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|  |  | | | | **ECTS Course Description Form** | | | | | | | | | | | | | | | | | | | | | | | |
|  | **PART I ( Senate Approval)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Offering School** | **Engineering** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Offering Department** | **Computer Engineering** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Program(s) Offered to** | **Computer Engineering** | | | | | | | | | | | |  | | | | | | | | | | | | | | |
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|  | **Course Code** | **CS 449** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Course Name** | **Data Visualization** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Language of Instruction** | **English** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Type of Course** | *Elective* | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Level of Course** | **Undergraduate** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Hours per Week** | **Lecture: 3** | | | | **Laboratory:** | | | | **Recitation:** | | **Practical:** | | | | | **Studio:** | | | | | | **Other:** | | | | | |
|  | **ECTS Credit** | **6** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Grading Mode** | **Letter Grade** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Pre-requisites** | **MATH 311** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Co-requisites** | **-** | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Registration Restriction** | *-* | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Educational Objective** | The main objective of this course is to introduce the students main techniques and theory used in visualization including visual encoding principles, effect of color, and tips for creating expressive and effective visualizations. | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Course Description** | Introduction to the main concepts of data visualization. The course will provide the key techniques for creating effective and expressive visualizations. Topics will include human perception, visual encoding principles, use of color, specific methods to visualize maps, networks, multivariate data. Students will also be able evaluate existing visualizations in a principled manner. | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Learning Outcomes** | *L01: Gain an understanding of the key techniques and theory used in visualization, including data models, graphical perception and techniques for visual encoding and interaction.*  *L02: Encounter a number of common data domains including multivariate data, networks, text and maps.*  *L03: Understand the effect of color for categorical, ordinal and quantitative data.*  *L04: Use principles of human perception and cognition in visualization design*  *L05: Practice building and evaluating visualization systems*  *L06: Practice building visualizations using different visualization tools such as D3.* | | | | | | | | | | | | | | | | | | | |
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|  | **PART II ( Faculty Board Approval)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Basic Outcomes (University-wide)** | | **No.** | **Program Outcomes** | | | | | | | | | **LO1** | | | **LO2** | | | **LO3** | | **LO4** | | | | | **LO5** | | **LO6** |
|  | **PO1** | **Ability** to communicate effectively and write and present a report in Turkish and English. | | | | | | | | | *2 1 1 1 1 1* | | | | | | | | | | | | | | | |
|  | **PO2** | **Ability** to work individually, and in intra-disciplinary and multi-disciplinary teams. | | | | | | | | | *1 1 1 1 3 1* | | | | | | | | | | | | | | | |
|  | **PO3** | **Recognition** of the need for life-long learning and **ability** to access information , follow developments in science and technology, and continually reinvent oneself. | | | | | | | | | *2 2 2 2 2 2* | | | | | | | | | | | | | | | |
|  | **PO4** | **Knowledge** of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. | | | | | | | | | *0 0 0 0 3 0* | | | | | | | | | | | | | | | |
|  | **PO5** | **Awareness** of sectors and **ability** to prepare a business plan. | | | | | | | | | *0 0 0 0 0 0* | | | | | | | | | | | | | | | |
|  | **PO6** | **Understanding** of professional and ethical responsibility and **demonstrating** ethical behavior. | | | | | | | | | *0 0 0 0 1 0* | | | | | | | | | | | | | | | |
|  | **Faculty/ Program Specific Outcomes** | | **PO7** | **Ability** to define complex engineering  problems, develop models and  implement solutions for these  problems | | | | | | | | | *2 2 2 2 3 3* | | | | | | | | | | | | | | | |
|  | **PO8** | **Ability** to conduct lab experiments by using  computers and the ability of collecting, analyzing and interpreting data. | | | | | | | | | *3 3 3 3 3 3* | | | | | | | | | | | | | | | |
|  | **PO9** | **Ability** to apply the knowledge of  mathematics, science and engineering  principles to solve problems in computer  engineering. | | | | | | | | | *3 3 3 3 3 3* | | | | | | | | | | | | | | | |
|  | **PO10** | An **understanding** of current contemporary  issues and impact of engineering solutions  in legal and ethical levels | | | | | | | | | *0 0 0 0 0 0* | | | | | | | | | | | | | | | |
|  | **PO11** | **Ability** to understand and apply discrete  mathematics concepts. | | | | | | | | | *0 1 0 0 0 0* | | | | | | | | | | | | | | | |
|  | **PO12** | **Ability** to use modern engineering  techniques, tools and information  technologies and develop software  equipment and software. | | | | | | | | | *1 1 1 2 3 3* | | | | | | | | | | | | | | | |
|  | **PO13** | **Ability** to analyze, design and manage the  hardware/software computer system  requirements with limited resources and  conditions by modern engineering  principles. | | | | | | | | | *1 1 1 1 3 3* | | | | | | | | | | | | | | | |
| **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** | | **LO6** |
| **S1** | 1 | | | Introduction & The value of visualization | | | | | | A1/2/6 | | |  | | |  | |  | | | | |  | |  |
| **S2** | 2 | | | Data & Image Models | | | | | | A1/2/6 | | |  | | |  | |  | | | | |  | |  |
| **S3** | 3 | | | Exploratory Data Analysis | | | | | | A1/2 | | | A1/2 | | |  | |  | | | | | A2 | |  |
| **S4** | 4 | | | Visual Encoding | | | | | | A1/2/6 | | A1/2/6 | | |  | | A1/2/6 | | | | |  | |  | |
| **S5** | 5-6 | | | Interaction & Narrative Visualization | | | | | |  | | A1/2 | | |  | |  | | | | | A2 | | A2 | |
| **S6** | 7 | | | Graphical Perception | | | | | |  | |  | | |  | | A1/2 | | | | |  | |  | |
| **S7** | 8 | | | Tables | | | | | | A1/2 | | A1/2 | | |  | |  | | | | | A2 | | A2 | |
| **S8** | 9,10 | | | Hierarchies & Trees | | | | | |  | | A1/2 | | |  | |  | | | | | A2 | | A2 | |
| **S9** | 11 | | | Maps & Color | | | | | |  | | A1/2 | | |  | |  | | | | | A2 | | A2 | |
| **S10** | 12 | | | Spatial Data | | | | | |  | | A1/2 | | |  | |  | | | | | A2 | | A2 | |
| **S11** | 13, 14 | | | Graphs & Networks | | | | | |  | | A1/2 | | |  | |  | | | | | A2 | | A2 | |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules** | | | **No.** | **Type** | | | | | **Weight** | | **Implementation Rule** | | | | | **Make-Up Rule** | | | | | | | | | | | | |
| **A1** | **Exam** | | | | | *60* | | *There is one midterm and one final exam for the course. Exam dates will be shown on the tentative schedule and it can be changed according to the course schedule.* | | | | | If a student misses an exam and provides an acceptable legitimate document, a make-up exam will be provided. | | | | | | | | | | | | |
| **A2** | **Homework** | | | | | *30* | | *There are 3 or 4 homeworks. Students can work in groups.* | | | | | There is no make-up. | | | | | | | | | | | | |
| **A4** | **Project** | | | | | *-* | | *.* | | | | |  | | | | | | | | | | | | |
| **A5** | **Report** | | | | |  | | - | | | | |  | | | | | | | | | | | | |
| **A6** | **Presentation** | | | | | 10 | | Students have to choose one paper from the provided list and present the tool that is proposed in the paper. | | | | | There is no make-up. | | | | | | | | | | | | |
| **A7** | **Attendance/ Interaction** | | | | |  | | - | | | | | - | | | | | | | | | | | | |
| **A8** | **Class/Lab./**  **Field Work** | | | | |  | | - | | | | | - | | | | | | | | | | | | |
| **A9** | **Other** | | | | |  | |  | | | | |  | | | | | | | | | | | | |
| **TOTAL** | | | | | | **100%** | | | | | | | | | | | | | | | | | | | |
| **Evidence of Achievement of Learning Outcomes** | | | Students will demonstrate learning outcomes through midterm exam, homework assignments, project and the final exam. Every topic is tested with at least one exam or homework question. In order to pass, a student needs to accumulate certain percentage of points and this percentage is determined by the class mean. | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Method for Determining Letter Grade** | | | Weighted average will be calculated based on the table below (there can be changes depending on the performance of the students)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Activities** | Midterm Exam | Homeworks | Presentation | Final Exam | | **Quantity** | 1 | 3 | 1 | 1 | | **Effects on Grading, %)** | 30 | 30 | 10 | 30 |   Letter grades are tentatively determined using the table below. Here “-x” means (average-3-x) and “+x” means (average+3+x), and each denotes the minimum points necessary for the corresponding letter grade.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Total points | +25 | +20 | +15 | +10 | +5 | Avg ±3 | -5 | -10 | -15 | -20 | | Letter Grade | A | A- | B+ | B | B- | C+ | C | C- | D+ | D | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Teaching Methods, Student Work Load** | | | **No** | **Method** | | | | **Explanation** | | | | | | | | | | | | | | | | **Hours** | | | | |
| ***Time applied by instructor*** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1** | **Lecture** | | | | Lecturing with slides as well as utilizing white board. | | | | | | | | | | | | | | | | 3\*14 | | | | |
| **2** | **Interactive Lecture** | | | |  | | | | | | | | | | | | | | | |  | | | | |
| **3** | **Recitation** | | | |  | | | | | | | | | | | | | | | |  | | | | |
| **4** | **Laboratory** | | | |  | | | | | | | | | | | | | | | |  | | | | |
| **5** | **Practical** | | | |  | | | | | | | | | | | | | | | |  | | | | |
| **6** | **Field Work** | | | |  | | | | | | | | | | | | | | | |  | | | | |
| ***Time expected to be allocated by student*** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **7** | **Project** | | | |  | | | | | | | | | | | | | | | | *-* | | | | |
| **8** | **Homework** | | | | Both programming and written assignments to practice the concepts taught in class. Prepare material for paper presentation. | | | | | | | | | | | | | | | | 52 | | | | |
| **9** | **Pre-class Learning of Course Material** | | | | Read new material from the book before the class. | | | | | | | | | | | | | | | | 22 | | | | |
| **10** | **Review of Course Material** | | | | Review of the subjects before the exam | | | | | | | | | | | | | | | | 50 | | | | |
| **11** | **Studio** | | | |  | | | | | | | | | | | | | | | |  | | | | |
| **12** | **Office Hour** | | | | One office hour per week is allocated for students’ questions | | | | | | | | | | | | | | | | 14 | | | | |
| **TOTAL** | | | | |  | | | | | | | | | | | | | | | | | | | | |
| **IV. PART** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Instructor** | | | **Name** | | | | | Hilal Kazan | | | | | | | | | | | | | | | | | | | | |
| **E-mail** | | | | | Hilal.kazan@antalya.edu.tr | | | | | | | | | | | | | | | | | | | | |
| **Phone Number** | | | | | *0242 245 0271* | | | | | | | | | | | | | | | | | | | | |
| **Office Number** | | | | | *A1-29* | | | | | | | | | | | | | | | | | | | | |
| **Office Hours** | | | | | *TBA* | | | | | | | | | | | | | | | | | | | | |
| **Course Materials** | | | **Mandatory** | | | | | - The Visual Display of Quantitative Information, E. Tufte. Graphics Press, 2001.  - Envisioning Information, E. Tufte. Graphics Press, 1990.  - Interactive Data Visualization for the Web, 2nd Edition. Scott Murray, O'Reilly Press.2017 | | | | | | | | | | | | | | | | | | | | |
| **Recommended** | | | | | - | | | | | | | | | | | | | | | | | | | | |
| **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 for 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. | | | | | | | | | | | | | | | | | | | | |
| **Flexibility** | | | | | 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. | | | | | | | | | | | | | | | | | | | | |