|  |  |
| --- | --- |
| **Course Title:** | **Solar Physics** |
| **Course Code:** | **ASTR 472** |
| **Program:** | **ASTR-MATH** |
| **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 371, ASTR352** | | | | | | | | | | | | | | | | |
| **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** | **15** |
| **3** | **Tutorial** |  |
| **4** | **Others** (specify) |  |
|  | **Total** | **45** |
| **Other Learning Hours\*** | | |
| **1** | **Study** | **60 (minimum)** |
| **2** | **Assignments** | **10** |
| **3** | **Library** |  |
| **4** | **Projects/Research Essays/Theses** |  |
| **5** | **Others (Lab experiments)** | **20** |
|  | **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 The course is intended to study the sun, its structure and atmosphere, solar atmospheric features, sunspots, solar magnetic field, solar atmospheric motion, solar cycles, solar flares, prominences, chromosphere, corona and transition region, solar constant and solar spectra. Solar wind, solar-terrestrial interaction and solar radio bursts. |
| 2. Course Main Objective To educate students about the physics of the Sun and its atmosphere, including energy generation and solar activity. |
|  |

## 3. Course Learning Outcomes

| **CLOs** | | **Aligned****PLOs** |
| --- | --- | --- |
| 1 | **Knowledge:** |  |
| 1.1 | Describe main layers of the Sun | K3 |
| 1.2 | Outline the different solar activities | K3 |
| 1.3 | Describe the composition of Sun | K11 |
| 1.4 | Recall the effects of the solar wind on the Earth | K1 |
| 1.5 | Define the coronal mass ejection, solar radio burst, solar constant, solar flares, solar prominence, and sunspots. | K3, K9 |
| **2** | **Skills :** |  |
| 2.1 | Compare between the solar flares and solar prominences. | S1, S7 |
| 2.2 | Explain the relation between the solar magnetic field and various solar activities. | S1, S7 |
| 2.3 | Interpret the formation of the solar magnetic field. | S1, S8 |
| 2.4 | Write a brief report concern one of the various solar activities. | S12, S13 |
| 2.5 | Write a report concern the SOHO spacecraft and its various solar measurements. | S12, S13, S14 |
| **3** | **Competence:** |  |
| 3.1 | Initiate a project regard the solar activities based on the analysis of space observational data. | C2, C4 |

# C. Course Content

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1 | Sun and its interior  Lab1: Determination of the solar differential rotation. | 5 |
| 2 | Sun and its atmosphere, solar atmospheric features  Lab2: Study the solar spectrum and characterization of spectral lines | 8 |
| 3 | Solar constant and solar spectra  Lab3: Determination of the value of the solar constant. | 7 |
| 4 | Solar Magnetic field and Sunspots  Lab4: Measurement of Solar Magnetic Fields in the active regions | 8 |
| 5 | Prominences and Solar Flares Lab5: Study the correlation between coronal mass ejection and solar flares using SOHO spacecraft measurements. | 7 |
| 6 | Solar radio burst  Lab6: Determination of the velocity of the moving material of the coronal mass ejection using C1, C2 and C3 detectors on SOHO spacecraft. | 5 |
| 7 | Solar wind and its effects on Earth  Lab7: Determination of electron plasma beta in the solar wind. | 5 |
| **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 | Describe main layers of the Sun | Lectures & in class discussion | Exams & Homework |
| 1.2 | Outline the different solar activities |
| 1.3 | Describe the composition of Sun |
| 1.4 | Recall the effects of the solar wind on the Earth |
| 1.5 | Define the coronal mass ejection, solar radio burst, solar constant, solar flares, solar prominence, and sunspots. |
| **2.0** | **Skills** | | |
| 2.1 | Compare between the solar flares and solar prominence | Lectures & in class discussion | Exams & Homework |
| 2.2 | Explain the relation between the solar magnetic field and various solar activities. |
| 2.3 | Interpret the formation of the solar magnetic field. |
|  | Write a brief report concern one of the various solar activities. | Oral discussion | Student presentation & Lab Exam |
|  | Write a report concern the SOHO spacecraft and its various solar measurements. |
| **3.0** | **Competence** | | |
| 3.1 | Initiate a project regard the solar activities based on the analysis of space observational data. | Data reduction and analysis project. | Project reports |

## 

## 2. Assessment Tasks for Students

| **#** | **Assessment task\*** | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | Exams I | 6th | 15% |
| **2** | Exams II | 11th | 15% |
| **4** | Homework | Each two weeks | 10% |
| **5** | Reports + In class discussion | 4th, 7th, 11th | 10% |
| **6** | Lab exam | 13th | 20% |
| **7** | Final Exam | 15th | 30% |

**\*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: 4 hours per week |

# F. Learning Resources and Facilities

## 1.Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | Lectures on Solar Physics: From the Core to the Heliopause, H. Koskinen, R. Vanio, Springer (2011) |
| **Essential References Materials** | 1. The Sun from Space, K. R. Lang, Springer (2009)  2. Fundamental Astronomy, H. Karttunen, P. Kroger, H. Oja, M. Poutanen, K. J. Donner (Eds), Springer (2007) |
| **Electronic Materials** | <http://solar-center.stanford.edu/>  <http://solarscience.msfc.nasa.gov/>  <http://solarphysics.livingreviews.org/> |
| **Other Learning Materials** | <http://helios.gsfc.nasa.gov/>  <http://istp.gsfc.nasa.gov/istp/outreach/> |

## 2. Facilities Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**  (Classrooms, laboratories, demonstration rooms/labs, etc.) | * Lecture’s room with 15 seats * Internet connection * Library |
| **Technology Resources**  (AV, data show, Smart Board, software, etc.) | Data show and overhead projector |
| **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 |