

## OPTICAL AND CHEMICAL SENSORS

|      |                                                                                                                    |                                                                                                                           |                                                                                                                  |
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| 1    | Course Title:                                                                                                      | OPTICAL AND CHEMICAL SENSORS                                                                                              |                                                                                                                  |
| 2    | Course Code:                                                                                                       | KIM6049                                                                                                                   |                                                                                                                  |
| 3    | Type of Course:                                                                                                    | Optional                                                                                                                  |                                                                                                                  |
| 4    | Level of Course:                                                                                                   | Third Cycle                                                                                                               |                                                                                                                  |
| 5    | Year of Study:                                                                                                     | 1                                                                                                                         |                                                                                                                  |
| 6    | Semester:                                                                                                          | 1                                                                                                                         |                                                                                                                  |
| 7    | ECTS Credits Allocated:                                                                                            | 6.00                                                                                                                      |                                                                                                                  |
| 8    | Theoretical (hour/week):                                                                                           | 3.00                                                                                                                      |                                                                                                                  |
| 9    | Practice (hour/week):                                                                                              | 0.00                                                                                                                      |                                                                                                                  |
| 10   | Laboratory (hour/week):                                                                                            | 0                                                                                                                         |                                                                                                                  |
| 11   | Prerequisites:                                                                                                     | -                                                                                                                         |                                                                                                                  |
| 12   | Language:                                                                                                          | Turkish                                                                                                                   |                                                                                                                  |
| 13   | Mode of Delivery:                                                                                                  | Face to face                                                                                                              |                                                                                                                  |
| 14   | Course Coordinator:                                                                                                | Prof. Dr. MEHMET HALUK TÜRKDEMİR                                                                                          |                                                                                                                  |
| 15   | Course Lecturers:                                                                                                  | Prof.Dr. Belgin İZGİ                                                                                                      |                                                                                                                  |
| 16   | Contact information of the Course Coordinator:                                                                     | e-mail: hturkdemir@uludag.edu.tr<br>Tlf : 0224 29 41 741                                                                  |                                                                                                                  |
| 17   | Website:                                                                                                           |                                                                                                                           |                                                                                                                  |
| 18   | Objective of the Course:                                                                                           | Chemical and optical sensors, classification, working principles and mechanisms, to teach using areas at today and future |                                                                                                                  |
| 19   | Contribution of the Course to Professional Development:                                                            | Knows sensor technologies, usage areas and structures.                                                                    |                                                                                                                  |
| 20   | Learning Outcomes:                                                                                                 |                                                                                                                           |                                                                                                                  |
|      |                                                                                                                    | 1                                                                                                                         | Learn identification, general properties and classifications of chemical and optical sensors                     |
|      |                                                                                                                    | 2                                                                                                                         | Comprehend working principles of chemical and optical sensors and can transfer these principles to other persons |
|      |                                                                                                                    | 3                                                                                                                         | Learn actuators in chemical and optical sensors                                                                  |
|      |                                                                                                                    | 4                                                                                                                         | Search and suggests a chemical and optical sensors for any chemical measurement                                  |
|      |                                                                                                                    | 5                                                                                                                         | Compare the performance of chemical and optical sensors                                                          |
|      |                                                                                                                    | 6                                                                                                                         | To know the sensors using area, present and in future                                                            |
|      |                                                                                                                    | 7                                                                                                                         |                                                                                                                  |
|      |                                                                                                                    | 8                                                                                                                         |                                                                                                                  |
|      |                                                                                                                    | 9                                                                                                                         |                                                                                                                  |
|      |                                                                                                                    | 10                                                                                                                        |                                                                                                                  |
| 21   | Course Content:                                                                                                    |                                                                                                                           |                                                                                                                  |
|      |                                                                                                                    | <b>Course Content:</b>                                                                                                    |                                                                                                                  |
| Week | Theoretical                                                                                                        | Practice                                                                                                                  |                                                                                                                  |
| 1    | Chemical sensor and optical sensor concepts; development and properties of chemical sensors                        |                                                                                                                           |                                                                                                                  |
| 2    | Transducer, selectivity, limit of detection, sensitivity, continuous measurement, maintenance, life etc properties |                                                                                                                           |                                                                                                                  |

|    |                                                                 |  |
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| 3  | Classification of chemical and optic sensors                    |  |
| 4  | Electrochemical sensors; Potantiometric chemical sensors        |  |
| 5  | Voltammetric chemical sensors                                   |  |
| 6  | Semi-conductors and conductivity dependent chemical sensors     |  |
| 7  | Fiber-optical chemical sensors, Biochemical sensors             |  |
| 8  | General reminders, description of unifying concepts and Midterm |  |
| 9  | Calorimetric chemical sensors                                   |  |
| 10 | Piezoelectric chemical sensors                                  |  |
| 11 | Surface effective ion selective electrodes                      |  |
| 12 | Gas sensors                                                     |  |
| 13 | Smart sensors                                                   |  |
| 14 | Usage areas of chemical and optical sensors                     |  |

|    |                                               |                                                                                                                                                                                                                                                              |
|----|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22 | Textbooks, References and/or Other Materials: | 1. J. Wang, Analytical Electrochemistry, Wiley, 2006<br>2. A. Telefoncu. Biyosensörler<br>3. P.T. Kissenger and W.R. Heineman. Laboratory Tech. in Electroanalytical Chem. Marcel-Dekker Inc.<br>4. Chemical Sensors and Biosensors, B.R. Eggins, Wiley 2002 |
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| 23 | Assesment |  |
|----|-----------|--|

| Activites                                                        |   |    | Number                                                                                  | Duration (hour) | Total Work Load (hour) |
|------------------------------------------------------------------|---|----|-----------------------------------------------------------------------------------------|-----------------|------------------------|
| Quiz                                                             |   |    |                                                                                         |                 |                        |
| Theoretical                                                      | 0 | 0  | 0                                                                                       | 3.00            | 42.00                  |
| Practicals/Labs                                                  |   |    | 0                                                                                       | 0.00            | 0.00                   |
| Final Exam                                                       |   |    |                                                                                         |                 |                        |
| Self study and preperation                                       | 1 | 60 | 14                                                                                      | 3.00            | 42.00                  |
| Homeworks                                                        |   |    | 1                                                                                       | 20.00           | 20.00                  |
| Contribution of Term (Year) Learning Activities to Success Grade |   |    | 40                                                                                      | 0.00            | 0.00                   |
| Field Studies                                                    |   |    | 0                                                                                       | 0.00            | 0.00                   |
| Contribution of Final Exam to Success Grade                      |   |    | 60                                                                                      | 0.00            | 0.00                   |
| Midterm exams                                                    |   |    | 1                                                                                       | 30.00           | 30.00                  |
| Others                                                           |   |    | 0                                                                                       | 0.00            | 0.00                   |
| Measurement and Evaluation Techniques Used in the Course         |   |    | Absolute evaluation system will be used. Each student must provide a minimum of success |                 |                        |
| Total Work Load                                                  |   |    |                                                                                         |                 | 184.00                 |
| <b>24. ECTS / WORK LOAD TABLE</b>                                |   |    |                                                                                         |                 |                        |
| Total work load/ 30 hr                                           |   |    |                                                                                         |                 | 6.13                   |
| ECTS Credit of the Course                                        |   |    |                                                                                         |                 | 6.00                   |

| 25  | CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |
|-----|---------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
|     | PQ1                                                           | PQ2 | PQ3 | PQ4 | PQ5 | PQ6 | PQ7 | PQ8 | PQ9 | PQ10 | PQ11 | PQ12 | PQ13 | PQ14 | PQ15 | PQ16 |
| ÖK1 | 4                                                             | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 2    | 0    | 0    | 0    | 0    | 0    | 0    |
| ÖK2 | 0                                                             | 3   | 0   | 4   | 0   | 0   | 0   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ÖK3 | 3                                                             | 0   | 3   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ÖK4 | 0                                                             | 0   | 0   | 0   | 4   | 0   | 0   | 0   | 0   | 3    | 0    | 0    | 0    | 0    | 0    | 0    |

|                                                       |            |   |   |       |   |   |          |   |   |        |   |   |             |   |   |   |
|-------------------------------------------------------|------------|---|---|-------|---|---|----------|---|---|--------|---|---|-------------|---|---|---|
| ÖK5                                                   | 0          | 0 | 0 | 0     | 2 | 0 | 0        | 0 | 3 | 0      | 0 | 0 | 0           | 0 | 0 | 0 |
| ÖK6                                                   | 0          | 0 | 0 | 0     | 0 | 0 | 0        | 0 | 4 | 0      | 0 | 0 | 0           | 0 | 0 | 0 |
| LO: Learning Objectives    PQ: Program Qualifications |            |   |   |       |   |   |          |   |   |        |   |   |             |   |   |   |
| Contribution Level:                                   | 1 very low |   |   | 2 low |   |   | 3 Medium |   |   | 4 High |   |   | 5 Very High |   |   |   |