|  |  |
| --- | --- |
| **Course Title:**  | **Radio Astronomy** |
| **Course Code:** | **ASTR 361** |
| **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)**: ASTR211, ASTR351** |
| **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** | **2** | **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**  |  |
| **4** | **Others** (specify) |  |
|  | **Total** | **30** |
| **Other Learning Hours\*** |
| **1** | **Study**  | **60 (minimum)** |
| **2** | **Assignments** |  |
| **3** | **Library** |  |
| **4** | **Projects/Research Essays/Theses**  |  |
| **5** | **Others**  |  |
|  | **Total** | **60** |

**\*** 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 This course contains the following subjects: Principles of radio astronomy, instrumentation, radio telescopes, and interferometry. The origin of radio waves (thermal and non-thermal radiation - Plasma Vibration and radiation of accelerated charges. Liner radio spectra. Radio emission generated from the Sun, interstellar medium, galaxy, and extra galaxies. Detection of some astronomical measurements by radio instruments. |
| 2. Course Main Objective* Introduce students to general radio astronomy.
* Highlight the contribution of radio astronomy in the field of astronomy and astrophysics.
* Developing student's motivation of general reading in various fields of astronomy.
 |
|  |

## 3. Course Learning Outcomes

| **CLOs** | **Aligned****PLOs** |
| --- | --- |
| 1 | **Knowledge:** |  |
| 1.1 | Recall the core bases and facts of radio astronomy | K1 |
| 1.2 | Outline the contribution and importance of radio astronomy in our knowledge of the Universe. | K6 |
| 1.3 | Describe theories, terminology, concepts and methods commonly used in radio astronomy. | K9 |
| 1.4 | Describe types, structures, composition, evolution and classifications of different radio sources. | K11 |
| **2** | **Skills :** |  |
| 2.1 | Explain how to use mathematical and physical laws to understand some radio astronomy phenomenal. | S5, S7 |
| 2.2 | Differentiate between thermal and non-thermal radio sources.  | S7 |
| 2.3 | Understand the different parts of radio telescope. | S9 |
| **3** | **Competence:** |  |
| 3.1 | Work in groups to solve radio astronomy problems. | C1, C3 |

# C. Course Content

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1 | Lecture Unit 1: Radio Astronomy FundamentalsChapter One: Introduction, The role of Radio Astronomy in Astrophysics, The radio window, Discoveries in radio astronomy, Basic definitions, Radiation transfer, Black Body radiation and the brightness temperature, Emissivity and reflectivity of surfaces, The Nyquist theorem and the noise temperature | 10 |
| 2 | Lecture Unit 2: Electromagnetic wave propagation fundamentalsChapter Two: Maxwell's equations, Plane waves in non-conductive media, Wave packets and group velocities, plane waves in conductive media. | 5 |
| 3 | Lecture Unit 3: Practical receiver systemsChapter Three Basic components of active devices: Phase lock systems, Amplifiers, Mixers, Local oscillator sources. | 5 |
| 4 | Lecture Unit 4: Fundamental of antenna theoryChapter Four: Electromagnetic potentials, Green's function for wave equation, Hertz dipole, The reciprocity theorem, Descriptive antenna properties: The power pattern, The main beam solid angle, Effective area, Antenna temperature, Primary feed. | 5 |
| 5 | Lecture Unit 5: Emission Mechanism of continuous radiationChapter Five: The nature of radio sources: Thermal, Black body radiation from astronomical objects, Dust emission, radiation from accelerated electrons, Non thermal radiation mechanisms: The synchrotron radiation | 5 |
| **Total** | **30** |

# 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 | Recall the core bases and facts of radio astronomy | In class lectures | Exams & Homework  |
| 1.2 | Outline the contribution and importance of radio astronomy in our knowledge of the Universe. |
| 1.3 | Describe theories, terminology, concepts and methods commonly used in radio astronomy. |
| 1.4 | Describe types, structures, composition, evolution and classifications of different radio sources. |
| **2.0** | **Skills** |
| 2.1 | Explain how to use mathematical and physical laws to understand some radio astronomy phenomenal. | In class lectures  | Exams & Homework  |
| 2.2 | Differentiate between thermal and non-thermal radio sources.  |
| 2.3 | Understand the different parts of radio telescope. |
| **3.0** | **Competence** |
| 3.1 | Work in groups to solve radio astronomy problems. | Oral discussion  | Exam |

##

## 2. Assessment Tasks for Students

| **#** | **Assessment task\***  | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | Exams I | 4th | 20% |
| **2** | Exams II | 10th | 20% |
| **4** | Homework | Every two weeks | 20% |
| **5** | 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: 2 hours per week |

# F. Learning Resources and Facilities

## 1.Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | * Tools of Radio Astronomy Rohlts, 2000, Springer.
* Radio Astronomy by: J. D. Kraus, Cygnus-Quasar Book, 1986
* Tools of Radio Astronomy Problems and Solutions, Wilson, 2000, Springer
 |
| **Essential References Materials** |  |
| **Electronic Materials** |  |
| **Other Learning Materials** |  |

## 2. Facilities Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**(Classrooms, laboratories, demonstration rooms/labs, etc.) | * Lecture’s room with 10 seats
* 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 |