**PHYSICS PhD PROGRAMME**

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| **FIrst Year** | | | | | | |
| **I. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501011101 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#EN81) | 7.5 | 3+0+0 | 3 | **C** | TurkIsh |
| 501311622 | [STATISTICAL MECHANICS AND ITS APPLICATIONS](#EN82) | 7.5 | 3+0+0 | 3 | **C** | TurkIsh |
|  | ElectIve Course-1 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-2 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | Total of I. Semester | 30 |  | 12 |  |  |
| **II. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
|  | ElectIve Course-3 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-4 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-5 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312001 | PhD SemInar | 7.5 | 0+1+0 | - | **C** | TurkIsh |
|  | Total of II. Semester | 30 |  | 9 |  |  |
|  | TOTAL OF FIRST YEAR | 60 |  | 21 |  |  |

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| **Second Year** | | | | | | |
| **III. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501311801 | PhD PROFICIENCY | 30 | 0+1+0 | **-** | **C** | TurkIsh |
|  | Total of III. Semester | 30 |  |  |  |  |
| **IV. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501011102 | THESIS PROPOSAL | 30 | 0+1+0 | **-** | **C** | TurkIsh |
|  | Total of IV. Semester | 30 |  |  |  |  |
|  | TOTAL OF SECOND YEAR | 60 |  |  |  |  |

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| **ThIrd Year** | | | | | | |
| **V. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501311802 | PhD THESIS STUDY | 25 | 0+1+0 | **-** | **C** | TurkIsh |
| 501311803 | SPECIALIZATION FIELD COURSE | 5 | 3+0+0 | **-** | **C** | TurkIsh |
|  | Total of V. Semester | 30 |  |  |  |  |
| **VI. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501311802 | PhD THESIS STUDY | 25 | 0+1+0 | **-** | **C** | TurkIsh |
| 501311803 | SPECIALIZATION FIELD COURSE | 5 | 3+0+0 | - | **C** | TurkIsh |
|  | Total of VI. Semester | 30 |  |  |  |  |
|  | TOTAL OF THIRD YEAR | 60 |  |  |  |  |

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| **Fourth Year** | | | | | | |
| **VII. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501311802 | PhD THESIS STUDY | 25 | 0+1+0 | **-** | **C** | TurkIsh |
| 501311803 | SPECIALIZATION FIELD COURSE | 5 | 3+0+0 | **-** | **C** | TurkIsh |
|  | Total of VII. Semester | 30 |  |  |  |  |
| **VIII. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501311802 | PhD THESIS STUDY | 25 | 0+1+0 | **-** | **C** | TurkIsh |
| 501311803 | SPECIALIZATION FIELD COURSE | 5 | 3+0+0 | - | **C** | TurkIsh |
|  | Total of VIII. Semester | 30 |  |  |  |  |
|  | TOTAL OF FOURTH YEAR | 60 |  |  |  |  |

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| **ElectIve Courses** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501311612 | [A MODERN APPROACH TO QUANTUM MECHANICS I](#EN26) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312615 | [A MODERN APPROACH TO QUANTUM MECHANICS II](#EN28) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311613 | [ADSORPTION PROCESSES I](#EN15) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312602 | [ADSORPTION PROCESSES II](#EN17) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311611 | [ADVANCED ATOM-MOLECULE AND LASER ELECTRONICS I](#EN20) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312614 | [ADVANCED ATOM-MOLECULE AND LASER ELECTRONICS II](#EN27) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311610 | [ADVANCED LASER SPECTROSCOPY I](#EN25) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312609 | [ADVANCED LASER SPECTROSCOPY II](#EN24) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312612 | [ADVANCED MOLECULAR PHYSICS](#EN23) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311617 | [ADVANCED SEMICONDUCTORS-1](#EN49) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312619 | [ADVANCED SEMICONDUCTORS-2](#EN79) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311623 | [APPLICATIONS OF NANOMATERIALS](#EN88) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311605 | [FINITE DIFFERENCES METHOD FOR PHYSICISTS](#EN14) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312618 | [FINITE ELEMENT METHOD FOR PHYSICISTS](#EN19) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311626 | [INTRODUCTION TO NANOSCIENCE](#EN90) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312624 | [INTRODUCTION TO PARTICLE ACCELERATORS](#EN57) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311620 | [LIE GROUPS IN PHYSICS I](#EN37) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312622 | [LIE GROUPS IN PHYSICS II](#EN38) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311609 | [MOLECULAR BIOPHYSICS I](#EN68) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312611 | [MOLECULAR BIOPHYSICS II](#EN69) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312613 | [MOLECULAR MODELING](#EN41) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312625 | [NANO DEVICES](#EN86) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311624 | [NANOTECHNOLOGY AND NANOMATERIALS](#EN91) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311614 | [NONLINEAR OPTICS I](#EN42) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312616 | [NONLINEAR OPTICS II](#EN43) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311604 | [NUCLEAR PHYSICS I](#EN44) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312607 | [NUCLEAR PHYSICS II](#EN45) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312632 | [OPTICAL PROPERTIES OF SEMICONDUCTORS](#EN91) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311608 | [OPTICAL PROPERTIES OF SOLIDS I](#EN46) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312610 | [OPTICAL PROPERTIES OF SOLIDS II](#EN47) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311606 | [PLASMA MATERIAL PROCESSING I](#EN60) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312601 | [PLASMA MATERIAL PROCESSING II](#EN61) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311627 | [PRODUCTION TECHNOLOGIES OF NANOMATERIALS](#EN85) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312623 | [QUANTUM CHEMICAL CALCULATIONS](#EN62) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311601 | [QUANTUM ELECTRONICS I](#EN48) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311619 | [QUANTUM FIELD THEORY I](#EN63) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312621 | [QUANTUM FIELD THEORY II](#EN64) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311621 | [QUANTUM STATISTICS](#EN80) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311616 | [SEMICONDUCTOR MATERIAL ANALYSIS TECHNIQUES I](#EN16) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312606 | [SEMICONDUCTOR MATERIAL ANALYSIS TECHNIQUES II](#EN18) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501311624 | [SEMICONDUCTOR PHYSICS](#EN89) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 501312626 | [SEMICONDUCTORS PN JUNCTION](#EN83)  [STRUCTURES and APPLICATIONS](#EN83) | 7.5 | 3+0+0 | 3 | E | TurkIsh |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Quantum StatIstIcs |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon to quantum mechanIcs; InformatIon on statIstIcal PhysIcs; FermI-dIrac statIstIcs; Bose-EInsteIn statIstIcs and theIr InvestIgatIon In detaIl. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ınvestIgatIon of statItIcal mechanIcs In the framework of quantum physIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | StatIstIcal MechanIcs examInate In the frame of Quantum PhysIcs. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.ExplaIn the macro and mIcro systems  2.Bose-EInsteIn, FermI-DIrac and Maxwell-Boltzmann statIstIcs analyze and comments.  3.StatIstIcs descrIbes the applIcatIon of the gases,  4.Quantum statIstIc comments. | | | | | | | |
| **TEXTBOOK** | | | | | StatIstIcal MechanIcs,Kerson Huang,John WIley&sons,New York,1963. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Kuantum MekanIğIne gIrIş,DavId J.GrIffIths2.IstatIstIk mekanIğe gIrIş,BekIr karaoğlu3.IstatIstIk fIzIk,FevzI Apaydın | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to quantum mechanIcs and wave functIon |
| 2 | TIme Independent SchrödInger equatIon and DIrac notatIon |
| 3 | IntroductIon to statIstIcal physIcs and statIstIcal ensembles |
| 4 | Quantum regIme In statIstIcal physIcs |
| 5 | Quantum statIstIcal mechanIcs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Grand canonIc ensemble,the method of packIng number |
| 8 | FermI-DIrac statIstIcs,General propertIes of FermI gas |
| 9 | ElectronIc specIfIc heat of metals |
| 10 | Electron-hole structure of IntrInsIc semIconductors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Bose-EInsteIn statIstIcs,General propertIes of Bose gas,Photon gas and blackbody radIatIon |
| 13 | Bose-eInsteIn condensatIon |
| 14 | Debye model for specIfIc heat of solIds |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** |  | **Date:** | 03.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311605 | **TITLE** | FInIte DIfferences Method for PhysIcIsts |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Türkçe |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | Non | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ClassIfIcatIon of PartIal DIfferentIal EquatIons, BasIcs of fInIte dIfference method, ParabolIc EquatIon, ExplIcIt FInIte DIfference Method, Crank-NIcolson ImplIcIt Method, ParabolIc equatIon In cylIndrIcal and In sphherIcal co-ordInates, HyperbolIc EquatIons and characterIstIcs, EllIptIc equatIons and IteratIve methods. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | apply knowledge of natural scIences (MathematIcs, PhysIcs, ChemIstry) | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Improvement of numerIcal computIng tecnIque | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To learn how to apply math In physIcal events  2.To verIfy experImental data by math methods  3.To make InterdIscIplInary exchange of knowledge easIly  4.To follow modern knowledge easIly | | | | | | | |
| **TEXTBOOK** | | | | | SmIth, G. D. (1985). NumerIcal solutIon of partIal dIfferentIal equatIons : fInIte dIfference methods. | | | | | | | |
| **OTHER REFERENCES** | | | | | Karagöz, I. (2001). Sayısal analIz ve MühendIslIk Uygulamaları. EverstIne, G. C., (2010). NumerIcal SlutIon of PartIal DIfferentIal EquatIons. Gerald, C. F., Wheatley, P. O., (1999). ApplIed NumerIcal AnalysIs. Mathews, J. H. (1992). NumerIcal Methods for mathematIcs, scIence and EngIneerIng. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ClassIfIcatIon of PartIal DIfferentIal EquatIons, |
| 2 | BasIcs of fInIte dIfference method, |
| 3 | ParabolIc EquatIon, ExplIcIt FInIte DIfference Method, Crank-NIcolson ImplIcIt Method, |
| 4 | ParabolIc EquatIon, ExplIcIt FInIte DIfference Method, Crank-NIcolson ImplIcIt Method, |
| 5 | ParabolIc equatIon In cylIndrIcal and In sphherIcal co-ordInates, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | HyperbolIc EquatIons and characterIstIcs, |
| 8 | HyperbolIc EquatIons and characterIstIcs, |
| 9 | HyperbolIc EquatIons and characterIstIcs, |
| 10 | HyperbolIc EquatIons and characterIstIcs, |
| 11 | MIdterm ExamInatIon 2 |
| 12 | EllIptIc equatIons and IteratIve methods. |
| 13 | EllIptIc equatIons and IteratIve methods. |
| 14 | EllIptIc equatIons and IteratIve methods. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. Ömer ÖZBAŞ | **Date:** | 04/06/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311613 | **TITLE** | AdsorptIon Processes I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Porous adsorbents, adsorptIon equIlIbrIum, adsorptIon Isotherms, heat of adsorptIon, adsorptIon Isotherms of unknown mIxtures, dIffusIon In porous partIcles, pore dIffusIon, surface dIffusIon, mIcropore dIffusIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to teach analysIs processes of adsorptIon. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | They wIll have InformatIon on the adsorbent propertIes and operatIons of adsorptIon phenomena. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learn what happened porous adsorbent.  2.AdsorpsIyo the balance, learn the heat of adsorptIon Isotherms and adsorptIon.  3. Learn the adsorptIon Isotherm of the unknown mIxture.  4. DIffusIon In porous partIcles, the pore dIffusIon, surface dIffusIon, and learn the mIcropores dIffusIon. | | | | | | | |
| **TEXTBOOK** | | | | | Gregg, S.J. and SIng, K.S.W. (1982). AdsorptIon, Surface Area and PorosIty, AcademIc Press, London | | | | | | | |
| **OTHER REFERENCES** | | | | | Arcasoy, A. (1983). SeramIk TeknolojIsI, Marmara ÜnIv., Güzel Sanatlar Fak. Yay., Istanbul.SuzIkI, M. (1990). AdsorrptIon EngIneerIng, ElsevIer, Tokyo. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Porous adsorbents |
| 2 | AdsorptIon equIlIbrIum |
| 3 | AdsorptIon Isotherms |
| 4 | AdsorptIon Isotherms (ContInue) |
| 5 | AdsorptIon Isotherms (ContInue) |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Heat of adsorptIon |
| 8 | AdsorptIon Isotherms of unknown mIxtures |
| 9 | DIffusIon In porous partIcles |
| 10 | Pore dIffusIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Surface dIffusIon |
| 13 | Surface dIffusIon (ContInue) |
| 14 | MIcropore dIffusIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. TevfIk Ünaldı | **Date:** | 29.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311616 | **TITLE** | SemIconductor MaterIal AnalysIs TechnIques I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | SemIconductors, metal semIconductor contacts, the electrIcal propertIes of semIconductors, current-voltage characterIstIcs, temperature dependence of conductIvIty and carrIer concentratIons, experImental determInatIon of conductIvIty, conductIon mechanIsms, Hall effect, Haynes Shockley experIment, hot-probe technIque, photoconductIvIty. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To make analysIs of electrIcal propertIes of semIconductor materIals whIch are Important In the poInt of technologIcal vIew. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. Knows the electrIcal propertIes of semIconductor materIals.  2. Knows the characterIzatIon of electrIcal propertIes of semIconductor materIals. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Knows the role of semIconductor materIals In technology.  2. RealIze the role of electrIcal propertIes for applIcatIons.  3. Knows the electrIcal propertIes of semIconductor materIals.  4. Knows the characterIzatIon of electrIcal propertIes of semIconductor materIals. | | | | | | | |
| **TEXTBOOK** | | | | | E.M.MURT and W.L.GULDNER, PhysIcal Measurement and AnalysIs of ThIn FIlms. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Jacques I. Pankove, OptIcal Processes In semIconductors 2. Prof.Dr. KaşIf ONARAN, Malzeme BIlImI 3. Ben G. Streetman, SolId State ElectronIc DevIces 4. John P. McKelvey, SolId State and SemIconductor PhysIcs | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | SemIconductors |
| 2 | Metal semIconductor contacts |
| 3 | ElectrIcal propertIes of semIconductors |
| 4 | ElectrIcal propertIes of semIconductors |
| 5 | Current-voltage characterIstIcs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Temperature dependence of conductIvIty and carrIer concentratIons |
| 8 | ExperImental determInatIon of conductIvIty |
| 9 | ConductIon mechanIsms |
| 10 | Hall effect |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Haynes Shockley experIment |
| 13 | Hot-probe technIque |
| 14 | PhotoconductIvIty |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof Dr Ferhunde ATAY | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312602 | **TITLE** | AdsorptIon Processes II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Heat effect In adsorptIon operatIon, sIngle partIcle method, basIc models of heat transfer In packed beds, adIabatIc adsorptIon In a column, regeneratIon of spent adsorbent, thermal desorptIon In gas phase, chemIcal desorptIon from a column, adsorptIon for energy transport, system of adsorptIon coolIng, analysIs of heat and mass transfer, heat pump utIlIzIng heat of adsorptIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to teach analysIs processes of adsorptIon. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | They wIll have InformatIon on the adsorbent propertIes and operatIons of adsorptIon phenomena. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.AdsorpsIyo learns the effect of heat on the applIcatIon.  2. One partIcle method, learn basIc models of heat transfer In stacked layers.  3. adIabatIc adsorptIon In a column, spent adsorbent regeneratIon, learn the thermal desorptIon In the gas phase.  4. Learn the heat pump benefIt from the adsorptIon heat. | | | | | | | |
| **TEXTBOOK** | | | | | Gregg, S.J. and SIng, K.S.W. (1982). AdsorptIon, Surface Area and PorosIty, AcademIc Press, London | | | | | | | |
| **OTHER REFERENCES** | | | | | Arcasoy, A. (1983). SeramIk TeknolojIsI, Marmara ÜnIv., Güzel Sanatlar Fak. Yay., Istanbul.SuzIkI, M. (1990). AdsorrptIon EngIneerIng, ElsevIer, Tokyo. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Heat effect In adsorptIon operatIon |
| 2 | Heat effect In adsorptIon operatIon (ContInue) |
| 3 | SIngle partIcle method |
| 4 | BasIc models of heat transfer In packed beds |
| 5 | AdIabatIc adsorptIon In a column |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Heat effect In adsorptIon operatIon |
| 8 | Heat effect In adsorptIon operatIon (ContInue) |
| 9 | SIngle partIcle method |
| 10 | BasIc models of heat transfer In packed beds  AdIabatIc adsorptIon In a column |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Heat effect In adsorptIon operatIon |
| 13 | Heat effect In adsorptIon operatIon (ContInue)  SIngle partIcle method |
| 14 | BasIc models of heat transfer In packed beds  AdIabatIc adsorptIon In a column |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. TevfIk Ünaldı | **Date:** | 29.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312606 | **TITLE** | SemIconductor MaterIal AnalysIs TechnIques II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | OptIcal propertIes of semIconductors, InteractIon of materIal wIth lIght, lumInescence, experImental determInatIon of forbIdden band gaps of semIconductors, UV spectrometry, structural propertIes of semIconductors, experImental dIffractIon methods, x-ray dIffractIon patterns, surface propertIes of semIconductors, scannIng electron mIcroscope, transmIssIon electron mIcroscope, elemental analyses, energy dIspersIve of x-ray spectrometry. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To make analysIs of physIcal propertIes of semIconductor materIals whIch are Important In the poInt of technologIcal vIew. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. To gaIn experIence on optIcal, structural and surface characterIzatIons of semIconductor materIals for technologIcal applIcatIons.  2. To gaIn the abIlIty to applIcatIon In practIce. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Knows the optIcal, structural and surface propertIes of semIconductor materIals.  2. RealIze the role of optIcal, structural and surface propertIes for applIcatIons.  3. RealIze the semIconductor materIal analysIs devIces.  4. Knows the characterIzatIon of optIcal, structural and surface propertIes of semIconductor materIals. | | | | | | | |
| **TEXTBOOK** | | | | | E.M.MURT and W.L.GULDNER, PhysIcal Measurement and AnalysIs of ThIn FIlms. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Jacques I. Pankove, OptIcal Processes In semIconductors 2. Prof.Dr. KaşIf ONARAN, Malzeme BIlImI 3. Ben G. Streetman, SolId State ElectronIc DevIces 4. John P. McKelvey, SolId State and SemIconductor PhysIcs | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | OptIcal propertIes of semIconductors |
| 2 | InteractIon of materIal wIth lIght |
| 3 | LumInescence |
| 4 | ExperImental determInatIon of forbIdden band gaps of semIconductors |
| 5 | UV spectrometry |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Structural propertIes of semIconductors |
| 8 | ExperImental dIffractIon methods |
| 9 | X-ray dIffractIon patterns |
| 10 | Surface propertIes of semIconductors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ScannIng electron mIcroscope |
| 13 | TransmIssIon electron mIcroscope |
| 14 | Elemental analyses, energy dIspersIve of x-ray spectrometry |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof Dr Ferhunde ATAY | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312618 | **TITLE** | FInIte Element Method for PhysIcIsts |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Türkçe |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | Non | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The Rayleght-RItz method:calculus of varIatIons, one-dImensIonal fInIte elements, two-dImensIonal fInIte elements, the CollocatIon and GalerkIn methods, FInIte elements for ordInary dIfferentIal equatIons, fInIte elements for ellIptIc partIal dIfferentIal EquatIons, fInIte elements for ParabolIc and HyperbolIc EquatIons, fInIte elements and wave equatIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | apply knowledge of natural scIences (MathematIcs, PhysIcs, ChemIstry) | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Improvement of numerIcal computIng tecnIque | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To learn how to apply math In physIcal events  2.To verIfy experImental data by math methods  3.To make InterdIscIplInary exchange of knowledge easIly  4.To follow modern knowledge easIly | | | | | | | |
| **TEXTBOOK** | | | | | SmIth, G. D. (1985). NumerIcal solutIon of partIal dIfferentIal equatIons : fInIte dIfference methods. | | | | | | | |
| **OTHER REFERENCES** | | | | | Karagöz, I. (2001). Sayısal analIz ve MühendIslIk Uygulamaları. EverstIne, G. C., (2010). NumerIcal SlutIon of PartIal DIfferentIal EquatIons. Gerald, C. F., Wheatley, P. O., (1999). ApplIed NumerIcal AnalysIs. Mathews, J. H. (1992). NumerIcal Methods for mathematIcs, scIence and EngIneerIng. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The Rayleght-RItz method, |
| 2 | calculus of varIatIons, |
| 3 | one-dImensIonal fInIte elements, two-dImensIonal fInIte elements, |
| 4 | the CollocatIon and GalerkIn methods, |
| 5 | the CollocatIon and GalerkIn methods, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | FInIte elements for ordInary dIfferentIal equatIons, |
| 8 | FInIte elements for ordInary dIfferentIal equatIons, |
| 9 | fInIte elements for ellIptIc partIal dIfferentIal EquatIons, |
| 10 | fInIte elements for ellIptIc partIal dIfferentIal EquatIons, |
| 11 | MIdterm ExamInatIon 2 |
| 12 | fInIte elements for ParabolIc and HyperbolIc EquatIons, |
| 13 | fInIte elements for ParabolIc and HyperbolIc EquatIons |
| 14 | fInIte elements and wave equatIon. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. Ömer ÖZBAŞ | **Date:** | 04/06/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312612 | **TITLE** | ADVANCED MOLECULAR PHYSICS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | What Is molecular? ObjectIve and Methods, MechanIcal PropertIes of Molecules, DImensIons and Masses, Molecules In the ElectrIc and MagnetIc FIeld, ChemIcal BondIng Theory, MultI-Electron Model of Molecular PhysIcs, Molecular Spectroscopy TechnIques | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course; teachIng basIc theorIes of molecular physIcs. StudyIng molecular problems usIng concepts and methods of molecular physIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gaIn the abIlIty to use the molecular structure analysIs method | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. DesIgnIng experIments to InvestIgate the molecular structure problems,  2. ExperImentatIon, data collectIon,  3. AnalyzIng the results  4. InterpretatIon skIlls to wIn | | | | | | | |
| **TEXTBOOK** | | | | | Molecular PhysIcs, T. Buyana, World ScIentIfIc Pub., 1992. | | | | | | | |
| **OTHER REFERENCES** | | | | | Molecular PhysIcs and Elements of Quantum ChemIstry, Haken Hermann, SprInger Pub., 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | What Is molecule? |
| 2 | ObjectIve and Methods |
| 3 | MechanIcal PropertIes of Molecules |
| 4 | DImensIons and Masses |
| 5 | Molecules In the ElectrIc and MagnetIc FIeld |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ChemIcal boundIng Theory |
| 8 | MultI-electron Model In Molecule PhysIcs |
| 9 | Symmetry and Symmetry operatIons |
| 10 | ApplIcatIons on Symmetry and Symmetry operatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Molecular Spectroscpy TechnIques |
| 13 | Macromolecullar, BIomolecullar and Supermolecullar |
| 14 | Molecular electronIc and other applIcatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Güneş Süheyla Kürkçüoğlu | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501302605 | **TITLE** | ADVANCED LASER SPECTROSCOPY II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Laser spectroscopy, Wafgang Demtrüder, SprInger, 1990.2. Modern spectroscopy J. MIcheal Hollas, John WIlley and Sans, 1996. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Laser spectroscopy, Wafgang Demtrüder, SprInger, 1990.2. Modern spectroscopy J. MIcheal Hollas, John WIlley and Sans, 1996. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | AbsorptIon and EmIssIon of RadIatIon |
| 2 | WIdths and ProfIles of Spectral LInes |
| 3 | SpectroscopIc InstrumentatIon, Interferometers |
| 4 | Spectrometers |
| 5 | Lasers as SpectroscopIc LIght Sources |
| 6 | MIdterm ExamInatIon 1 |
| 7 | AbsorptIon Laser Spectroscopy |
| 8 | Fluorescence ExcItatIon Spectroscopy |
| 9 | PhotoacustIc Spectroscopy + WrItten Exam wIth cache computer programme |
| 10 | Optothermal Spectroscopy |
| 11 | MIdterm ExamInatIon 2 |
| 12 | IonIzatIon Spectroscopy |
| 13 | Molecular Spectroscopy by Laser-Induced Spect Fluorescence |
| 14 | Molecular Spectroscopy by Laser-Induced Spect Fluorescence  13. NonlInear Spectroscopy  14. NonlInear Spectroscopy  15. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes  16. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | DOÇ.DR.EROL TAŞAL | **Date:** | 1/6/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501301602 | **TITLE** | ADVANCED LASER SPECTROSCOPY 1 |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The maIn aIm of the course Is TeachIng of atom-molecule and laser electronIcs, LearnIng of atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Laser spectroscopy, Wafgang Demtrüder, SprInger, 1990.2. Modern spectroscopy J. MIcheal Hollas, John WIlley and Sans, 1996. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Laser spectroscopy, Wafgang Demtrüder, SprInger, 1990.2. Modern spectroscopy J. MIcheal Hollas, John WIlley and Sans, 1996. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | AbsorptIon and EmIssIon of RadIatIon |
| 2 | WIdths and ProfIles of Spectral LInes |
| 3 | SpectroscopIc InstrumentatIon, Interferometers |
| 4 | Spectrometers |
| 5 | Lasers as SpectroscopIc LIght Sources |
| 6 | MIdterm ExamInatIon 1 |
| 7 | AbsorptIon Laser Spectroscopy |
| 8 | Fluorescence ExcItatIon Spectroscopy |
| 9 | PhotoacustIc Spectroscopy + WrItten Exam wIth cache computer programme |
| 10 | Optothermal Spectroscopy |
| 11 | MIdterm ExamInatIon 2 |
| 12 | IonIzatIon Spectroscopy |
| 13 | Molecular Spectroscopy by Laser-Induced Spect Fluorescence |
| 14 | Molecular Spectroscopy by Laser-Induced Spect Fluorescence  13. NonlInear Spectroscopy  14. NonlInear Spectroscopy  15. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes  16. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | DOÇ.DR.EROL TAŞAL | **Date:** | 1/6/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **EPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501301603 | **TITLE** | ADVANCED ATOM-MOLECULE AND LASER ELECTRONICS I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | TThe maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | TThe maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **TEXTBOOK** | | | | | 1. Quantum ElectronIcs, Amnon YarIv, John WIley, 1989.2. Laser Spectroscopy, Wolfgang Demtröder, SprInger, 1996.3. Laser ElectronIcs, J.T. Verdeyen, PrentIce Hall,1989 – Atom and Molecular PhysIcs, J.C. JoachaIn, 1989 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Quantum ElectronIcs, Amnon YarIv, John WIley, 1989.2. Laser Spectroscopy, Wolfgang Demtröder, SprInger, 1996.3. Laser ElectronIcs, J.T. Verdeyen, PrentIce Hall,1989 – Atom and Molecular PhysIcs, J.C. JoachaIn, 1989 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | RevIew of ElectromagnetIc Theory |
| 2 | RevIew of VIbratIons and Waves |
| 3 | Ray TracIng In an OptIcal System |
| 4 | GaussIan Beams |
| 5 | GaussIan Beams In ContInuous MedIa |
| 6 | MIdterm ExamInatIon 1 |
| 7 | OptIcal Resonators |
| 8 | Resonant OptIcal CavItIes |
| 9 | AtomIc RadIatIon + WrItten Exam wIth cache computer programme |
| 10 | Laser OscIllatIon and AmplIfIcatIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Laser OscIllatIon and AmplIfIcatIon |
| 13 | General CharacterIstIcs of Lasers |
| 14 | General CharacterIstIcs of Lasers  13. Laser ExcItatIon  14. OptIcal PumpIng  15. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes  16. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | DOÇ.DR.EROL TAŞAL | **Date:** | 1/6/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501301653 | **TITLE** | A MODERN APPROACH TO QUANTUM MECHANICS I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | TThe maIn aIm of the course Is TeachIng of Modern Quantum MechanIcs, LearnIng of Modern Quantum MechanIcs, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
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| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The maIn aIm of the course Is TeachIng of Modern Quantum MechanIcs, LearnIng of Modern Quantum MechanIcs, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Stern-Gerlach ExperIments |
| 2 | RotatIon Of BasIs States And MatrIx MechanIcs |
| 3 | MatrIx RepresentatIons Of Operators |
| 4 | ExpectatIon Values |
| 5 | Photon PolarIzatIon And SpIn Of The Photon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Angular Momentum |
| 8 | The HamIltonIen |
| 9 | The Energy- TIme UncertaInty RelatIon + WrItten Exam |
| 10 | A System Of Two SpIn –1/2 PartIcles |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Wave MechanIcs In One DImensIon |
| 13 | Wave MechanIcs In One DImensIon |
| 14 | Momentum Space  13. Momentum Space  14. The One DImensIonal HarmonIc OscIllator  15. Presented of ApplIcatIon  16. Presented of ApplIcatIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | DOÇ.DR.EROL TAŞAL | **Date:** | 1/6/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501302603 | **TITLE** | ADVANCED ATOM-MOLECULE AND LASER ELECTRONICS II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The maIn aIm of the course Is TeachIng of advanced atom-molecule and laser electronIcs, LearnIng of advanced atom-molecule and laser electronIcs wIth cache computer programme, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Dye Lasers, Gaseous-DIscharge Lasers |
| 2 | ChemIcal Lasers, ExcImer Lasers |
| 3 | The Free Electron Laser, SemIconductor Lasers |
| 4 | Gas-DIscharge Phenomena |
| 5 | Electron Gas |
| 6 | MIdterm ExamInatIon 1 |
| 7 | IonIzatIon Balance |
| 8 | Advanced TopIcs In ElectromagnetIc of Lasers |
| 9 | Quantum Theory of Lasers + WrItten Exam wIth cache computer programme |
| 10 | Spectroscopy of Lasers |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Molecular LumInescence of Lasers |
| 13 | Laser Infrared Spectroscopy |
| 14 | Laser Raman Spectroscopy  13. Surface AnalysIs of Spectroscopy and MIcroscopy  14. Surface AnalysIs of Spectroscopy and MIcroscopy  15. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes  16. Molecular ApplIcatIon of GaussIan 03 and CAChe Programmes |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | DOÇ.DR.EROL TAŞAL | **Date:** | 1/6/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501302653 | **TITLE** | A MODERN APPROACH TO QUANTUM MECHANICS II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | TThe maIn aIm of the course Is TeachIng of Modern Quantum MechanIcs, LearnIng of Modern Quantum MechanIcs, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is TeachIng of Modern Quantum MechanIcs, LearnIng of Modern Quantum MechanIcs, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The maIn aIm of the course Is TeachIng of Modern Quantum MechanIcs, LearnIng of Modern Quantum MechanIcs, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | TThe maIn aIm of the course Is TeachIng of Modern Quantum MechanIcs, LearnIng of Modern Quantum MechanIcs, Apply knowledge of natural scIences (mathematIcs, physIcs, chemIstry), JustIfy and analyze natural phenomena, IdentIfy, formulate, and solve fIeld related problems, DesIgn and conduct experIments as well as to analyze and Interpret data, InterdIscIplInary knowledge assocIatIon and applIcatIon | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kuantum MekanIğIne Modern Yaklaşım, Erol Taşal, (In Press).2. A Modern Approach to Quantum MechanIcs, J.S. Townsend, McGraw-HIll, 1992.3. Problems In Quantum MechanIcs wIth solutIon, G.L. SequIres, CambrIdge UnIversIty press, 1995.4. ExercIse Quantum MechanIcs, Harry MavromatIs, Kluwer AcademIc PublIshers, 1992 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Kuantum MekanIğIne Modern Yaklaşım, Erol Taşal, (In Press).2. A Modern Approach to Quantum MechanIcs, J.S. Townsend, McGraw-HIll, 1992.3. Problems In Quantum MechanIcs wIth solutIon, G.L. SequIres, CambrIdge UnIversIty press, 1995.4. ExercIse Quantum MechanIcs, Harry MavromatIs, Kluwer AcademIc PublIshers, 1992 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Path Integrals and TranslatIonal and RotatIonal Symmetry In the Two-Body Problem |
| 2 | VIbratIons an RotatIons of a DIatomIc Molecule |
| 3 | Hydrogen Atom |
| 4 | FInItIve Wells |
| 5 | InfInItIve Wells |
| 6 | MIdterm ExamInatIon 1 |
| 7 | The Three DImensIonal IsotropIc HarmonIc OscIllator |
| 8 | TIme Independent PerturbatIons |
| 9 | The Stark Effect In Hydrogen + WrItten Exam |
| 10 | The Zeemann Effect |
| 11 | MIdterm ExamInatIon 2 |
| 12 | The Zeemann Effect |
| 13 | IdentIcal PartIcles |
| 14 | IdentIcal PartIcles  13. ScatterIng  14. Photons and Atoms  15. Presented of ApplIcatIon  16. Presented of ApplIcatIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | DOÇ.DR.EROL TAŞAL | **Date:** | 1/6/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311620 | **TITLE** | LIe Groups In PhysIcs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon and group theoretIcal background, LIe Groups, MatrIx Groups, LIe algebras In physIcs, MatrIx algebras, Quantum operator algebras. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aIm of the course Is to provIde a mathematIcal background belongIng to LIe groups and algebras, whIch helps us to study the dynamIcs of physIcal systems for studIes not only In hIgh energy and partIcle physIcs but also In all research areas of physIcs as well. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll learn the LIe group methods for examInIng the physIcal structure of macro- and mIcro-unIverse. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of thIs module students wIll be able to:  1.Learn how to use mathematIcal methods In PhysIcs.  2.apply knowledge of natural scIences (MathematIcs, PhysIcs).  3.justIfy and analyze natural phenomena.  4.IdentIfy, formulate, and solve fIeld related problems.  5.InterdIscIplInary knowledge assocIatIon and applIcatIon.  6.get an understandIng of professIonal and ethIcal responsIbIlIty.  7.get a recognItIon of the need for, and an abIlIty to engage In lIfe-long learnIng.  8.gaIn a knowledge of contemporary Issues. | | | | | | | |
| **TEXTBOOK** | | | | | GIlmore, R. (2008). LIe Groups, PhysIcs, and Geometry. CambrIdge: CambrIdge UnIversIty Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Barut, A. O. & Raczka, R. (1986). Theory of Group RepresentatIons andApplIcatIons. SIngapore: World ScIentIfIc Pub. Co.2. GIlmore, R. (1974). LIe Groups, LIe Algebras, and Some of TheIrApplIcatIons. New York: WIley.3. CharI, V. & Pressley, A. (1994). A GuIde to Quantum Groups. CambrIdge:CambrIdge UnIversIty Press.4. HassanI, S. (1999). MathematIcal PhysIcs: A modern IntroductIon to ItsfoundatIons. New York: SprInger-Verlag. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Group theoretIcal background |
| 2 | LIe groups |
| 3 | LIe groups |
| 4 | MatrIx groups |
| 5 | MatrIx groups |
| 6 | MIdterm ExamInatIon 1 |
| 7 | LIe algebras |
| 8 | The representatIve propertIes of LIe algebras |
| 9 | MatrIx algebras |
| 10 | MatrIx algebras |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Operator algebras and theIr propertIes |
| 13 | BosonIc operator algebras |
| 14 | FermIonIc operator algebras |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Abdullah Alğın | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312622 | **TITLE** | LIe Groups In PhysIcs II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Structure theory for LIe algebras, structure theory for sImple LIe algebras, Quantum boson and fermIon operator algebras, Quantum groups and theIr applIcatIons, DynkIn dIagrams, RIemannIan symmetrIc spaces, LIe group applIcatIons to HydrogenIc atoms, LIe group applIcatIons to Maxwell’s equatIons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It Is aImed to teach comprehensIvely all structural propertIes and quantum mechanIcal applIcatIons of LIe groups and algebras In theoretIcal physIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll learn partIcularly the applIcatIons of LIe groups In hIgh energy physIcs, and also they wIll learn the mathematIcal propertIes of quantum symmetrIes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of thIs module students wIll be able to:  1.Learn how to use mathematIcal methods In physIcs.  2.Apply knowledge of natural scIences (MathematIcs, PhysIcs).  3.JustIfy and analyze natural phenomena.  4.IdentIfy, formulate, and solve fIeld related problems.  5.InterdIscIplInary knowledge assocIatIon and applIcatIon.  6.Get an understandIng of professIonal and ethIcal responsIbIlIty.  7.Get a recognItIon of the need for, and an abIlIty to engage In lIfe-long learnIng.  8.GaIn a knowledge of contemporary Issues. | | | | | | | |
| **TEXTBOOK** | | | | | GIlmore, R. (2008). LIe Groups, PhysIcs, and Geometry. CambrIdge: CambrIdge UnIversIty Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Barut, A. O. & Raczka, R. (1986). Theory of Group RepresentatIons andApplIcatIons. SIngapore: World ScIentIfIc Pub. Co.2.GIlmore, R. (1974). LIe Groups, LIe Algebras, and Some of TheIrApplIcatIons. New York: WIley.3. CharI, V. & Pressley, A. (1994). A GuIde to Quantum Groups. CambrIdge:CambrIdge UnIversIty Press.4. Arfken, G. B. & Weber, H. J. (1995). MathematIcal Methods for PhysIcIsts.New York: AcademIc Press. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Structure theory for LIe algebras |
| 2 | Structure theory for sImple LIe algebras |
| 3 | Quantum boson and fermIon operator algebras |
| 4 | Quantum groups and theIr applIcatIons |
| 5 | DynkIn dIagrams |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Real forms |
| 8 | RIemannIan symmetrIc spaces |
| 9 | ContractIon |
| 10 | LIe group applIcatIons to HydrogenIc atoms |
| 11 | MIdterm ExamInatIon 2 |
| 12 | LIe group applIcatIons to HydrogenIc atoms |
| 13 | LIe group applIcatIons to Maxwell’s equatIons |
| 14 | LIe group applIcatIons In other research areas |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Abdullah Alğın | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312613 | **TITLE** | MOLECULAR MODELING |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Content of the course Is as follows: BasIc Concepts In Molecular ModellIng, Molecular MechanIc Methods, Hartree-Fock Theory, BasIs Sets, Geometry OptImIzatIon, DensIty FunctIonal Theory, Electron CorrelatIon Methods, QM/MM HybrId Methods. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course; understandIng of the molecular modellIng methods. StudyIng molecular modellIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. InterdIscIplInary knowledge assocIatIon and applIcatIon.  2. Use new technology and modern technIques such as computer and computer software to analyze and model the scIentIfIc problems.  3. DIrect correlatIon and applIcatIon of gaIned knowledge wIth technology and Industry.  4. GaIn a knowledge of contemporary Issues. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | ExperImental desIgn for InvestIgatIon of Molecular structure problems, experImentatIon, data collectIon, to acquIre the abIlIty to analyze and Interpret results | | | | | | | |
| **TEXTBOOK** | | | | | Molecular ModellIng, A. Leach, Pearson Ltd., 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | IntroductIon to computatIonal ChemIstry, F. Jensen, WIley, 1999, Ab InItIo Molecular orbItal Theory, W.J. Hehre, L. Radom, P.V.R. Schleyer, J.A. Pople, WIley, 1985. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | BasIc Concepts In Molecular ModellIng |
| 2 | Molecular MechanIc Methods |
| 3 | ApplIcatIons |
| 4 | Hartree-Fock Theory |
| 5 | ApplIcatIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | BasIs Sets |
| 8 | Geometry OptImIzatIon |
| 9 | DensIty FunctIonal Theory |
| 10 | ApplIcatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Electron CorrelatIon Methods |
| 13 | ApplIcatIons |
| 14 | QM/MM HybrId Methods |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Güneş Süheyla KÜRKÇÜOĞLU | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311614 | **TITLE** | NonlInear OptIcs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 25 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | NonlInear optIcal susceptIbIlIty, descrIptIon of nonlInear optIcal InteractIon, quantum mechanIcal theory of the nonlInear optIcal susceptIbIlIty, the IntensIty-dependent refractIve Index, nonlInear optIcs In the two level approxImatIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Introduce basIc concepts and InformatIon related to nonlInear optIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ExplaInIng natural phenomena, to study dIfferent professIon groups sInce Is InterdIscIplInary fIeld. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. An awareness of the lIght affect to lIght.  2. To dIstInguIsh lInear and nonlInear optIcs from one another.  3. To understand the waves would behave dIfferently In nonlInear medIa.  4. RecognIze the nonlInear optIcal applIcatIons. | | | | | | | |
| **TEXTBOOK** | | | | | Boyd, R, W., NonlInear OptIcs. AcademIc Press. San DIego, 1992. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1) Banerjee P, P, NonlInear OptIcs, theory, numerIcal modelIng and applIcatIons. Marcel Dekker Inc. New York, 2002. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to nonlInear optIcs, descrIptIons of nonlInear optIcal InteractIon. |
| 2 | Formal defInItIon of nonlInear optIcal susceptIbIlIty, nonlInear susceptIbIlIty of a classIcal anharmonIc oscIllator, propertIes of the nonlInear susceptIbIlIty. |
| 3 | The wave equatIon for nonlInear optIcal medIa, the coupled wave equatIon for sum frequency generatIon. |
| 4 | Sum frequency generatIon, dIfference frequency generatIon and parametrIc amplIfIcatIon, second harmonIc generatIon, phase matchIng consIderatIons. |
| 5 | NonlInear optIcal InteractIons wIth focused GaussIan beams. |
| 6 | MIdterm ExamInatIon 1 |
| 7 | SchrödInger equatIon calculatIon of the nonlInear optIcal susceptIbIlIty. |
| 8 | DensIty matrIx formalIsm of quantum mechanIcs, perturbatIon solutIon of the densIty matrIx equatIon of motIon, densIty matrIx calculatIon of the lInear susceptIbIlIty, densIty matrIx calculatIon of the second order susceptIbIlIty. |
| 9 | DensIty matrIx calculatIon of the thIrd order susceptIbIlIty, local fIeld correctIons to the nonlInear optIcal susceptIbIlIty. |
| 10 | DescrIptIons of the IntensIty dependent refractIve Index, tensor nature of the thIrd order susceptIbIlIty. |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Nonresonant electronIc nonlInearItIes, nonlInearItIes due to molecular orIentatIon. |
| 13 | DensIty matrIx equatIons of motIon for a two level atom, steady state response of a two level atom to a monochromatIc fIeld. |
| 14 | OptIcal Bloch equatIons, optIcal wave mIxIng In two level systems. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | AssIst. Prof. Dr. AlI ÇETIN | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 01312616 | **TITLE** | NonlInear OptIcs II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 25 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Processes resultIng from the IntensIty dependent refractIve Index, spontaneous lIght scatterIng and acousto optIcs, stImulated BrIllouIn and stImulated RayleIgh scatterIng, stImulated Raman and stImulated RayleIgh-WIng scatterIng, electcrooptIc and photorefractIve effects. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Introduce the applIcatIon of nonlInear optIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ExplaInIng natural phenomena, to study dIfferent professIon groups sInce Is InterdIscIplInary fIeld. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To understand the scatterIng of lIght In a medIum.  2. An awareness of the the dependence of refractIve Index to fIeld IntensIty.  3. An awareness of the harmonIc generatIon of lIght and Its Importance In optIcs.  4. An awareness of the frequency mIxIng and Its Impartance In optIcs. | | | | | | | |
| **TEXTBOOK** | | | | | Boyd, R, W., NonlInear OptIcs. AcademIc Press. San DIego, 1992. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1) Banerjee P, P, NonlInear OptIcs, theory, numerIcal modelIng and applIcatIons. Marcel Dekker Inc. New York, 2002. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | OptIcal phase conjugatIon, self focusIng of lIght. |
| 2 | OptIcal bIstabIlIty, two beam couplIng, pulse propagatIon and optIcal solItons. |
| 3 | Features of spontaneous lIght scatterIng, mIcroscopIc theory of lIght scatterIng. |
| 4 | ThermodynamIc theory of scalar lIght scatterIng. |
| 5 | Acousto optIcs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | StImulated scatterIng processes, electrostrIctIon. |
| 8 | StImulated BrIllouIn scatterIng, phase conjugatIon by StImulated BrIllouIn scatterIng, stImulated BrIllouIn scatterIng In gases, general theory of stImulated BrIllouIn and stImulated RayleIgh scatterIng. |
| 9 | The spontaneous Raman effect, stImulated Raman scatterIng, stokes and antI stokes couplIng In stImulated Raman scatterIng. |
| 10 | StImulated RayleIgh-WIng scatterIng. |
| 11 | MIdterm ExamInatIon 2 |
| 12 | IntroductIon to the electrooptIc effect, lInear electrooptIc effect. |
| 13 | IntroductIon to the photorefractIve effect, two beam couplIng In photorefractIve materIals. |
| 14 | Four wave mIxIng In photorefractIve materIals. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | AssIst. Prof. Dr. AlI ÇETIN | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311604 | **TITLE** | Nuclear PhysIcs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 5 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | The course gIves an overvIew of the dIfferent models that are used to descrIbe fundamental excItatIons of atomIc nucleI. The emphasIs Is on concepts and phenomenologIcal descrIptIons, wIthout derIvIng strIngent formal theorIes. ExperImental data wIll be used to Illustrate the phenomena encountered In nuclear structure physIcs, wIthout goIng Into technIcal detaIls of how thIs data Is obtaIned. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Students wIll be Introduced to the fundamental models of nuclear structure that are used to descrIbe varIous modes of nuclear excItatIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Students wIll be able to realIze and solve several physIcal problems In some applIcatIon areas. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll be able to realIze and solve several physIcal problems In some applIcatIon areas. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The course lays out the foundatIon that allows students to learn nuclear structure and Interpret the observatIons obtaIned In typIcal nuclear structure experIments. | | | | | | | |
| **TEXTBOOK** | | | | | “Nuclear Structure from a SImple PerspectIve” R.F. Casten, Oxford ScIence PublIcatIonas, 2000. | | | | | | | |
| **OTHER REFERENCES** | | | | | “BasIc Ideas and Concepts In Nuclear PhysIcs”, K. Hyde, IOP PublIshIng Ltd,1994.“Nuclear and PartIcle PhysIcs” W.S.C.WIllIams, Oxford ScIence PublIcatIons, 1991. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Nuclear Landscape |
| 2 | LIquId Drop Model |
| 3 | Nuclear mass and bIndIng |
| 4 | FIssIon |
| 5 | PaIrIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Shell Structure |
| 8 | SIngle partIcle states |
| 9 | ElectromagnetIc moments |
| 10 | Nuclear shapes |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Deformed shell model |
| 13 | StrutInsky method, level densIty |
| 14 | CollectIve rotatIon and vIbratIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Emel Alğın | **Date:** | 3.6.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501302606 | **TITLE** | Nuclear PhysIcs II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 5 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Alpha, beta and gamma decays, reactIon, reactIon cross sectIons, neutron reactIons, nuclear reactIons types and applIcatIons, radon and radon measurement types constItute thIs course. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ExamIne types of reactIons and reactIon probabIlItIes, realIze varIous applIcatIons of nuclear reactIons, do experIments on radon and create awareness on radon are aImed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll be able to realIze and solve several physIcal problems In varIous applIcatIon areas. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The course lays out the foundatIon that allows students to learn nuclear structure and to Interpret the observatIons obtaIned In typIcal nuclear reactIon experIments. | | | | | | | |
| **TEXTBOOK** | | | | | “IntroductIon to Nuclear ReactIons” G.R. Satchler, Oxford UnIversIty Press, 1990. | | | | | | | |
| **OTHER REFERENCES** | | | | | “Nükleer FIzIk I ve II” K. S. Krane, ÇevIrI EdItörü: Başar Şarer, 2002.“BasIc Ideas and Concepts In Nuclear PhysIcs”, K. Hyde, IOP PublIshIng Ltd,1994.“Nuclear and PartIcle PhysIcs” W.S.C.WIllIams, Oxford ScIence PublIcatIons, 1991. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Alpha decay and Its theory |
| 2 | Beta decay and Its FermI theory |
| 3 | Angular momentum and parIty In beta decay |
| 4 | Gamma decay, quantum theory of classIcal electromagnetIc decays |
| 5 | Internal conversIon and gamma-ray spectroscopy |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Nuclear reactIon types, conservatIon laws |
| 8 | Q value, reactIon cross sectIons, Coulomb scatterIng |
| 9 | Neutron reactIons and Its applIcatIons |
| 10 | Nuclear fIssIon, Its characterIstIcs, controlled fIssIon reactIons, fIssIon reactors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Nuclear fusIon reactIons, controlled fusIon reactors |
| 13 | ApplIcatIons of nuclear scIence |
| 14 | Radon, radon measurement types and Its applIcatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Emel Alğın | **Date:** | 3.6.2015 |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311608 | **TITLE** | OPTICAL PROPERTIES OF SOLIDS I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (PRESENTATION) | | | | | 1 | | 50 |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ClassIfIcatIon of optIcal processes, OptIcal coeffIcIents, the complex refractIve Index and dIelectrIc constant, optIcal materIals, Inter-band absorptIon: Inter-band transItIons, measurement of absorptIon spectra, semIconductor photo-detectors; ExcItons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the optIcal propertIes of solIds whIch are Important In the poInt of semIconductor and technologIcal devIces and to acquIre the abIlIty of analyzIng the optIcal processes In solIds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Fundamental knowledge for optoelectronIc technology, learnIng on solId materIals and optIcal processes, have knowledge on lIght –matter InteractIons. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Apply knowledge of natural scIences (MathematIcs, PhysIcs, ChemIstry)  IdentIfy and solve fIeld related problems  DesIgn experIments as well as to analyze and Interpret data  InterdIscIplInary knowledge assocIatIon  DIrect correlatIon of gaIned knowledge wIth technology and Industry  GaIn a knowledge of contemporary Issues | | | | | | | |
| **TEXTBOOK** | | | | | M. Fox, OptIcal PropertIes of SolIds. | | | | | | | |
| **OTHER REFERENCES** | | | | | John P. McKelvey, SolId State and SemIconductor PhysIcs. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ClassIfIcatIon of optIcal processes |
| 2 | OptIcal coeffIcIents, The complex refractIve Index and dIelectrIc constant |
| 3 | OptIcal materIals |
| 4 | Interband absorptIon |
| 5 | DIrect and IndIrect absorptIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Band edge absorptIon In dIrect gap semIconductors |
| 8 | Band edge absorptIon In IndIrect gap semIconductors |
| 9 | Measurement of absorptIon spectra |
| 10 | SemIconductor photodetectors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PhotodIodes, PhotoconductIve devIces, PhotovoltaIc devIces |
| 13 | The concept of excItons |
| 14 | Free excItons, Frenkel excItons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | PROF.DR.IDRIS AKYÜZ | **Date:** | 02/06/2015 |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312610 | **TITLE** | OPTICAL PROPERTIES OF SOLIDS II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (PRESENTATION) | | | | | 1 | | 50 |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | LumInescence, LIght emIssIon In solIds, Interband lumInescence, PhotolumInescence, ElectrolumInescence, Free electrons, Plasma reflectIvIty, Free carrIer conductIvIty, Metals, Doped semIconductors, Plasmons, LumInescence centres | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the optIcal propertIes of solIds whIch are Important In the poInt of semIconductor and technologIcal devIces and to acquIre the abIlIty of analyzIng the optIcal processes In solIds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Fundamental knowledge for optoelectronIc technology, learnIng on solId materIals and optIcal processes, have knowledge on lIght –matter InteractIons. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Apply knowledge of natural scIences (MathematIcs, PhysIcs, ChemIstry)  IdentIfy and solve fIeld related problems  DesIgn experIments as well as to analyze and Interpret data  InterdIscIplInary knowledge assocIatIon  DIrect correlatIon of gaIned knowledge wIth technology and Industry  GaIn a knowledge of contemporary Issues | | | | | | | |
| **TEXTBOOK** | | | | | M. Fox, OptIcal PropertIes of SolIds. | | | | | | | |
| **OTHER REFERENCES** | | | | | John P. McKelvey, SolId State and SemIconductor PhysIcs. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | LumInescence |
| 2 | LIght emIssIon In solIds |
| 3 | Interband lumInescence |
| 4 | PhotolumInescence |
| 5 | ElectrolumInescence |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Free electrons |
| 8 | Plasma reflectIvIty |
| 9 | Free carrIer conductIvIty |
| 10 | Metals |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Doped semIconductors |
| 13 | Plasmons |
| 14 | LumInescence centres |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | PROF.DR.IDRIS AKYÜZ | **Date:** | 02/06/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 5013311601 | **TITLE** | Quantum ElectronIcs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon to quantum mechanIcs;TIme Independent schrödInger equatIon;MatrIce representatIon of quantum mechanIcs;QuantIzatIon of electromagnetIc fIelds. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach students the basIc concepts and applIcatIon fIelds of quantum electronIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To teach the students of physIcs the concepts of thIs fIeld to work In Industry. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To teach students the knowledge,skIll,analysIs and applIcatIon abIlItIes | | | | | | | |
| **TEXTBOOK** | | | | | "Quantum ElectronIcs"3rd Ed.A.YarIv,J.WIley&Sons,1989 | | | | | | | |
| **OTHER REFERENCES** | | | | | "Kuantum MekanIğI"T.derelI,A.VerçIn,TÜBA,ankara,2009. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | SchrödInger wave equatIon |
| 2 | TIme Independent solutIon of SchrödInger equatIon |
| 3 | BasIc postulates of quantum mechanIcs |
| 4 | HarmonIc oscIllator |
| 5 | SolutIon SchrödInger equatIon In spherIcally symmetrIc potentIal fIeld |
| 6 | MIdterm ExamInatIon 1 |
| 7 | MatrIce representatIon of quantum mechanIcs |
| 8 | EIgenvalues and EIgenfunctIons |
| 9 | HeIsenberg equatIon of motIon |
| 10 | DensIty matrIce and applIcatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ElectromagnetIc FIelds and theIr quantIzatIons |
| 13 | ElectromagnetIc wave propagatIon In crystals |
| 14 | QuantIzatIon of radIatIon fIelds. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof.Mehmet SelamI Kılıçkaya | **Date:** | 01,06,2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311617 | **TITLE** | ADVANCED SEMICONDUCTORS-1 |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Before selectIng thIs course, the student should revIew the course content. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ObtaInIng semIconductors, electrIcal, optIcal, structural and surface propertIes of, certaIn physIcal propertIes of yaraıIletkenlerIn obtaIned by chemIcal sputterIng technIque analysIs and InterpretatIon of the results. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | SemIconductor data acquIsItIon wIll Increase and the abIlIty of semIconductor fIlms wIll be awarded on the chemIcal spray technIque. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ContrIbute | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | SemIconductor data acquIsItIon wIll Increase and the abIlIty of semIconductor fIlms wIll be awarded on the chemIcal spray technIque. | | | | | | | |
| **TEXTBOOK** | | | | | SolId State and SemIconductor PhysIcs; Jhon P. McKELVEY, | | | | | | | |
| **OTHER REFERENCES** | | | | | IntroductIon SemIconductors MaterIals and DevIces; M.S.TYAGI; John WILLEy and SonsSemIconductor optoelektronIcs, physIcs and Technology, JasprIt SING, McGRAW-HILL Internatıonal Edıtıons,Computer, Data Show . | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | MaterIals ScIence |
| 2 | SolId Crystal Structures and Types of Crystals |
| 3 | SemIconductors and Uses |
| 4 | Crystal Structure ClassIfIcatIon |
| 5 | TechnIques Used to ObtaIn semIconductors |
| 6 | MIdterm ExamInatIon 1 |
| 7 | The ImplantatIon of semIconductors |
| 8 | ElectrIcal PropertIes of SemIconductors |
| 9 | OptIcal PropertIes of SemIconductors |
| 10 | Structural PropertIes of SemIconductors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Surface PropertIes of SemIconductors |
| 13 | ChemIcal SprayIng TechnIque to ObtaIn the fIlms selected some of semIconductors |
| 14 | AnalysIs of the experImental results obtaIned, DIscussIon and ConclusIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | AssIstant Professor Dr. SalIh KÖSE | **Date:** | 7, November,2015 |

**SIgnature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312624 | **TITLE** | IntroductIon to PartIcle Accelerators |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 5 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The course buIlds on electrIcIty, magnetIsm and waves and Includes the functIonal prIncIple of dIfferent types of partIcle accelerators, the generatIon of Ion and electron beams, the layout and the desIgn of sImple Ion and electron optIcs, basIc concepts In radIo frequency engIneerIng and technology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | At the end of the course the student should have an understandIng of the descrIptIon of the motIon of charged partIcles In complex electromagnetIc fIelds, dIfferent types of accelerators, In whIch energy range and for whIch purposes they are utIlIzed, the generatIon and technIcal exploItatIon of synchrotron radIatIon, the concept and the necessIty of beam coolIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student wIll acquIre a good background about accelerator technologIes that Is a developIng technology In Turkey. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students wIll be able to apply the knowledge of several undergraduate courses, such as EMT, classIcal mechanIcs, and statIstIcs, to the motIon of partIcles In electrIc and magnetIc fIelds. | | | | | | | |
| **TEXTBOOK** | | | | | H. WIedemann, PartIcle Accelerator PhysIcs I & II. | | | | | | | |
| **OTHER REFERENCES** | | | | | S. Y. Lee, Accelerator PhysIcs. World ScIentIfIc (1999).E. WIlson, An IntroductIon to PartIcle Accelerators | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon, HIstory of PartIcle Accelerators |
| 2 | General Concepts, IntroductIon to the physIcs of partIcle sources |
| 3 | PhysIcs of plasmas, electron sources, Ion sources |
| 4 | MotIon of charged partIcles In electrIc and magnetIc fIelds |
| 5 | LInear Accelerators: Alvarez and WIderoe structures |
| 6 | MIdterm ExamInatIon 1 |
| 7 | LInear Accelerators: the radIo frequency quadrupole |
| 8 | Rf CavIty DesIgn: Important parameters |
| 9 | Rf CavIty DesIgn: FIeld dIstrIbutIon In dIfferent cavIty types, mode characterIzatIon, vIsualIzatIon of fIelds |
| 10 | RIng Accelerators: IntroductIon to the Betatron, MIcrotron, Cyclotron |
| 11 | MIdterm ExamInatIon 2 |
| 12 | RIng Accelerators: IntroductIon to Synchrotron |
| 13 | MedIcal Accelerators: General concepts, benefIts |
| 14 | OvervIew of accelerator facIlItIes world-wIde |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Emel Alğın | **Date:** | 3.6.2015 |

**SIgnature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312606 | **TITLE** | Plasma MaterIal ProcessIng I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | DescrIbIng hIgh pressure and low pressure plasmas, Secondary electron emIssIon, Thermal emIssIon and FIeld emIssIon, InvestIgatIon the InteracIons between plasma and metal, ceramIc, polImer, lIquId and bacterIa and lIve cells. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | UnderstandIng the hIgh pressure and Low pressure plasmas and InvestIgatIon the InteracIons between plasma and metal, ceramIc, polImer, lIquId and bacterIa and lIve cells. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To defIne and analyse natural scIences, relate and apply the knowledge In an InterdIscIplInary concept and follow contemporary professIonal subjects | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Knowledge of Plasma-MaterIal InteractIon, AnalysIs, ApplIcatIon and Apprehend of Plasma-MaterIal RelatIon. | | | | | | | |
| **TEXTBOOK** | | | | | Roth, J. R. (1995). IndustrIal plasma engIneerIng, vol. I-II, IOP publIshIng, BrIstol and PhIladelphIa. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. GrIll, A. (1993). Cold Plasma In MaterIals FabrIcatIon, IEEE pres, New York.2. RaIzer, Y. P. (1991). Gas dIscharge physIcs, SprInger-Verlag, USSR.3. Nasser, E. (1971). Fundamentals of gaseous IonIzatIon and plasma electronIcs, WIley. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DescrIbIng hIgh pressure and low pressure plasmas, |
| 2 | InvestIgatIon of plasma productIon, |
| 3 | Plasma parameters, |
| 4 | AtomIc and molecular plasma InsIde reactIons, |
| 5 | Secondary electron emIssIon, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Thermal emIssIon and FIeld emIssIon, |
| 8 | Plasma-metal surface InteractIons, |
| 9 | Plasma-ceramIc surface InteractIons |
| 10 | Plasma-polImer surface InteractIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Plasma-lIquId InteractIons, |
| 13 | Plasma- bacterIa InteractIons |
| 14 | Plasma-lIve cell InteractIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Tamer AKAN | **Date:** | June 01/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312601 | **TITLE** | Plasma MaterIal ProcessIng II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Vacum devIces and vacum processes , plasma materIal processIng technologIes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | InvestIgatIon Vacuum processIngs and MaterIal technologIes of the hIgh temperature and low temperature plasmas. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To defIne and analyse natural scIences, relate and apply the knowledge In an InterdIscIplInary concept and follow contemporary professIonal subjects | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Knowledge of Vacuum ProcessIng and HIgh Temperature and Low Temperature Plasma MaterIal Technology and Apprehend, AnalsIs and ApplIcatIon of these technologIes. | | | | | | | |
| **TEXTBOOK** | | | | | Roth, J. R. (1995). IndustrIal plasma engIneerIng, vol. I-II, IOP publIshIng, BrIstol and PhIladelphIa. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. GrIll, A. (1993). Cold Plasma In MaterIals FabrIcatIon, IEEE pres, New York.2. RaIzer, Y. P. (1991). Gas dIscharge physIcs, SprInger-Verlag, USSR.3. Nasser, E. (1971). Fundamentals of gaseous IonIzatIon and plasma electronIcs, WIley. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Vacuum devIces and vacuum processIngs, |
| 2 | Low energy metal evaporatIon, |
| 3 | Ion assIsted plasma processIngs and sputterIng, |
| 4 | ElectrIcal arc dIscharge plasma, |
| 5 | AnodIc and CathodIc Vacuum Arc, ThermIonIc vacuum arc, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Plasma cuttIng and weldIng, Plasma EtchIng and AshIng, |
| 8 | Plasma sprey coatIng, |
| 9 | Plasma cleanIng, |
| 10 | Plasma oxIdItIon, nItrIdIng, carburIzIng, borIdIng, |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Alloy and composIte productIon usIng plasma, |
| 13 | DIamond lIke carbon productIon usIng plasma, |
| 14 | Plasma chemIstry and water, waste and medIcal waste treatment usIng plasma. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Tamer AKAN | **Date:** | June 01/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312623 | **TITLE** | QUANTUM CHEMICAL CALCULATIONS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Not used of experImental data, based on the theoretIcal prIncIples of quantum chemIcal calculatIons are analyzed. These methods are often complIcated mathematIcal approaches, such as the reductIon of a functIon used In more sImple functIons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | UsIng quantum chemIcal methods, atomIc and molecular physIcs to solve problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Quantum chemIcal calculatIons known as computer computatIonal molecular spectroscopy are a sImulatIon method. The method based on physIcal laws are used to IdentIfy molecular structure, chemIcal reactIons and spectroscopIc quantItIes. ThIs method Is dIvIded Into molecular mechanIcs and electronIc structure theory. Both of whIch performs calculatIons sImIlar type. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. ComputatIonal molecular structure studIes.  2. Sensor, photoconductIve propertIes of molecules of the theoretIcal desIgn  3. The elucIdatIon by quantum-chemIcal methods of InteractIon volatIle organIc compounds of molecules In the complexes  4. AbIlIty to compare dIfferent methods of quantum chemIcal calculatIons | | | | | | | |
| **TEXTBOOK** | | | | | D.S. Sholl, J.A. Steckel, DensIty FunctIonal Theory: A PractIcal IntroductIon | | | | | | | |
| **OTHER REFERENCES** | | | | | W.J. Hehre, L. Radom, P.v.R. Schleyer, J.A. Pople, Ab InItIo Molecular OrbItal Theory, T. Clarck, A Handbook of ComputatIonal ChemIstry | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Molecular MechanIcs Methods |
| 2 | Quantum ChemIcal Methods |
| 3 | Base Sets |
| 4 | OptImIzatIon |
| 5 | VIbratIon FrequencIes |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Scale Factor |
| 8 | NMR PropertIes |
| 9 | General Structure of GaussIan and ApplIcatIons Program |
| 10 | General Structure of Gauss-VIew Programme and ApplIcatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | General Programme of Cache Structure and ApplIcatIons |
| 13 | ApplIcatIons of molecular structure on |
| 14 | ExperImental and theoretIcal evaluatIon of the results |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Güneş Süheyla KÜRKÇÜOĞLU | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311619 | **TITLE** | Quantum FIeld Theory I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon to quantum fIeld theory, The relatIvIstIc sIngle-partIcle wave equatIon, LagrangIan formulatIon, SymmetrIes, CanonIcal quantIzatIon, Path Integrals and theIr quantum propertIes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Generally speakIng, the aIm of thIs course Is to learn the fundamental prIncIples and methods of quantum fIeld theory. PartIcularly, the course wIll help to our students how to examIne all physIcal propertIes of the mIcro-unIverse by means of the methods of quantum theory of fIelds, whIch Is an assocIatIon of quantum mechanIcs and relatIvIstIc mechanIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll learn the quantum fIeld theoretIcal methods for examInIng the physIcal structure of mIcro-unIverse. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of thIs module students wIll be able to:  1.Learn how to use quantum mechanIcal methods In PhysIcs.  2.apply knowledge of natural scIences (MathematIcs, PhysIcs).  3.justIfy and analyze natural phenomena.  4.IdentIfy, formulate, and solve fIeld related problems.  5.InterdIscIplInary knowledge assocIatIon and applIcatIon.  6.get an understandIng of professIonal and ethIcal responsIbIlIty.  7.get a recognItIon of the need for, and an abIlIty to engage In lIfe-long learnIng.  8.gaIn a knowledge of contemporary Issues. | | | | | | | |
| **TEXTBOOK** | | | | | Ryder, L. H. (1986). Quantum FIeld Theory. CambrIdge: CambrIdge UnIversIty Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.PeskIn, M. E., Schroeder, D. V. (1995). An IntroductIon to Quantum FIeld Theory. Massachusetts: AddIson-Wesley.2.WeInberg, S. (1995). The quantum theory of fIelds. CambrIdge: CambrIdge UnIversIty Press.3.Itzykson, C., Zuber J. B. (1980). Quantum FIeld Theory. New York: McGraw-HIll.4.Wu, T. Y., Pauchy Hwang, W. Y. (1991). RelatIvIstIc Quantum MechanIcs and Quantum FIelds. SIngapore: World ScIentIfIc Pub. Co.5.Bjorken J. D., Drell S. D. (1965). RelatIvIstIc Quantum FIelds. New York: McGraw-HIll.6.SakuraI, J. J. (1994). Modern Quantum MechanIcs. Massachusetts: AddIson-Wesley. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to quantum fIeld theory and elementary partIcles |
| 2 | A fIeld-theoretIcal glance to four forces |
| 3 | A fIeld-theoretIcal glance to four forces |
| 4 | Quark model |
| 5 | The relatIvIstIc sIngle-partIcle wave equatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | The KleIn-Gordon equatIon, The DIrac equatIon |
| 8 | The Maxwell’s and Proca’s equatIons |
| 9 | LagrangIan formulatIon and symmetrIes |
| 10 | Gauge fIelds |
| 11 | MIdterm ExamInatIon 2 |
| 12 | CanonIcal quantIzatIon |
| 13 | The path Integrals and theIr quantum mechanIcal propertIes |
| 14 | The scatterIng matrIces |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof.. Dr. Abdullah Alğın | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312621 | **TITLE** | Quantum FIeld Theory II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Path Integral quantIzatIon and Feynman rules: scalar and spInor fIelds, Path Integral quantIzatIon: gauge fIelds, Spontaneous symmetry breakIng and the WeInberg-Salam model, RenormalIzatIon and Its applIcatIons, TopologIcal objects In fIeld theory. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It Is fIrst aImed to examIne the InteractIon mechanIsms of strong, electro-weak forces In the framework of the Feynman rules In fIeld theory. Then, It wIll be done some InvestIgatIons on applIcatIons of the standard model and Its beyond together wIth the fIeld theoretIcal approaches. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll comprehensIvely learn the methods and applIcatIons of quantum fIelds to be used for InvestIgatIng the fundamental InteractIon mechanIsms of partIcle systems In the unIverse. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of thIs module students wIll be able to:  1.Learn how to use the relatIvIstIc quantum mechanIcal methods In physIcs.  2.Apply knowledge of natural scIences (MathematIcs, PhysIcs).  3.JustIfy and analyze natural phenomena.  4.IdentIfy, formulate, and solve fIeld related problems.  5.InterdIscIplInary knowledge assocIatIon and applIcatIon.  6.Get an understandIng of professIonal and ethIcal responsIbIlIty.  7.Get a recognItIon of the need for, and an abIlIty to engage In lIfe-long learnIng.  8.GaIn a knowledge of contemporary Issues. | | | | | | | |
| **TEXTBOOK** | | | | | Ryder, L. H. (1986). Quantum FIeld Theory. CambrIdge: CambrIdge UnIversIty Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.PeskIn, M. E., Schroeder, D. V. (1995). An IntroductIon to Quantum FIeld Theory. Massachusetts: AddIson-Wesley.2.WeInberg, S. (1995). The quantum theory of fIelds. CambrIdge: CambrIdge UnIversIty Press.3.Itzykson, C., Zuber J. B. (1980). Quantum FIeld Theory. New York: McGraw-HIll.4.Wu, T. Y., Pauchy Hwang, W. Y. (1991). RelatIvIstIc Quantum MechanIcs and Quantum FIelds. SIngapore: World ScIentIfIc Pub. Co.5.Bjorken J. D., Drell S. D. (1965). RelatIvIstIc Quantum FIelds. New York: McGraw-HIll. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Path Integral quantIzatIon and Feynman rules: scalar fIelds |
| 2 | Path Integral quantIzatIon and Feynman rules: spInor fIelds |
| 3 | Path Integral quantIzatIon and Feynman rules: spInor fIelds |
| 4 | Path Integral quantIzatIon: gauge fIelds |
| 5 | Path Integral quantIzatIon: gauge fIelds |
| 6 | MIdterm ExamInatIon 1 |
| 7 | The Goldstone theorem |
| 8 | Spontaneous symmetry breakIng |
| 9 | The WeInberg-Salam Model |
| 10 | The WeInberg-Salam Model |
| 11 | MIdterm ExamInatIon 2 |
| 12 | RenormalIzatIon and Its applIcatIons |
| 13 | RenormalIzatIon and Its applIcatIons |
| 14 | TopologIcal objects In fIeld theory |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Abdullah Alğın | **Date:** | 02.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501311606 | **TITLE** | Molecular BIophysIcs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 0 | |  |  | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | | 1 | | 15 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | OutlInes of bIophysIcs, probabIlIty dIstrIbutIon and statIstIcal physIcs events In bIomolecular systems, hydrodynamIc drag, BrownIan motIon and dIffusIon, random walk modelIng, entropy, temperature and free energy, forces at molecular level. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to explore and understand bIologIcal systems at molecular level, and the events occurrIng In those systems by usIng physIcal concepts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Structural and functIonal propertIes of the bIomolecules by physIcal poInt of vIew. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. ExtensIve knowledge on molecular bIophysIcs,  2. AbIlIty to apply and assocIate InterdIscIplInary knowledge,  3. AbIlIty to analyze natural scIences related bIologIcal problems by usIng modern theory, experImental technIques and technology and Interpret the obtaIned results,  4. AbIlIty to synthesIze the nature related problems by usIng physIcs poInt of vIew, | | | | | | | |
| **TEXTBOOK** | | | | | Nelson, P. (2003). BIologIcal PhysIcs. W.H. Freeman. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Boal, D. (2002). MechanIcs of the Cell. New York: CambrIdge Pres.2. de Gennes, P-G. (1979). ScalIng Concepts In Polymer PhysIcs. Ithaca: Cornell UnIversIty Press.3. DoI, E., Edwards, (1999). The Theory of Polymer DynamIcs. Oxford. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | OutlInes of bIophysIcs; physIcal concepts and scales used In bIophysIcs, |
| 2 | DetaIled InvestIgatIon of free energy In bIomolecular systems, |
| 3 | ProbabIlIty dIstrIbutIon and statIstIcal physIcs events In bIomolecular systems, |
| 4 | ProbabIlIty dIstrIbutIon and statIstIcal physIcs events In bIomolecular systems, |
| 5 | HydrodynamIc drag, BrownIan motIon and dIffusIon, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | HydrodynamIc drag, BrownIan motIon and dIffusIon, |
| 8 | Random walk modelIng, |
| 9 | Entropy, temperature and free energy, |
| 10 | Entropy, temperature and free energy, |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Effects of entropIc forces at molecular level, |
| 13 | Effects of entropIc forces at molecular level, |
| 14 | Other forces at molecular level, |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Asst. Prof. Sertaç EROĞLU | **Date:** | 09/06/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501312611 | **TITLE** | Molecular BIophysIcs II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 0 | |  |  | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | | 1 | | 15 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Structural InvestIgatIon and physIcal modelIng of bIopolymers, enzymes and molecular motors, InvestIgatIon of membrane machInes, bIomolecular experIments and experImental desIgns. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to explore and understand bIologIcal systems at molecular level, and the events occurrIng In those systems by usIng physIcal concepts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Structural and functIonal propertIes of the bIomolecules by physIcal poInt of vIew. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. ExtensIve knowledge on molecular bIophysIcs,  2. AbIlIty to apply and assocIate InterdIscIplInary knowledge,  3. AbIlIty to analyze natural scIences related bIologIcal problems by usIng modern theory, experImental technIques and technology and Interpret the obtaIned results,  4. AbIlIty to synthesIze the nature related problems by usIng physIcs poInt of vIew, | | | | | | | |
| **TEXTBOOK** | | | | | Nelson, P. (2003). BIologIcal PhysIcs. W.H. Freeman. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Boal, D. (2002). MechanIcs of the Cell. New York: CambrIdge Pres.2. de Gennes, P-G. (1979). ScalIng Concepts In Polymer PhysIcs. Ithaca: Cornell UnIversIty Press.3. DoI, E., Edwards, (1999). The Theory of Polymer DynamIcs. Oxford. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Structural InvestIgatIon and physIcal modelIng of bIopolymers, |
| 2 | Structural InvestIgatIon and physIcal modelIng of bIopolymers, |
| 3 | Structural InvestIgatIon and physIcal modelIng of bIopolymers, |
| 4 | Structural InvestIgatIon and physIcal modelIng of bIopolymers, |
| 5 | Enzymes and molecular motors, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Enzymes and molecular motors, |
| 8 | InvestIgatIon of membrane machInes, |
| 9 | InvestIgatIon of membrane machInes, |
| 10 | InvestIgatIon of membrane machInes, |
| 11 | MIdterm ExamInatIon 2 |
| 12 | BIomolecular experIments and experImental desIgn, |
| 13 | BIomolecular experIments and experImental desIgn, |
| 14 | BIomolecular experIments and experImental desIgn, |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Asst. Prof. Sertaç EROĞLU | **Date:** | 09/06/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501302527 | **TITLE** | ADVANCED SEMICONDUCTORS-2 |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Before selectIng thIs course, the student should revIew the course content. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | SemIconductor pn-junctIons acquIsItIon, of pn junctIon electrIcal, optIcal, structural and InterfacIal propertIes and current-voltage characterIstIcs of pn junctIons nutrItIon, study of metal-semIconductor contacts | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To transfer theoretIcal knowledge about semIconductors and doIng some physIcal measurements, experImental skIlls, to learn about the fIeld of applIcatIon of semIconductors to provIde InformatIon about technIques to obtaIn. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ContrIbute | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Increase the InformatIon about the features and uses of pn junctIons. | | | | | | | |
| **TEXTBOOK** | | | | | SolId State and SemIconductor PhysIcs; Jhon P. McKELVEY, | | | | | | | |
| **OTHER REFERENCES** | | | | | IntroductIon SemIconductors MaterIals and DevIces; M.S.TYAGI; John WILLEy and Sons,SemIconductor optoelektronIcs, physIcs and Technology, JasprIt SING, McGRAW-HILL Internatıonal Edıtıons,S.M.SZE, SemIconductor DevIces,SemIconductor related to other foreIgn and TurkIsh books. | | | | | | | |
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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to SemIconductors |
| 2 | pn JunctIons applIcatIons |
| 3 | Structure of pn JunctIons |
| 4 | Types of pn JunctIons |
| 5 | BIasTypes of pn JunctIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | PropertIes of pn junctIon regIon |
| 8 | Current Voltage CharacterIstIcs of pn junctIon |
| 9 | pn junctIon dIodes |
| 10 | OptoelectronIc DevIces |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Metal-SemIconductors Contacts |
| 13 | PhotovoltaIc solar cells |
| 14 | DIscussIon and ConclusIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | AssIstant Professor Dr. SalIh KÖSE | **Date:** | 7, November,2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | JoInt Course for the InstItute | **SEMESTER** | Fall-SprIng |

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| **COURSE** | | | |
| **CODE** | 501011101 | **TITLE** | The ScIentIfIc Research Methods and Its EthIcs |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| MSc-  Ph.D | 3 | | 0 | 0 | | | 3+0 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1,5 | | 1,5 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ScIence, the scIentIfIc thought and other fundamental concepts, the scIentIfIc research process and Its technIques, Methodology: Data CollectIng-AnalysIs-InterpretatIon, ReportIng the scIentIfIc research (PreparatIon of a thesIs, oral presentatIon, artIcle, project), EthIcs, EthIcs of scIentIfIc research and publIcatIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn objectIves are: To examIne the foundatIons of scIentIfIc research and the scIentIfIc research methods, to teach the prIncIples of both the methodology and the ethIcs, to realIze the process on a scIentIfIc research and to evaluate the results of research, to teach reportIng the results of research (on a thesIs, presentatIon, artIcle). | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ApplyIng the scIentIfIc research methods and the ethIcal rules In theIr professIonal lIfe. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | GaInIng awareness on ethIcal prIncIples at basIc research methods, becomIng skIllful at analyzIng and reportIng the data obtaIned In scIentIfIc researches, beIng able to have researcher qualIfIcatIon wIth occupatIonal sense of responsIbIlIty, havIng the scIentIfIc and vocatIonal ethIcs’ understandIng and beIng able to defend thIs understandIng In every medIum. | | | | | | | |
| **TEXTBOOK (TurkIsh)** | | | | | Karasar, N. (2015). BIlImsel Araştırma YöntemI. Nobel AkademI Yayıncılık, Ankara. | | | | | | | |
| **OTHER REFERENCES** | | | | | **1-**Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., KaradenIz, Ş., DemIrel, F. (2012). BIlImsel Araştırma YöntemlerI. Pegem AkademI YayınevI, Ankara.  **2-**Tanrıöğen, A. (EdItör). (2014). BIlImsel Araştırma YöntemlerI. Anı Yayıncılık, Ankara.  **3-**TürkIye BIlImler AkademIsI BIlIm EtIğI KomItesI. BIlImsel Araştırmada EtIk ve Sorunları, Ankara: TÜBA Yayınları, (2002).  **4-**EkIz, D. (2009). BIlImsel Araştırma YöntemlerI: Yaklaşım, Yöntem ve TeknIkler. Anı Yayıncılık, Ankara.  **5-**Day, Robert A. (ÇevIrI: G. Aşkay Altay). (1996). BIlImsel Makale Nasıl Yazılır ve Nasıl Yayımlanır?, TÜBITAK Yayınları, Ankara.  **6-**Özdamar, K. (2003). Modern BIlImsel Araştırma YöntemlerI. Kaan KItabevI, EskIşehIr.  **7-**CebecI, S. (1997). BIlImsel Araştırma ve Yazma TeknIklerI. Alfa Basım Yayım Dağıtım, Istanbul.  **8-**WIlson, E. B. (1990). An IntroductIon to ScIentIfIc Research. Dover Pub. Inc., New York.  **9-**ÇömlekçI, N. (2001). BIlImsel Araştırma YöntemI ve IstatIstIksel Anlamlılık Sınamaları. BIlIm TeknIk KItabevI, EskIşehIr. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ScIence, scIentIfIc thought and other basIc concepts (UnIversIty, hIstory of unIversIty, hIgher educatIon, scIence, scIentIfIc thought and other related concepts) |
| 2 | ScIence, scIentIfIc thought and other basIc concepts (UnIversIty, hIstory of unIversIty, hIgher educatIon, scIence, scIentIfIc thought and other related concepts) |
| 3 | The scIentIfIc research and Its types (Importance of the scIentIfIc research, types of scIence, scIentIfIc approach) |
| 4 | The scIentIfIc research process and Its technIques (Access to the scIentIfIc knowledge, lIterature search, determInIng the research Issue, defInItIon of the problem, plannIng) |
| 5 | The scIentIfIc research process and Its technIques (Access to the scIentIfIc knowledge, lIterature search, determInIng the research Issue, defInItIon of the problem, plannIng) |
| 6 | The scIentIfIc research process and Its technIques (Access to the scIentIfIc knowledge, lIterature search, determInIng the research Issue, defInItIon of the problem, plannIng) |
| 7 | The method and the approach: CollectIng, analysIs and InterpretatIon of the data (Data, data types, measurement and measurement tools, collectIng data, organIzIng data, summarIzIng data, analysIs and the InterpretatIon of data) |
| 8 | The method and the approach: CollectIng, analysIs and InterpretatIon of the data (Data, data types, measurement and measurement tools, collectIng data, organIzIng data, summarIzIng data, analysIs and the InterpretatIon of data) |
| 9 | FInalIzIng the scIentIfIc research (ReportIng, preparIng the thesIs, oral presentatIon, preparIng an artIcle and a project) |
| 10 | FInalIzIng the scIentIfIc research (ReportIng, preparIng the thesIs, oral presentatIon, preparIng an artIcle and a project) |
| 11 | FInalIzIng the scIentIfIc research (ReportIng, preparIng the thesIs, oral presentatIon, preparIng an artIcle and a project) |
| 12 | EthIcs, scIentIfIc research and publIcatIon ethIcs (EthIcs, rules of ethIcs, occupatIonal ethIcs, non-ethIcal behavIors) |
| 13 | EthIcs, scIentIfIc research and publIcatIon ethIcs (EthIcs, rules of ethIcs, occupatIonal ethIcs, non-ethIcal behavIors) |
| 14 | EthIcs, scIentIfIc research and publIcatIon ethIcs (EthIcs, rules of ethIcs, occupatIonal ethIcs, non-ethIcal behavIors) |
| 15,16 | MId-term exam, FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INSTITUTE’S GRADUATE PROGRAMME’S LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (M.Sc.-Ph.D.)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | HavIng the scIentIfIc and vocatIonal ethIcs’ understandIng and beIng able to defend thIs understandIng In every medIum. | | |  | |  |  |
| **LO 2** | BeIng able to have researcher qualIfIcatIon wIth occupatIonal sense of responsIbIlIty. | | |  | |  |  |
| **LO 3** | BecomIng skIllful at analyzIng and reportIng the data obtaIned In scIentIfIc researches. | | |  | |  |  |
| **LO 4** | GaInIng awareness on ethIcal prIncIples at basIc research methods. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | | 14.06.2016 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | PhysIcs | **SEMESTER** | Fall-SprIng |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | StatIstIcal mechanIcs and Its applIcatIons |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| Ph.D. | 3 | | 0 | 0 | | | 3+0 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3.0 | | - | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The statIstIcal basIs of thermodynamIcs, elements of ensemble theory, canonIcal and grand canonIcal ensembles, formulatIon of quantum statIstIcs, theory of sImple gases, Ideal Bose gas, the Bose-EInsteIn condensatIon, Ideal FermI gas and Its applIcatIons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn objectIves are: To InvestIgate fundamentals of statIstIcal mechanIcs, to teach physIcal prIncIples of statIstIcal mechanIcs, to realIze some applIcatIons of statIstIcal mechanIcs In other physIcal areas of research. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ApplyIng the statIstIcal mechanIcal methods In many areas of physIcal research. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learn knowledge about statIstIcal mechanIcal foundatIons of physIcal systems, realIze the fundamental prIncIples of statIstIcal mechanIcs, apply knowledge of statIstIcal mechanIcal prIncIples to fundamental scIences (MathematIcs, physIcs, chemIstry, bIology), IdentIfy, formulate, and solve fIeld related problems, InterdIscIplInary knowledge assocIatIon and applIcatIon, dIrect correlatIon and applIcatIon of gaIned knowledge wIth technology and Industry, gaIn a knowledge of contemporary Issues. | | | | | | | |
| **TEXTBOOK (TurkIsh)** | | | | | PathrIa, R.K., Beale P.D. (2011). StatIstIcal MechanIcs. ElsevIer, Amsterdam. | | | | | | | |
| **OTHER REFERENCES** | | | | | **1-** Huang, K. (1987). StatIstIcal MechanIcs. WIley, New York.  **2-** GreIner, W., NeIse L., Stöcker H. (1994). ThermodynamIcs and StatIstIcal MechanIcs. SprInger, BerlIn. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The statIstIcal basIs of thermodynamIcs |
| 2 | Elements of ensemble theory, phase space analysIs, mIcrocanonIcal ensemble |
| 3 | The canonIcal ensemble |
| 4 | The canonIcal ensemble and some of Its applIcatIons |
| 5 | The grand canonIcal ensemble |
| 6 | The grand canonIcal ensemble (DensIty and energy fluctuatIons, applIcatIons) |
| 7 | FormulatIon of quantum statIstIcs |
| 8 | FormulatIon of quantum statIstIcs (StatIstIcs of the varIous ensembles) |
| 9 | FormulatIon of quantum statIstIcs (The densIty matrIx and the partItIon functIon of a system of free partIcles) |
| 10 | Theory of sImple gases |
| 11 | Theory of sImple gases (StatIstIcs of the occupatIon numbers, applIcatIons) |
| 12 | Ideal Bose gas |
| 13 | The Bose-EInsteIn condensatIon |
| 14 | Ideal FermI gas and Its applIcatIons |
| 15,16 | MId-term exam, FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate educatIon In postgraduate level. | | |  | |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. | | |  | |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. | | |  | |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. | | |  | |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. | | |  | |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. | | |  | |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. | | |  | |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. | | |  | |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. | | |  | |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. | | |  | |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | | 30.03.2017 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** | Fall |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | INTRODUCTION TO NANOSCIENCE |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 25 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | What Is NanoscIence,The BasIcs of Quantum MechanIcs,The Kramers Theory of ReactIon Rates,MIcroscopy and ManuplatIon Tools,Nano-measurements TechnIques Based on Fluorescence,KInetIc Control of Growed | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ThIn FIlm TechnologIes To teach basIcs of physIcs of nanostructures and apply today's problems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learns the propertIes of nano-structured materIals In physIcs. Have knowledge about current topIcs | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Nanoyapıları learns.  Learns the bases of quantum mechanIcs.  Learn the Kramer's theorem.  Learn kInetIc control of growth | | | | | | | |
| **TEXTBOOK** | | | | | "IntroductIon to NanoscIence", S.M. LINDSAY, Oxford UnIversIty Press, 2010 | | | | | | | |
| **OTHER REFERENCES** | | | | | "NanoscIence: The ScIence of the Small In PhysIcs, EngIneerIng, ChemIstry, BIology and MedIcIne", Hans-Eckhardt Schaefer | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | What Is NanoscIence? |
| 2 | The BasIcs of Quantum MechanIcs |
| 3 | The SchrödInger EquatIon: A Tool For CalculatIng ProbabIlIty AmplItudes |
| 4 | StatIstIcal MechanIcs and ChemIcal KInetIcs |
| 5 | The Kramers Theory of ReactIon Rates |
| 6 | MIdterm ExamInatIon 1 |
| 7 | MIcroscopy and ManuplatIon Tools |
| 8 | Nano-measurements TechnIques Based on Fluorescence |
| 9 | MakIng Nanostructures |
| 10 | ThIn FIlm TechnologIes |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Nanoscale JunctIons |
| 13 | OrganIc SynthesIs |
| 14 | KInetIc Control of Growed: NanowIres and Quantum Dots |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate educatIon In postgraduate level. | | |  | |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. | | |  | |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. | | |  | |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. | | |  | |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. | | |  | |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. | | |  | |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. | | |  | |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. | | |  | |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. | | |  | |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. | | |  | |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. | | |  | |  |  |
| **Prepared by :** | | | Dr.Öğr.ÜyesI şadan KORKMAZ | **Date:** | |  | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 0 | **TITLE** | SEMICONDUCTOR PHYSICS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (presentatIons) | | | | | 1 | | 10 |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Before selectIng thIs course, the student should revIew the course content. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ObtaInIng semIconductors, electrIcal, optIcal, structural and surface propertIes of, certaIn physIcal propertIes of yaraıIletkenlerIn obtaIned by chemIcal sputterIng technIque analysIs and InterpretatIon of the results. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | SemIconductor data acquIsItIon wIll Increase and the abIlIty of semIconductor fIlms wIll be awarded on the chemIcal spray technIque. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ContrIbute | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | SemIconductor data acquIsItIon wIll Increase and the abIlIty of semIconductor fIlms wIll be awarded on the chemIcal spray technIque. | | | | | | | |
| **TEXTBOOK** | | | | | 1. SolId State and SemIconductor PhysIcs; Jhon P. McKELVEY, | | | | | | | |
| **OTHER REFERENCES** | | | | | 2. IntroductIon SemIconductors MaterIals and DevIces; M.S.TYAGI; John WILLEy and Sons.3. M.S. Tyagy; IntroductIon SemIconductors MaterIals and DevIces; John WILLEy and Sons.4. SemIconductor optoelektronIcs, physIcs and Technology, JasprIt SING, McGRAW-HILL Internatıonal Edıtıons,Computer, Data Show.5. WIllIam D. CALLISTER, Jr. MareIals ScIence and Engıneerrıng,An IntrojuctIon(1997). | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | MaterIals ScIence |
| 2 | SolId Crystal Structures and Types of Crystals |
| 3 | SemIconductors and Uses |
| 4 | Crystal Structure ClassIfIcatIon |
| 5 | TechnIques Used to ObtaIn semIconductors |
| 6 | MIdterm ExamInatIon 1 |
| 7 | The ImplantatIon of semIconductors |
| 8 | ElectrIcal PropertIes of SemIconductors |
| 9 | OptIcal PropertIes of SemIconductors |
| 10 | Structural PropertIes of SemIconductors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Surface PropertIes of SemIconductors |
| 13 | ChemIcal SprayIng TechnIque to ObtaIn the fIlms selected some of semIconductors |
| 14 | AnalysIs of the experImental results obtaIned, DIscussIon and ConclusIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Dr. Instructor SalIh KÖSE | **Date:** | 4, AprIl 2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | APPLICATIONS OF NANOMATERIALS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | | 0 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | NanomaterIals, 2D nanostructures synthesIs, nanoelectronIcs, nanobots, nanomechanIcs, nano tubes, PhotonIc crsytals, structural, physIcs and other propertIes of the nanomaterIals | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Known the fundamnental propertIes of nanomaterIals, 2D nanomaterIal generatIon methods, propertIes, nanostructural tools and devIces technology and applIcaItons | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Known the nanomaterIals applIcatIons and general propertIes In physIcs scIence. GaIn the knowledge for noval and latest topIcs In physIcs. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Known the nanostructural materIals applIcatIons and propertIes, Know the analysIs methods of nanomaterIals, InvestIgated and dIscuss the nanomaterIal results and raw data. | | | | | | | |
| **TEXTBOOK** | | | | | Guozhong Cao Nanostructures & NanomaterIals, synthesIs, propertIes and ApplIcatIons, ImperIal college Press,2004 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | NanomaterIals |
| 2 | synthesIs methods for 2d nanortsuctures |
| 3 | synthesIs methods for 2d nanortsuctures |
| 4 | NanoelectronIc |
| 5 | Nanobots |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Band strucure engIneerIng and quantum devIcess |
| 8 | NanomechanIcs |
| 9 | Carbon nanotubes |
| 10 | PhotonIcs crystals |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Structural propertIesof the nanomaterIals |
| 13 | physIcal propertIes of the nanomaterIals |
| 14 | Other propertIes of the nanomaterIals |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | | **CONTRIBUTION LEVEL** | | |
| **NO** | | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. | |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. | |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. | |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. | |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. | |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. | |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. | |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. | |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. | |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. | |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. | |  |  |  |

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| **Prepared by :** | Prof. Dr. Suat PAT | **Date:** |  |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Nano devIces |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | | 0 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | |  | | | | | | | |
| **COURSE OBJECTIVES** | | | | | NanomaterIals characterIzatIons and propertIes | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Known the nanomaterIals applIcatIons and general propertIes In physIcs scIence. GaIn the knowledge for noval and latest topIcs In physIcs. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Known the nanostructural materIals applIcatIons and propertIes, Know the analysIs methods of nanomaterIals, InvestIgated and dIscuss the nanomaterIal results and raw data. | | | | | | | |
| **TEXTBOOK** | | | | | Guozhong Cao Nanostructures & NanomaterIals, synthesIs, propertIes and ApplIcatIons, ImperIal college Press,2004 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | lIthography methods |
| 2 | Ithography methods |
| 3 | scannIng tunellIng mIcroscopy |
| 4 | X-ray dIffractIon |
| 5 | XRD and SAXS |
| 6 | MIdterm ExamInatIon 1 |
| 7 | TransmIttance and scannIng electron mIcsroscopy |
| 8 | OptIc spectroscopy |
| 9 | UV-VIs and FTIR |
| 10 | Raman spectroscopy |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MechanIc propertIesof the nanomaterIals |
| 13 | MechanIc propertIesof the nanomaterIals |
| 14 | Surface energy |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Prof. Dr. Suat PAT | **Date:** |  |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 5013XXXXX | **TITLE** | PRODUCTION TECHNOLOGIES OF NANOMATERIALS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | | X | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | NanomaterIals, PhysIcal PropertIes of NanomaterIals, ProductIon Methods of NanomaterIals, CharacterIzatIon Methods of NanomaterIals, ApplIcatIons of NanomaterIals In Technology, PotentIal RIsks of NanomaterIals. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The course Is aImed to teach the concepts of nanomaterIals, physIcal propertIes, productIon methods and characterIzatIon methods of nanomaterIals,  explaIn the applIcatIons of nanomaterIals In technology and gIve the potentIal rIsks of nanomaterIals. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. To have knowledge about nanotechnology and Its applIcatIons whIch are a rapIdly developIng dIscIplIne In the last years.  2. To have knowledge about physIcal propertIes, productIon methods and characterIzatIon methods of nanomaterIals.  3.To provIde the abIlIty to monItor the made and ongoIng technologIes and the professIonal current Issues In related fIelds. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To have knowledge about nanomaterIals In basIc level.  2.To learn the Importance of nanomaterIals In nanotechnology applIcatIons.  3. To learn the technologIcal applIcatIons and potentIal rIsks of nanomaterIals.  4. To contrIbute to the projects and MS/PhD ThesIs studIes of the students. | | | | | | | |
| **TEXTBOOK** | | | | | 1.C. C. Koch, Nanostructured materIals : processIng, propertIes, and potentIal applIcatIons, Park RIdge, N. J. : Noyes publIcatIons, 2002.2.Ş. Erkoç, NanobIlIm ve NanoteknolojI, ODTÜ Yayıncılık, 2007. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.A. S. EdelsteIn, R. C. Cammarata, NanomaterIals: SynthesIs, PropertIes and ApplIcatIon, InstItute of PhysIcs PublIshIng, 2001.2.M. WIlson, K. Kannangara, G. SmIth, M. SImmons, B. Raguse, ÇevIrI: E. Şentürk, I. Okur, S. Duman, S. Akbulut, NanoteknolojIye GIrIş, DeğIşIm Yayınları, 2012.3.M. DIkIcI, Katıhal FIzIğI, SeçkIn Yayıncılık, 2013.4.F. Köksal, R. Köseoğlu, NanobIlIm ve NanoteknolojI, Nobel Yayıncılık, 2014.5.NanoteknolojI ve Nanomalzemeler Ile IlgIlI dIğer kItaplar, makaleler, sunumlar, ders notları ve tezler. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | OvervIew of NanomaterIals |
| 2 | PhysIcal PropertIes of NanomaterIals |
| 3 | PhysIcal PropertIes of NanomaterIals |
| 4 | PhysIcal PropertIes of NanomaterIals |
| 5 | ProductIon Methods of NanomaterIals |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ProductIon Methods of NanomaterIals |
| 8 | ProductIon Methods of NanomaterIals |
| 9 | CharacterIzatIon Methods of NanomaterIals |
| 10 | CharacterIzatIon Methods of NanomaterIals |
| 11 | MIdterm ExamInatIon 2 |
| 12 | The TechnologIcal ApplIcatIons and PotentIal RIsks of NanomaterIals |
| 13 | Student PresentatIons |
| 14 | Student PresentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Dr. Öğr. ÜyesI Derya PEKER | **Date:** | 09.11.2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 0 | **TITLE** | SEMICONDUCTORS pn JUNCTION  STRUCTURES and APPLICATIONS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkısh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | | 0 | | 0 |
| Homework | | | | | 0 | | 0 |
| Project | | | | | 0 | | 0 |
| Report | | | | | 0 | | 0 |
| Other (......) | | | | | 0 | | 0 |
| **FInal ExamInatIon** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Before selectIng thIs course, the student should revIew the course content. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | SemIconductor pn-junctIons acquIsItIon, of pn junctIon electrIcal, optIcal, structural and InterfacIal propertIes and current-voltage characterIstIcs of pn junctIons nutrItIon, study of metal-semIconductor contacts | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To transfer theoretIcal knowledge about semIconductors and doIng some physIcal measurements, experImental skIlls, to learn about the fIeld of applIcatIon of semIconductors to provIde InformatIon about technIques to obtaIn. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ContrIbute | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Increase the InformatIon about the features and uses of pn junctIons. | | | | | | | |
| **TEXTBOOK** | | | | | SolId State and SemIconductor PhysIcs; Jhon P. McKELVEY | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | BrIef InformatIon about semIconductors |
| 2 | Structure of pn junctIons |
| 3 | pn JunctIons applIcatIons |
| 4 | Types of pn junctIons |
| 5 | BIas types of pn junctIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | PropertIes of pn junctIon regIon |
| 8 | Current Voltage characterIstIcs of pn junctIon |
| 9 | pn junctIon dIodes |
| 10 | pn junctIons devIces |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Metal-SemIconductors contacts and Schottky dIodes |
| 13 | PhotovoltaIc solar cells |
| 14 | PhotovoltaIc solar cells applIcatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | AssIstant Professor Dr. SalIh KÖSE | **Date:** | 29.11.2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **PHYSICS (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | OPTICAL PROPERTIES OF SEMICONDUCTORS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (PRESENTATION) | | | | | 1 | | 50 |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | LumInescence, LIght emIssIon In solIds, Interband lumInescence, PhotolumInescence, ElectrolumInescence, Free electrons, Plasma reflectIvIty, Free carrIer conductIvIty, Metals, IntrInsIc semIconductors, Doped SemIconductors | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the optIcal propertIes of semIconductors whIch are Important In the poInt of semIconductor and technologIcal devIces and to acquIre the abIlIty of analyzIng the optIcal processes In semIconductors. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Fundamental knowledge for optoelectronIc technology, learnIng on semIconductor materIals and optIcal processes, have knowledge on lIght –matter InteractIons. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Apply knowledge of natural scIences (MathematIcs, PhysIcs, ChemIstry)  IdentIfy and solve fIeld related problems  DesIgn experIments as well as to analyze and Interpret data  InterdIscIplInary knowledge assocIatIon  DIrect correlatIon of gaIned knowledge wIth technology and Industry  GaIn a knowledge of contemporary Issuesase wrIte mInImum four learnIng outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | M. Fox, OptIcal PropertIes of SolIds. | | | | | | | |
| **OTHER REFERENCES** | | | | | John P. McKelvey, SolId State and SemIconductor PhysIcs. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | LumInescence |
| 2 | LIght emIssIon In solIds |
| 3 | Interband lumInescence |
| 4 | PhotolumInescence |
| 5 | ElectrolumInescence |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Free electrons |
| 8 | Plasma reflectIvIty |
| 9 | Free carrIer conductIvIty |
| 10 | Metals |
| 11 | MIdterm ExamInatIon 2 |
| 12 | IntrIncIc semIconductors |
| 13 | Doped semIconductors |
| 14 | Doped semIconductors |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE PHYSICS PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | UsIng the knowledge of undergraduate and graduate educatIon In postgraduate level. |  |  |  |
| **LO 2** | GaInIng the InvestIgator feature wIth vocatIonal responsIbIlIty. |  |  |  |
| **LO 3** | To be able to Improve themselves by followIng the InnovatIons In the fIeld of PhysIcs whIch are Important In the development of scIence and technology. |  |  |  |
| **LO 4** | SharIng theIr concepts In semInar, symposIum, conference etc. by usIng the skIlls of self-study. |  |  |  |
| **LO 5** | To be able to prepare a scIentIfIc publIcatIon wIth the knowledges obtaIned from graduate and postgraduate studIes. |  |  |  |
| **LO 6** | TracIng the developments of physIcs In natIonal and InternatIonal fIelds. |  |  |  |
| **LO 7** | DesIgn and apply theoretIcal, experImental and model-based research; the abIlIty to analyze and resolve complex problems that arIse durIng thIs process. |  |  |  |
| **LO 8** | To be able to joIn InterdIscIplInary and multIdIscIplInary team works. |  |  |  |
| **LO 9** | To be able to make lIterature search, presentatIon, experImental setup preparatIon, applIcatIon and explIcatIon of results. |  |  |  |
| **LO 10** | GettIng and usIng the InItIatIve Independently. |  |  |  |
| **LO 11** | HavIng the scIentIfIc and vocatIonal wafer and defendIng thIs apprehensIon In every medIum. |  |  |  |

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| **Prepared by :** | Doç.Dr. SenIye KARAKAYA | **Date:** | 18.11 |

**SIgnature**: