
4			X		
5				X	
6					X
7			X		
8		X			
9			X		
10			X		

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Supply Chain Management	**EMÜ446**	Fall/ Spring	3	-	-	3	6
Prerequisites	None						
Course language	English						
Course type	Elective						
Mode of Delivery							
Learning and teaching strategies	Lectures, problem solving, discussions, individual and group studies.						
Instructor (s)	To be determined by the department						
Course objective	• The objective of this course is to develop students? ability to analyze and solve different types of supply chain problems						
Learning outcomes	By completion of this course; students will be able to • Define the fundamental components of a supply chain and explain the interactions among these components and related performance measures • Design logistics network • Compute the value of information and discuss the benefits obtained through information sharing • Discuss inventory planning problems in supply chains and propose appropriate control policies • Analyze the interactions of the strategic decisions of the players in a supply chain and report these interactions • Search for the recent practices related with supply chain and report them						
Course Content	• Introduction to supply chain and components of supply chain • Design issues in supply chain • Logistics network design • Inventory planning problems in supply chain • Value of information • Competititive and collaborative relations among players • Supply chain integration						
References	• Simchi Levi, D., Kaminsky, P. , Simchi-Levi, E. (2008) Designing and Managing the Supply Chain: Concepts, Strategies and Cases, 3rd ed. McGraw Hill. • Chopra, S., Meindl, P. (2007) Supply Chain Management, 3rd ed. Prentice Hall. • Silver E.A., Pyke D.F. and Peterson, R. (1998) Inventory Management, Production Planning and Scheduling, 3rd ed. Wiley. • Axsäter, S. (2006) Inventory Control, Springer Verlag. • Nahmias, S. (2008) Production and Operations Analysis, 6th ed. McGraw Hill.						

Course Outline Weekly

Weeks	Topics
1.	Introduction to Supply Chain Management
2.	Supply Chain Components and Metrics
3.	Network Design in the Supply Chain
4.	Network Design in the Supply Chain
5.	Network Design in the Supply Chain
6.	Managing Economies of Scale in a Supply Chain: Cycle Inventory
7.	Managing Economies of Scale in a Supply Chain: Safety Inventory
8.	Determining the Optimum Level of Product Availability
9.	Midterm Exam
10.	Sourcing Decisions in a Supply Chain
11.	Bullwhip effect
12.	Supply chain contracts
13.	Supply chain contracts
14.	Coordination in a Supply Chain
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	Number	Percentage
Attendance		
Laboratory		
Application		
Field activities		
Specific practical training		
Assignments	4	% 20
Presentation	2	% 10
Project	2	% 20
Seminar		
Midterms	1	%20
Final exam	1	% 40
Total		% 100
Percentage of semester activities contributing grade success		% 60
Percentage of final exam contributing grade success		% 40
Total		% 100

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory			
Application			
Specific practical training			
Field activities			
Study Hours Out of Class (Preliminary work, reinforcement, etc.)	12	3	36
Presentation / Seminar Preparation	2	6	12
Project	2	22	44
Homework assignment	4	4	16
Midterms (Study duration)	1	12	12
Final Exam (Study duration)	1	18	18
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1			X		
2				X	
3					X
4					X
5					X
6		X			
7		X			
8	X				
9	X				
10					X

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Decision Support Systems	**EMÜ413**	Fall/ Spring	3	-	-	3	6
Prerequisites	None						
Course language	English						
Course type	Elective						
Mode of Delivery							
Learning and teaching strategies	Lectures, problem solving, project design/management, question and answer, preparing and presenting reports, discussions, individual and group studies.						
Instructor (s)	To be determined by the department						
Course objective	• The objective of this course is to enable students acquire knowledge on the theoretical fundamentals, applications and development of decision support systems.						
Learning outcomes	By completion of this course; students will be able to • Define the development process of decision support systems and perform the process • Explain the effect of decision support systems on decision making. • Analyze the main concepts associated with modeling business decisions. • Distinguish different types of decision support systems and their differences; choose the convenient ones for problems and implement them • Model the group decision support systems in uncertain environment by considering appropriate approaches such as Cognitive Mapping. • Describe the effect of artificial intelligence process in Decision Support Systems.						
Course Content	• Methodologies and technologies of Decision Support Systems • Modeling and decision making • Analysis and optimization • Data modeling, data warehousing and distributed databases • Life cycles • Design principles • Group Decision Support Systems • Artificial Intelligence						
References	• Turban E., Aronson, J.E., Liang, T-P. (2010) Decision Support Systems and Intelligent Systems, Ninth Edition, Prentice Hall, 2010. • Marakas, G. (2003) Decison Support Systems, George Marakas, Prentice-Hall. • Holsapple, C.W., Whinston, A.B. (1996) Decision Support Systems: A Knowledge Based Approach, , 10th edition, West Group.						

Course Outline Weekly

Weeks	Topics
1.	Methodologies and technologies of Decision Support Systems
2.	Modelling and decision making in Decision Support Systems
3.	Analysis and optimization in Decision Support Systems
4.	Analysis and optimization in Decision Support Systems
5.	Data modelling in Decision Support Systems
6.	Data modelling in Decision Support Systems
7.	Data warehousing and distributed databases in Decision Support Systems
8.	Data warehousing and distributed databases in Decision Support Systems
9.	Midterm
10.	Life cycles of Decision Support Systems
11.	Design principles of Decision Support Systems
12.	Group Decision Support Systems
13.	Artificial Intelligence in Decision Support Systems
14.	Project Presentation
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	**Number**	**Percentage**
Attendance		
Laboratory		
Application		
Field activities		
Specific practical training		
Assignments		
Presentation		
Project	1	% 30
Seminar		
Midterms	1	%30
Final exam	1	% 40
Total		% 100
Percentage of semester activities contributing grade success		% 60
Percentage of final exam contributing grade success		% 40
Total		% 100

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory			
Application			
Specific practical training			
Field activities			
Study Hours Out of Class (Preliminary work, reinforcement, etc.)	12	4	48
Presentation / Seminar Preparation	1	8	8
Project	1	40	40
Homework assignment			
Midterms (Study duration)	1	18	18
Final Exam (Study duration)	1	24	24
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1			X		
2				X	
3					X
4					X
5			X		
6				X	
7			X		
8	X				
9	X				
10	X				

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Introduction to Regression Analysis	**EMÜ334**	Fall/ Spring	3	-	-	3	6
Prerequisites	EMÜ231 or EMÜ232						
Course language	English						
Course type	Elective						
Mode of Delivery	Distance Education						
Learning and teaching strategies	Lectures, problem solving, discussions, project design and management, individual and group studies.						
Instructor (s)	To be determined by the department						
Course objective	This course enables students to develop skills to build regression models to analyze engineering problems, make predictions and use a regression analysis software						
Learning outcomes	By completion of this course; students will be able to • Estimate single and multiple regression model parameters and test their statistical significance • Predict new observations • Check model adequacy • Make convenient variable transformations • Select variables • Use a statistical software for regression analysis and interpret the output of analysis on the content of the course • Perform the regression analysis to determine the relation between the data obtained from the real products, processes and systems						
Course Content	• Regression and model building • Simple linear regression • Least squares estimation of parameters • Prediction of new observations • Multiple linear regression • Model adequacy checking • Variable transformations • Variable selection • Indicator variables						
References	• Montgomery, D.C., Peck, E.A., Vining, G.G. (2012) Introduction to Linear Regression Analysis. 5th ed., Wiley Interscience.						

Course Outline Weekly

Weeks	Topics
1.	Introduction to regression and model building
2.	Simple linear regression - least squares estimation
3.	Simple linear regression - estimation, prediction
4.	Multiple linear regression - least squares estimation
5.	Multiple linear regression - estimation,prediction
6.	Model adequacy checking - residual analysis
7.	Model adequacy checking - PRESS statistics, outliers, lack of fit
8.	Transformations
9.	Midterm exam
10.	Diagnostics for leverage and influence
11.	Indicator variables
12.	Variable selection and model building
13.	Case studies
14.	Case studies
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	**Number**	**Percentage**
Attendance	13	10
Laboratory	0	0
Application	0	0
Field activities	0	0
Specific practical training	0	0
Assignments	0	0
Presentation	0	0
Project	1	25
Seminar	0	0
Midterms	1	25
Final exam	1	40
Total		% 100
Percentage of semester activities contributing grade success		% 60
Percentage of final exam contributing grade success		% 40
Total		% 100

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory	0	0	0
Application	0	0	0
Specific practical training	0	0	0
Field activities	0	0	0
Study Hours Out of Class (Preliminary work, reinforcement, ect)	12	5	60
Presentation / Seminar Preparation	0	0	0
Project	1	40	40
Homework assignment	0	0	0
Midterms (Study duration)	1	16	16
Final Exam (Study duration)	1	22	22
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1			X		
2					X
3			X		
4					X
5			X		
6				X	
7			X		
8		X			
9		X			
10		X			

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Quality Management	**EMÜ332**	Fall/ Spring	3	-	-	3	6
Prerequisites	None						
Course language	English						
Course type	Elective						
Mode of Delivery	Distance Education						
Learning and teaching strategies	Lectures, question and answer, discussions, preparing and presenting reports, individual and group studies.						
Instructor (s)	To be determined by the department						
Course objective	• The objective of the course is to enable students to acquire knowledge on the state-of-the-art quality management initiatives and quality standards, understand the impact of quality management on the competitive business environment and acquire skills to build quality into products /processes for improving customer satisfaction and productivity.						
Learning outcomes	By completion of this course; students will be able to • Discuss the quality management concepts • Define the dimensions of quality and explain the quality costs • Distinguish the differences between quality views • Compare the total quality management and six sigma approach • Explain and implement the principles of quality function deployment • Describe the steps of failure modes and effect analysis and perform them • Identify the differences between quality approaches in US, Japan and PRC						
Course Content	• Quality concepts and their historical development • Dimensions of quality • Quality costs • Quality circles • Quality function deployment • Failure modes and effects analysis • Quality assurance • Total quality management • Six sigma • ISO 9000 standards						
References	• Besterfield,D.H., Michna, C.B., Besterfield, G.H., Sacre, M.B. (2003). Total Quality Management, Prentice Hall, NJ. • Summers, D.C.S. (2009) Quality Management-Creating and Sustaining Organizational Effectiveness. 2nd ed., Pearson,NJ, 2009. • Montgomery,D.C.,Jennings,C.L.,Pfund,M.E.(2010) Managing, Controlling, and Improving Quality, John Wiley and Sons. • Garvin, D.A. (1987) "Competing on the Eight Dimensions of Quality", Harvard Business Review, Vol: 65, no. 6, pg. 101-109. • Garvin, David A. (1986) "A Note on Quality: The Views of Deming, Juran, and Crosby" Harvard Business School Note 687-011.						

	• Hagan, J.T. (ed.). Principles of Quality Costs, American Society for Quality Control, Wisconsin, 1986. • America's Quality Coaches: Deming, Juran, Crosby, Conway. • Taguchi, G., Clausing, D. (1990) "Robust Quality", Harvard Business Review, pg. 65-75. • Juran, J.M., Godfrey, A.B. (1999). Juran's Quality Handbook. 5th ed., McGraw-Hill.

Course Outline Weekly

Weeks	Topics
1.	Management aspects of quality
2.	8 Dimensions of Quality, Quality Costs
3.	Views and contributions of Deming, Juran, Crosby, Taguchi
4.	Total Quality in Organizations
5.	Leadership,Quality Statements,Strategic Planning
6.	Hoshin Kanri, Poka Yoke
7.	Quality Management Systems
8.	Six Sigma Methodology
9.	Midterm exam
10.	Six Sigma Methodology
11.	TQM vs Six Sigma
12.	Quality Function Deployment
13.	Failure Modes and Effects Analysis
14.	Quality in the US, Japan, and PRC, effects of quality problems on companies success
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	Number	Percentage
Attendance	13	5
Laboratory	0	0
Application	0	0
Field activities	0	0
Specific practical training	0	0
Assignments	0	0
Presentation	3	30
Project	0	0
Seminar	0	0
Midterms	1	25
Final exam	1	40
Total	8	% 100
Percentage of semester activities contributing grade success		% 60
Percentage of final exam contributing grade success		% 40
Total		% 100

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory	0	0	0
Application	0	0	0
Specific practical training	0	0	0
Field activities	0	0	0
Study Hours Out of Class (Preliminary work, reinforcement, ect)	12	4	48
Presentation / Seminar Preparation	3	17	51
Project	0	0	0
Homework assignment	0	0	0
Midterms (Study duration)	1	15	15
Final Exam (Study duration)	1	24	24
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1			X		
2		X			
3					X
4		X			
5			X		
6	X				
7				X	
8				X	
9			X		
10	X				

Course Name	Code	Semester	Theory (hours/week)	Application (hours/week)	Laboratory (hours/week)	National Credit	ECTS
Applied Operations Research	**EMÜ324**	Fall/ Spring	3	-	-	3	6
Prerequisites	EMÜ221 veya EMÜ222						
Course language	English						
Course type	Elective						
Mode of Delivery							
Learning and teaching strategies	Lectures, problem solving, discussions, case study, individual and group studies.						
Instructor (s)	To be determined by the department						
Course objective	• The objective of this course is to introduce the operations research models and quantitative techniques necessary to solve large-scale real world problems, give a practical view of operations research and develop students' skills to use computer software to analyze and solve large-scale problems.						
Learning outcomes	By completion of this course; students will be able to • Model and solve large-scale real problems and interpret the results • Use advanced topics of operations research for the problem specific cases and report the interpretation of results • Analyze the applications of deterministic models of operations research such as transportation and assignment problems, network models, integer programming, and dynamic programming • Analyze the classical and recent applications of stochastic models of operations research such as queueing theory, game theory, and inventory systems • Perform the applied studies of operations research and report the results of the studies						
Course Content	• Introduction to operations research and quantitative models • Linear programming with large-scale model formulation and case studies • Case studies related with transportation and assignment problems • Case studies related with applications of integer programming • Case studies related with network models and solution methodologies • Case studies related with queuing theory • Case studies related with inventory systems • Case studies related with game theory						
References	• Winston W. L. (2004) Operations Research Applications and Algorithms, 4th Ed., Brooks/Cole - Thomson Learning • Taha, H. A. (2002) Operations Research: An Introduction, 2002, 7th Ed., MacMillian Publishing Company. • Ravindran, A., Phillips, D. T., and Solberg, J. J. (1987) Operations Research: Principles and Practice, 2nd Ed., John Wiley & Sons. • Reklaitis, G.V., Ravindran, A., and Ragsdell K. M. (1983) Engineering Optimization: Methods and Applications, 1983, 1st Ed., John Wiley & Sons. Hillier, F. S. and Lieberman, G. J. (2002) Introduction to Operations Research, 7th Ed., McGraw Hill Science Publishing Company.						

Course Outline Weekly

Weeks	Topics
1.	Introduction to linear programming
2.	Large-scale modeling and solution methodologies
3.	Case study: linear programming
4.	Case study: large scale problems
5.	Case study: transportation/assignment problems
6.	Case study: integer programming
7.	Case study: integer programming
8.	Case study: network models
9.	Midterm Exam
10.	Case study: network models
11.	Case study: queuing theory
12.	Case study: inventory systems
13.	Case study: game theory
14.	Project presentations
15.	Study for the Final Exam
16.	Final Exam

Assessment Methods

Course activities	**Number**	**Percentage**
Attendance	13	5
Laboratory	0	0
Application	0	0
Field activities	0	0
Specific practical training	0	0
Assignments	5	5
Presentation	1	10
Project	1	10
Seminar	0	0
Midterms	1	30
Final exam	1	40
Total	8	% 100
Percentage of semester activities contributing grade success		% 60
Percentage of final exam contributing grade success		% 40
Total		% 100

Workload and ECTS Calculation

Activities	Number	Duration (hour)	Total Work Load
Course Duration (x14)	14	3	42
Laboratory			
Application			
Specific practical training			
Field activities			
Study Hours Out of Class (Preliminary work, reinforcement, etc.)	13	3	39
Presentation / Seminar Preparation	1	14	14
Project	1	40	40
Homework assignment	5	3	15
Midterms (Study duration)	1	12	12
Final Exam (Study duration)	1	18	18
Total Work Load			180

MATRIX OF THE COURSE LEARNING OUTCOMES VERSUS PROGRAM OUTCOMES

Program Outcomes	**Contribution level***				
	1	2	3	4	5
1			X		
2			X		
3			X		
4			X		
5				X	
6	X				
7			X		
8	X				
9	X				
10					X