هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Introduction to Astrophysics**
Course Code:	**PHY4509**
Program:	**Physics**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type a. University ☐ College ☐ Department ☒ Others ☐ b. Required ☐ Elective ☒
3. Level/year at which this course is offered: 4th year
4. Pre-requisites for this course (if any): **Department approval**
5. Co-requisites for this course (if any):

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	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	3 hrs per week
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	30 hrs

B. Course Objectives and Learning Outcomes

1. Course description

2. Course Main Objective

The course provides a general introduction to the fundamental concepts of astrophysics to physics students at advanced undergraduate or beginning graduate level.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Describe the components of the universe.	K1(I) K2(I)
1.2	Summarize the overall properties of the Sun and the processes that occur within it.	K1(I) K2(I)

CLOs		Aligned PLOs
1.3	Demonstrate an understanding of light and how the information contained in light can be deciphered by astronomers	K1(I)
1.4	Interpret physical properties of stars and galaxies	K2(I)
2	**Skills :**	
2.1	Present the properties, classification system, and life cycle of stars including objects like white dwarfs, red giants, super-novas, pulsars, neutron stars, and black holes.	S1(I) S2(I)
2.2	Understand qualitatively some of the physical laws that lead to these phenomena.	S2(I)
2.3	Estimate the stellar temperature , the color index and color excess.	S1(I) S2(I)
2.4	Understand the interstellar medium absorption and air masses on stellar spectra.	S1(I) S2(I)
3	**Values:**	
3.1	Apply standards of integrity and ethics in all tasks	V1(I)
3.2	Collaborate and contribute responsibly and effectively in teamwork	V2(I)

C. Course Content

No	List of Topics	Contact Hours
1	**1- Orbital Mechanics** 1.1 Kepler's First Law 1.2 Kepler's Second Law 1.3 Kepler's Third Law	3
2	**2- Interaction of Radiation and Matter** 2.1 Atomic Structure 2.2 Atomic Processes 2.3 Emission and Absorption Spectra 2.4 The Equation of Radiative Transfer	3
3	**3- Astronomical Detection of Light** 3.1 The Telescope as a Camera 3.2 Refracting and Reflecting Telescopes 3.3 Astronomical Instruments and Detectors 3.4 Observations and Photon Counting 3.5 Observations at Other Wavelengths 3.6 Modern Telescopes	6
4	**4- Overview of the Solar System** 4.1 Two Types of Planets 4.2 Physical Properties of Planets 4.3 Formation of the Solar System	3
5	**5- The Planets** 5.1 Terrestrial Planets: Mercury, Venus, and Mars	3

	5.2 Jovian Planets: Jupiter and Saturn, Satellites of Jupiter and Saturn, Uranus and Neptune	
6	**6- Properties of Stars** 6.1 Distances to stars 6.2 Brightness of stars 6.3 Mass of stars	3
7	**7- Formation and Evolution of Stars** 7.1 Star Formation 7.2 Evolution of Sun-like Stars 7.3 Pulsating Variable Stars	3
8	**8- Galaxies** 8.1 Galaxy Classification 8.2 Galaxy Spectra 8.3 Supermassive Black Holes in Galaxies 8.4 Distances to Galaxies 8.5 The Hubble Law	6
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 and Understanding**		
1.1	Describe the components of the universe.	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, Power point 4. Discussions 5. Revise each previous chapter before starting the next chapter.	Solve some examples during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid-term exams) c) Final exam d) Discussions during the lectures. e) Homework.
1.2	Summarize the overall properties of the Sun and the processes that occur within it.		
1.3	Demonstrate an understanding of light and how the information contained in light can be deciphered by astronomers		
1.4	Interpret physical properties of stars and galaxies		
2.0	**Skills**		
2.1	Present the properties, classification system, and life cycle of stars.	1.Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references	1.Midterm's exam. Exams, short quizzes 2.Asking about physical laws previously taught 3.Writing reports on selected parts of the course 4. Discussions of how to simplify or analyze some phenomena in solids.
2.2	Understand qualitatively some of the physical laws that lead to these phenomena.		
2.3	Estimate the stellar temperature , the color index and color excess.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		5.Ask the student to attend lectures for practice solving problem	
2.4	Understand the interstellar medium absorption and air masses on stellar spectra.		
3.0	**Values**		
3.1	Apply standards of integrity and ethics in all tasks	▪ Search through the internet and use the library. ▪ Small group discussion. ▪ Enhance educational skills. ▪ Develop their interest in Science through :(field trips, visits to scientific and research labs). ▪ Encourage the student to attend lectures regularly ▪ Give students tasks of duties	▪ Evaluate the efforts of each student in preparing the report. ▪ Evaluate the work in team ▪ Evaluation of students presentations
3.2	Collaborate and contribute responsibly and effectively in teamwork		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Exercises, Participation, In-Class Problem Solving	All weeks	10 %
2	Quizzes & Homework	2^{th} -10^{th} week	10 %
3	Midterm exam	5^{th} - 6^{th} week	30 %
4	Final exam	12^{th} week	50 %
5			

***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:

Each student will be supervised by an academic adviser in the physics Department. The timetable for academic advice is given to students at each level. (O.H. 3 hrs a week)

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Ryden, B., & Peterson, B. M. (2020). Foundations of astrophysics. Cambridge University Press.
Essential References Materials	Essential astrophysics Kenneth R. Lang . Springer 2013 Astrophysics for Physicists Arnab Rai Choudhuri Cambridge University Press 2010
Electronic Materials	
Other Learning Materials	An Introduction to Modern Astrophysics Bradly W Carrol Cambridge university press 2017

2. Facilities Required

This course is based upon Ryden & Peterson "Foundations of astrophysics". It includes,

- Lecture Notes aligned with the lecture videos
- Problem Sets (no solutions)
- Problem Solving Help Videos providing step-by-step solutions to sample problems
- Exams with Solutions

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	There are enough classrooms provided with a good accommodation
Technology Resources (AV, data show, Smart Board, software, etc.)	In each classroom, there is a data show, and board.
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
1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching	Teaching staff teams	Questionaries' Open discussion in the class room at the end of the lectures
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department	Teaching staff teams	Revision of student answer paper by another staff member. Analysis the grades of students.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
3. Processes for Improvement of Teaching	Teaching staff teams	Preparing the course as PPT. Using scientific movies. Periodical revision of course content.
4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)	Teaching staff and program leaders	After the agreement of Department and Faculty administrations

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	