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| antalya bilim Ã¼niversitesi ile ilgili gÃ¶rsel sonucu | **ECTS Course Description Form** |
| **PART I ( Senate Approval)** |
| **Offering School**  | *College of Engineering* |
| **Offering Department** | *Industrial Engineering* |
| **Program(s) Offered to** | *Industrial Engineering* | *Mechanical Engineering* |
| *Computer Engineering* | *Electrical and Electronics Engineering* |
|  |  |
| **Course Code**  | *IE 432* |
| **Course Name** | *Queueing* |
| **Language of Instruction** | *English* |
| **Type of Course** | **Departmental Area Elective** |
| **Level of Course** | Undergraduate |
| **Hours per Week** | **Lecture:** 3 | **Laboratory:**  | **Recitation:**  | **Practical:**  | **Studio:** | **Other:** *Field Work* |
| **ECTS Credit** | *6* |
| **Grading Mode** | *Curve* |
| **Pre-requisites** | *-* |
| **Co-requisites** | *-* |
| **Registration Restriction** | *-* |
| **Educational Objective** | * *Review of Stochastic Models*

*Introduction to Queueing Systems (Notation, M/M/1 Queue)* *Basic Laws (Little’s Law, PASTA Property)* * *Variations of the M/M/1 Queue*

*Expanding the Markovian Queue* *Jackson Networks* *Non Poisson Arrival Processes* * *The M/G/1 Queue*

*Embedded Markov Chain Analysis, Workload, Busy Period* *Variations (exceptional first service time, priority systems)* * *Infinite Server System*

*Many Server Approximations* * *GI/G/1 Queue*

*Random Walk, Duality, and Ladder Heights* * *Approximations and Bounds*
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| **Course Description** | *Theoretical foundations, models and techniques of queueing theory. Rigorous treatment of elementary through advanced queueing systems and queueing networks. Topics include Markov Renewal and Semi-Regenerative Processes.*  |
| **Learning Outcomes**  | **LO1** | 1. *Have a fundamental knowledge of the basic probability concepts.*
2. *Have a well – founded knowledge of standard distributions which can describe real life phenomena.*
3. *Acquire skills in handling situations involving more than one random variable and functions of random variables.*
4. *Understand and characterize phenomena which evolve with respect to time in a probabilistic manner.*
5. *Be exposed to basic characteristic features of a queuing system and acquire skills in analyzing queuing models.*
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| **LO2** |
| **LO3** |
| **LO4** |
| **LO5** |
| **n..** |
| **PART II ( Faculty Board Approval)** |
| **Basic Outcomes (University-wide)** | **No.** | **Program Outcomes** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** |  |
| **PO1** | **Ability** to communicate effectively and write and present a report in Turkish and English.  | 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸  🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸 🗸  |
| **PO2** | **Ability** to work individually, and in intra-disciplinary and multi-disciplinary teams. |
| **PO3** | **Recognition** of the need for life-long learning and **ability** to access information, follow developments in science and technology, and continually reinvent oneself. |
| **PO4** | **Knowledge** of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. |
| **PO5** | **Awareness** of sectors and **ability** to prepare a business plan. |
| **PO6** | **Understanding** of professional and ethical responsibility and **demonstrating** ethical behavior. |
| **Faculty Specific Outcomes** | **PO7** | Ability to develop, select and use modern techniques and tools necessary for engineering applications and ability to use information technologies effectively. |
| **PO8** | Recognition of the effects of engineering applications on health, environment and safety in the universal and societal dimensions and the problems of the time and awareness of the legal consequences of engineering solutions. |
| **PO9** | Ability to identify, define, formulate and solve complex engineering problems; and electing and applying appropriate analysis and modeling methods for this purpose. |
| **Discipline Specific Outcomes (program)** | **PO10** | Sufficient knowledge in mathematics, science and Industrial engineering; and the ability to apply theoretical and practical knowledge in these areas to model and solve engineering problems. |
| **PO11** | Ability to design a complex system, process, device or product to meet specific requirements under realistic constraints and conditions of economic, environmental, sustainability, manufacturability, ethics, health, safety, social and political issues; and the ability to apply modern design methods for this purpose. |
| **PO12** | Ability to design systems, conduct experiments, collect data, analyze and interpret results for the examination of Industrial engineering problems. |
| **Specialization Specific Outcomes** | **PO N….** | Ability to simulate a given real life problem and analyze the real problem using the simulation and recommend solutions to the real life problem |
| **PART III ( Department Board Approval)** |
| **Course Subjects, Contribution of Course Subjects to Learning Outcomes, and Methods for Assessing Learning of Course Subjects** | **Subjects** | **Week** |  | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** |  |
| **S1** | *1* | *Rates and the Law of Large Numbers, Renewals, Intro to Queueing Dynamics* | *A1* | *A2* |  |  |  |  |
| **S2** | *2* | *Multiplexing and Tracking Theorems* |  |  |  |  |  |  |
| **S3** | *3* | *Join the Shortest Queue, Rate Stability, Capacity Regions for Networks* | *A1* | *A2* |  |  |  |  |
| **S4** | *4* | *Leaky Bucket Envelopes, Network Calculus* | *A1* | *A2* | *A3* | *A4* |  |  |
| **S5** | *5* | *Worst Case Delay Analysis, Traffic Filters, Priority Service* | *A1* | *A2* | *A3* | *A4* |  |  |
| **S6** | *6* | *Minimum Clearance Time Problems and IMET* |  |  |  | *A4* |  |  |
| **S7** | *7* | *IMET for switches, Little’s Theorem, Bernoulli Queues and Steady State Analysis, Markov Chains, Global and Local Balance Equations* | *A1* | *A2* | *A3* | *A4* | *A5* |  |
| **S8** | *8* | *Coupling, Reversibility, Transform Methods and Tail Behavior* |  |  |  | *A4* | *A5* |  |
| **S9** | *9* | *Poisson Process, Random Sampling, PASTA, M/M/m systems, Finite buffer systems* |  |  |  |  |  |  |
| **S10** | *10* | *Continuous Time Reversibility, Jackson Networks, Inspection Paradox* |  |  |  |  |  |  |
| **S11** | *11* | *Renewal Theory and M/G/1 Queues, Queues with Vacations, Busy Periods* |  |  |  | *A4* | *A5* |  |
|  | **S12** | *12* | *Equivalent Models for Tree Networks,* |  |  |  | *A4* | *A5* |  |
|  | **S13** | *13* | *Special Topics* |  |  |  | *A4* | *A5* |  |
|  | **S14** | *14* | *Final Exam* |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Midterm Exam** | *40%* | *In class Exam* | *If a student misses an exam and provides an acceptable legitimate document, a make-up exam should be provided for the midterm.* |
| **A2** | **Quiz** | *10%* | *In Class Quizzes* |  |
| **A3** | **Homework** | *10%* | *Take Home* | *50% deduction of points due to late submission* |
| **A4** | **Final Exam** | *40%* | *In class Exam* |  |
| **A5** | **Other** |  |  |  |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | *Letter grades depend on the weighted total of the* *scores attained from homework, midterm, final, quiz* *according to the weights given above.* |
| **Method for Determining Letter Grade** | *Best Result of a Curve in class or the Catalog System given below:**A+:100 A: 95-99 A-: 90-94**B+: 85-89 B: 80-84 B-: 75-79**C+: 70-74 C: 65-69 C-: 60-64**D+: 55-59 D: 50-54 F:0-50* |
| **Teaching Methods, Student Work Load** | **No** | **Method** | **Explanation** | **Hours** |
| ***Time applied by instructor*** |
| **1** | **Lecture** | *14 weeks 3 hours* | *42* |
| **2** | **Preliminary preparation and finalizing****of course notes** | *14 weeks 2 hours* | *28* |
| **3** | **Self-Study for Mid-term exam** | *1 week 15 hours* | *15* |
| **4** | **Mid-term Exam** | *1 week 3 hours* | *3* |
| **5** | **Self-study for Final Exam** | *1 week 15 hours* | *15* |
| **6** | **Final Exam** | *1 week 3 hours* | *3* |
| **7** | **Assignment** | *14 weeks 3 hours* | *42* |
| **8** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **9** | **Pre-class Learning of Course Material**  |  |  |
| **10** | **Review of Course Material** |  |  |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** |  |  |
| **TOTAL** | *148* |
| ***IV. PART*** |
| **Instructor** | **Name** | *Dr. Semail Ülgen* |
| **E-mail** | *sulgen@antalya.ed.tr* |
| **Phone Number** | *0242 2452307* |
| **Office Number** | *A1-33* |
| **Office Hours** | *2 hrs per week* |
| **Course Materials** | **Mandatory** | *Ronald W. Wolff, Stochastic Modeling and the Theory of Queues, Prentice Hall*  |
| **Recommended** | *Articles and handouts, posted on Canvas*  |
| **Other** | **Scholastic Honesty** | *Violations of scholastic honesty include, but are not limited to cheating, plagiarizing, fabricating information or citations, facilitating acts of dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Any form of scholastic dishonesty is a serious academic violation and will result in a disciplinary action.* |
| **Students with Disabilities** | *Reasonable accommodations will be made for students with verifiable disabilities.* |
| **Safety Issues**  | *The course does not require any special safety precautions.* |
|  | *Circumstances may arise during the course that prevents the instructor from fulfilling each and every component of this syllabus; therefore, the syllabus is subject to change.  Students will be notified prior to any changes.* |
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