|  |  |
| --- | --- |
| **Course Title:** | **Stellar Radiation and Characteristics** |
| **Course Code:** | **ASTR 351** |
| **Program:** | **ASTR-PHYS** |
| **Department:** | **Astronomy** |
| **College:** | **Science** |
| **Institution:** | **King AbdulAziz University** |

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# A. Course Identification

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1. Credit hours:** | | | |  | | | | | | | | | | | | |
| **2. Course type** | | | | | | | | | | | | | | | | |
| **a.** | University | |  | | College | | |  | Department | | | | **✓** | Others |  |  |
| **b.** | | Required | | | | **✓** | Elective | | |  |  | | | | | |
| **3. Level/year at which this course is offered:** | | | | | | | | | | | | **5th Level / 3th Year** | | | | |
| **4. Pre-requisites for this course** (if any)**: ASTR 202, PHYS 202** | | | | | | | | | | | | | | | | |
| **5. Co-requisites for this course** (if any)**: None** | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |

## 6. Mode of Instruction (mark all that apply)

| **No** | **Mode of Instruction** | **Contact Hours** | **Percentage** |
| --- | --- | --- | --- |
| **1** | **Traditional classroom** | **3** | **100%** |
| **2** | **Blended** |  |  |
| **3** | **E-learning** |  |  |
| **4** | **Correspondence** |  |  |
| **5** | **Other** |  |  |

**7. Actual Learning Hours** (based on academic semester)

|  |  |  |
| --- | --- | --- |
| **No** | **Activity** | **Learning Hours** |
| **Contact Hours** | | |
| **1** | **Lecture** | **30** |
| **2** | **Laboratory/Studio** |  |
| **3** | **Tutorial** | **15** |
| **4** | **Others** (specify) |  |
|  | **Total** | **45** |
| **Other Learning Hours\*** | | |
| **1** | **Study** | **60 (minimum)** |
| **2** | **Assignments** |  |
| **3** | **Library** |  |
| **4** | **Projects/Research Essays/Theses** |  |
| **5** | **Others (Experiments + reports)** | **30** |
|  | **Total** | **90** |

**\*** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

# B. Course Objectives and Learning Outcomes

|  |
| --- |
| 1. Course Description In this course the student will study the following topics: the physics of electromagnetic radiation, stellar radiation in different spectral region, estimation of stellar temperature, color index and color excess, effects of absorption on stellar spectra in interstellar medium, photographic and photoelectric observations, photoelectric system and their applications, measurement and evaluation of the stellar radiation and its applications. Introductory idea of polarimetric studies and its applications. |
| 2. Course Main Objective To understand the physics of radiation, stellar radiation in different spectral regions and methods of their detection. This will help the student to understand the physics and evolution of stars. |
|  |

## 3. Course Learning Outcomes

| **CLOs** | | **Aligned****PLOs** |
| --- | --- | --- |
| 1 | **Knowledge:** |  |
| 1.1 | Define magnitude system. | K9 |
| 1.2 | List electromagnetic radiation bands. | K8 |
| 1.3 | Outline the different photometric systems. | K9 |
| 1.4 | List the spectral types of normal stars. | K3, K11 |
| 1.5 | Define the color index, extinction, correction factor. | K9 |
| 1.6 | Mention the advantages of CCD versus photographic plates | K5, K9 |
| **2** | **Skills :** |  |
| 2.1 | Compare between the spectra of stars, galaxies, emission line nebulae. | S1, S4 |
| 2.2 | Explain the relation between absolute magnitude, apparent magnitude, and stellar distance. | S7, S9, |
| 2.3 | Explain the relation between the radiation wavelength and energy & wavelength and frequency. | S7, S9 |
| 2.4 | Interpret the relation between the surface temperature and the stellar colors. | S1, S11 |
| 2.5 | Explain how to correct the stellar magnitude for interstellar extinction. | S11 |
| 2.6 | Write experiments' reports. | S5, S12, S13 |
| **3** | **Competence:** |  |
| 3.1 | Ability to formulate and solve problems related to stellar radiation and characteristics. | C3, C4 |

**C. Course Content**

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1 | Photometry: An Introduction  Experiment 1: Basic photometry – Part I. | 3 |
| 2 | Electromagnetic radiation  Experiment 2: Basic photometry – Part II. | 3 |
| 3 | Electromagnetic radiation  Experiment 3: Basic photometry – Part III. | 3 |
| 4 | Electromagnetic radiation  Experiment 4: Basic photometry – Part IV. | 3 |
| 5 | Imaging, spectroscopy and photometry  Experiment 5: Photoelectric photometry of the Pleiades – Part I. | 3 |
| 6 | Imaging, spectroscopy and photometry  Experiment 6: Photoelectric photometry of the Pleiades – Part II. | 3 |
| 7 | The magnitude system  Experiment 7: Estimating Cluster Ages and Distances through Analysis of their Color-Magnitude Diagrams – Part I. | 3 |
| 8 | The magnitude system  Experiment 8: Estimating Cluster Ages and Distances through Analysis of their Color-Magnitude Diagrams – Part II. | 3 |
| 9 | Photometric system and their applications  Experiment 9: HR diagrams of star clusters – Part I. | 3 |
| 10 | Photometric system and their applications  Experiment 10: HR diagrams of star clusters – Part II. | 3 |
| 11 | Photometric system and their applications  Experiment 10: HR diagrams of star clusters – Part III. | 3 |
| 12 | Temperature, color and luminosity of stars Experiment 11: The classification of stellar spectra – Part I. | 3 |
| 13 | Temperature, color and luminosity of stars. Experiment 12: The classification of stellar spectra – Part II. | 3 |
| 14 | Photography, photometry and polarimetry  Experiment 13: The classification of stellar spectra – Part III. | 3 |
| 15 | Photography, photometry and polarimetry  Experiment 14: The classification of stellar spectra – Part IV. | 3 |
| **Total** | | **45** |

# D. Teaching and Assessment

## 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| **Code** | **Course Learning Outcomes** | **Teaching Strategies** | **Assessment Methods** |
| --- | --- | --- | --- |
| **1.0** | **Knowledge** | | |
| 1.1 | Define magnitude system. | Lectures | Homework & Exams |
| 1.2 | List electromagnetic radiation bands. |
| 1.3 | Outline the different photometric systems. |
| 1.4 | List the spectral types of normal stars. |
| 1.5 | Define the color index, extinction, correction factor. |
| 1.6 | Mention the advantages of CCD versus photographic plates |
| **2.0** | **Skills** | | |
| 2.1 | Compare between the spectra of stars, galaxies, emission line nebulae. | Lectures | Homework & Exams |
| 2.2 | Explain the relation between absolute magnitude, apparent magnitude, and stellar distance. |
| 2.3 | Explain the relation between the radiation wavelength and energy & wavelength and frequency. |
| 2.4 | Interpret the relation between the surface temperature and the stellar colors. |
| 2.5 | Explain how to correct the stellar magnitude for interstellar extinction. |
| 2.6 | Write experiments’ reports. | Group discussion | Lab. reports |
| **3.0** | **Competence** | | |
| 3.1 | Ability to formulate and solve problems related to stellar radiation and characteristics. | Group discussion | Lab reports & oral presentations |

## 

## 2. Assessment Tasks for Students

| **#** | **Assessment task\*** | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | Exams I | 6th | 15% |
| **2** | Exams II | 12th | 15% |
| **4** | Experiments + reports + presentations | weekly | 20% |
| **5** | Homework | weekly | 10% |
| **6** | Final Exam | 15th | 40% |

**\*Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

# E. Student Academic Counseling and Support

|  |
| --- |
| **Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :** |
| Office hours: 3 hours per week |

# F. Learning Resources and Facilities

## 1. Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | * Stellar Physics, Bisnovatyi-Kogan, Springer (2001) * The Dynamic Universe, T.P. Snow (1988) |
| **Essential References Materials** | * An Introduction to Astronomical Photometry using CCD, W. Romanishin, University of Oklahom (2006) * 2. Introduction to Astronomical Photometry, E. Budding, O. Demircan, Cambridge Univ. Press (1988) * 3. Astronomical Photometry, A guide, Sterken and Manfroid, Springer (2008) |
| **Electronic Materials** | <http://www.astroex.org/english/exercise3/introduction.php>  <http://outreach.atnf.csiro.au> |
| **Other Learning Materials** | <http://www.astro.washington.edu/labs/clearinghouse//abs/labs.html>  <http://zebu.uoregon.edu/nsf/planck.html> |

## 2. Facilities Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**  (Classrooms, laboratories, demonstration rooms/labs, etc.) | * Lecture’s room with 10 seats * Internet connection * Library |
| **Technology Resources**  (AV, data show, Smart Board, software, etc.) | Data show |
| **Other Resources**  (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) |  |

# G. Course Quality Evaluation

| **Evaluation**  **Areas/Issues** | **Evaluators** | **Evaluation Methods** |
| --- | --- | --- |
| Course contents | Students | Course evaluation questionnaire (Direct) |
| Learning resources and equipment | Students | Student experience questionnaire (Direct) |
| Effectiveness of teaching and assessment | Students | Student experience questionnaire (Direct) |
| Course contents and materials | Faculty members | By department council discussion (Indirect) |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

# H. Specification Approval Data

|  |  |
| --- | --- |
| **Council / Committee** |  |
| **Reference No.** |  |
| **Date** | September 2017 |