

ELECTRON SPIN RESONANCE II

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| 1 | Course Title: | ELECTRON SPIN RESONANCE II |
| 2 | Course Code: | FZK6104 |
| 3 | Type of Course: | Optional |
| 4 | Level of Course: | Third Cycle |
| 5 | Year of Study: | 1 |
| 6 | Semester: | 2 |
| 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: | None |
| 12 | Language: | Turkish |
| 13 | Mode of Delivery: | Face to face |
| 14 | Course Coordinator: | Prof. Dr. AHMET PEKSÖZ |
| 15 | Course Lecturers: | Doç.Dr. Hüseyin OVALIOĞLU, Dr. Öğr.Üyesi Cengiz AKAY |
| 16 | Contact information of the Course Coordinator: | peksoz@uludag.edu.tr, (0224) 29 41 713, Prof. Dr. Ahmet PEKSÖZ, UÜ Fen Edebiyat Fakültesi, Fizik Bölümü 16059 Görükle Kampüsü Bursa |
| 17 | Website: | |
| 18 | Objective of the Course: | Teaches observing and describing of paramagnetic centers occurred in matters by electron spin resonance spectroscopy, and determination of properties of the centers |
| 19 | Contribution of the Course to Professional Development: | Learn ESR technique related to determination of magnetic properties of the materials |
| 20 | Learning Outcomes: | |
| | 1 | Comments advanced spectroscopic data |
| | 2 | Learns double-rezonance techniques |
| | 3 | Learns investigation of free radicals by ESR |
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| 21 | Course Content: | |
| | Course Content: | |
| Week | Theoretical | Practice |
| 1 | Quantization of spin and angular momentum, the relation between magnetic moment and angular momentum, the interaction of magnetic dipol moment by external magnetic field | |
| 2 | Energy levels and transitions, determination of g Lande factor | |

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| 3 | Electron Zeeman, Nuclear Zeeman Interactions, Hyperfine interactions, Spin Hamiltonian and operators | |
| 4 | Isotropic hyperfine interactions and $S=1/2$, $I=1/2$ transitions, selection rules | |
| 5 | Structure of CW spectrometers and working principals | |
| 6 | Isotropic hyperfine for interactions with nuclear spins of $I>1/2$ | |
| 7 | Small, moderate and large hyperfine interactions, Examples on sigma and pi radicals | |
| 8 | MIDTERM EXAM | |
| 9 | Spin-Orbit interactions and contributions to g values, EPR line intensities, Powder spectra | |
| 10 | Hyperfine anisotropy, formation of anisotropic Hamiltonian matrices | |
| 11 | Combined anisotropic g and hyperfine interactions | |
| 12 | Anisotropy of interactions with nuclear spins of $I>1/2$ | |
| 13 | ESR spectra of some free radicals, Discussions on the examples | |
| 14 | Radical pairs, high spins and energy terms. | |

| 22 | Textbooks, References and/or Other | 1. Arthur Schweiger, Gunnar Jeschke. Principles of Pulse EPR, Ellis Horwood, Chichester (1993). | | |
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| Activities | | Number | Duration (hour) | Total Work Load (hour) |
| Theoretical | | 14 | 6.00 | 84.00 |
| Practicals/Labs | | 0 | 0.00 | 0.00 |
| Self study and preparation | | 0 | 0.00 | 0.00 |
| 23 Assessment | | | | |
| Homeworks | | 1 | 14.00 | 14.00 |
| Projects | R | 14 | 6.00 | 84.00 |
| Midterm Exam | 1 | 1 | 20.00 | 20.00 |
| Field Studies | | 0 | 0.00 | 0.00 |
| Quiz | | 0 | 0.00 | 0.00 |
| Midterm exams | | 1 | 20.00 | 20.00 |
| Others | | 0 | 0.00 | 0.00 |
| Final Exam | 1 | 1 | 20.00 | 20.00 |
| Final Exams | | 1 | 20.00 | 20.00 |
| Total Work Load | | | | 180.00 |
| Contribution of Term (Year) Learning Activities to Total Work load/ 30 hr | | 50.00 | | 6.00 |
| ECTS Credit of the Course | | | | 6.00 |
| Contribution of Final Exam to Success Grade | | 50.00 | | |
| Total | | 100.00 | | |
| Measurement and Evaluation Techniques Used in the Course | Written examination | | | |

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| 24 | ECTS / WORK LOAD TABLE |
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| 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 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| ÖK2 | 3 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |

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| ÖK3 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| LO: Learning Objectives PQ: Program Qualifications | | | | | | | | | | | | | | | | |
| Contrib ution Level: | 1 very low | | 2 low | | 3 Medium | | 4 High | | 5 Very High | | | | | | | |