

Fakuliteit Natuur- & Landbouwetenskappe
Faculty of Natural & Agricultural Sciences

School of Physical Sciences

Department of Physics

PHY 300: Consolidated Study Guide
(Observational Astronomy) 2015

DRAFT VERSION – NOT FINAL



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

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Leading Minds

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The use of the computer facilities in the Physics Department are subject to the following conditions:10

Additionally, the use of the computer facilities at the University of Pretoria are subject to the “Code of Conduct for Computer Users” of UP:10

Internet Access:10

Consolidated Study Guide

PHY 300 ORGANIZATIONAL COMPONENT

General

This study guide should be read in conjunction with the general guidelines of the Department of Physics.

Course Description: Observational Astronomy

Optical Astronomy

This course will cover structure of the universe, navigation of the sky, spherical geometry, optical, radio and high energy physics and sources, instruments, practical observational skills, data recording, analysis, interpretation (signal and image processing, noise, calibration, error analysis). Project: A selected project in either optical or radio astronomy, resulting in a formal report and a presentation.

Radio Astronomy

Official time table

PHY 300	S1	G01	B	L1	Ma/Mo	08:30-09:20	NW1 5-42	Lecture
PHY 356	S1	G01	B	L2	Di/Tu	09:30-10:20	NW1 5-69	Lecture
PHY 356	S1	G01	B	L3	Wo/We	08:30-09:20	NW1 5-31	Lecture
PHY 356	S1	G01	B	L4	Vr/Fr	07:30-08:20	NW1 5-31	Lecture
PHY 356	S1	G01	B	P1	Wo/We	14:30-17:20	NW1 5-31	Lecture
PHY 356	S1	G01	B	P2	Vr/Fr	11:30-14:20	NW1 5-55	Experiment

In order to observe the night-time sky, some of the practicals will be moved to evening sessions.

PHY 300 lecturers and tutors

Lecturer (Optical Astronomy)

Prof Henry Throop, office 5-73, NW-1 Building. Tel: 079 762 3528

E-mail: henry.throop@gmail.com

Consulting hours: By appointment.

Lecturer (Radio Astronomy)

Prof Roy Booth, office 5-73, NW-1 Building. Tel:

E-mail: rbooth@ska.ac.za

Consulting: By appointment

The appointed tutors will be available for consultation for a set number of hours per week. The details thereof will be communicated to you in class.

Course website

<http://www.eaubergine.com/observational>

All homework, external readings, night-time status updates, and more will be posted here.

PHY 300 Examination admission and subminima in examinations

Examination admission

This module is comprised of 3 theory subdivisions; namely Optical Astronomy, and Radio Astronomy. A minimum mark of 40% in each module is required to gain admission to the examination. Each subdivision mark is obtained through assignments, homework and semester tests, the details of which will be communicated by the relevant lecturer.

In addition, this module also has a practical component. A subminimum of 40% must be obtained as a final practical mark and *all* practical reports have to be handed in, in order to be admitted to the examinations. There is no examination for the practical experiments, but reports have to be handed in within prescribed timeframes. Furthermore, attendance of practical sessions is *mandatory* and non-attendance (5% or more) will result in students not being admitted to the examinations. Absence must be validated by a doctor's certificate, whereby a missed practical session may be rescheduled, completed and a report handed in.

Subminima in examinations

A subminimum examination mark of 40% is required for each of the two theory subdivisions (Optical Astronomy and Radio Astronomy) individually in order to pass the module. There are written examinations for the individual sections. These are normally in May/June and details will be communicated in class.

Pass requirements

A student passes the module if the final mark is more than or equal to 50% and the subminima requirements are fulfilled.

Supplementary and ancillary exams

In the case where not all the pass requirements are fulfilled, either an ancillary or a supplementary exam may be awarded at the discretion of the lecturer. In the case of a supplementary exam, a maximum final mark of 50% can be awarded.

General regulations

See p. 8 and 9 of the "General Regulations and Rules (2013)" and p. 21 and 22 of the Faculty "(Undergraduate) Regulations and Syllabi (2013)" yearbook for the relevant sections on examination matters.

Processing of PHY 300 marks

The breakdown and weighting of the different components are configured as follows:

Optical mark¹:

$$\mathbf{TM} = (1/3) \times \text{General} + (1/3) \times \text{Optical} + (1/3) \times \text{Radio}$$

(Information on how the theory mark is calculated for each subdivision will be provided by the lecturers concerned.)

Practical mark²:

¹ A minimum mark of 40% is required in each theory subdivision individually to gain admission to the examination.

PM = Average of *all* the reported experiments done during the semester

Discussion mark:

$$\mathbf{DM} = (1/3) \times \text{Presentation} + (1/2) \times \text{Discussion}$$

Discussion mark is calculated based on performance leading assigned discussions, and participation in classroom discussions.

Semester mark:

$$\mathbf{SM} = 0.40 \times \mathbf{TM} + 0.40 \times \mathbf{PM} + 0.20 \times \mathbf{DM}$$

Examination mark³:

$$\mathbf{EM} = (1/3) \times \text{General} + (1/3) \times \text{Optical} + (1/3) \times \text{Radio}$$

Final Mark⁴:

$$\mathbf{FM} = 0.5 \times \mathbf{SM} + 0.5 \times \mathbf{EM}$$

² A subminimum of 40% must be obtained as a final practical mark to be admitted to the examinations.

³ A subminimum examination mark of 40% is required for each of the 3 theory subdivisions.

⁴ A student passes the module if the final mark is more than or equal to 50% and the subminima requirements are fulfilled.

STUDY COMPONENT

Plagiarism

UP views plagiarism very seriously and a policy setting out the definition, guidelines for deterring, detecting and dealing with plagiarism across the university has been developed. The "[Plagiarism Prevention Policy](#)" (S 4726/09) is available from the Office of the Registrar and from the Library website at <http://www.library.up.ac.za/plagiarism/index.htm>.

According to this policy, "Plagiarism is a form of academic misconduct. It involves both appropriating someone else's work and passing it off as one's own work afterwards." Plagiarism as a misconduct is dealt with in the (document): "Disciplinary Code: Students" and can lead to suspension from academic activities or even expulsion from the university. Civil claims and criminal charges could also be brought against the guilty party.

When submitting assignments or homework for academic assessment, students are required to complete and attach a Declaration of Originality form, as on page 28 of the Plagiarism Prevention Policy document. The lecturers will make the form available to students.

The Library is conducting weekly Awareness and Training sessions on Plagiarism. For more information, contact Bettie de Kock Tel.: 012 420 4719 or e-mail: bettie.dekock@up.ac.za

Prescribed and Recommended Textbooks

Optical Astronomy and General (Prescribed)

1. F. R. Chromey, "To Measure the Sky: An Introduction to Observational Astronomy," Cambridge University Press, 2010.

Radio Astronomy (Prescribed)

1. NRAO lectures?

Optical Astronomy course outline

Optical Astronomy course description

Electronic Circuits: XXX

Optical course outline:

Familiarity with the sky

Chromey Ch. 1, 4

Practical 1: Constellations and magnitudes

Celestial Motions and Coordinates

Chromey Ch. 3

Practical 2: Celestial Motions

Optics and Telescopes

Chromey Ch. 5, 6

Practical 3: Telescopes Types

Instrumentation

Chromey 7, 8, 9

Practical 4: CCD Noise Analysis

Practical 8:

Practical 9: Operational Amplifier Characteristics

Data Acquisition and Reduction

Chromey 10

Practical 5: Star Cluster Photometry

Practical 6: Astrometry

Practical 7: Jovian Moon motions

Specific outcomes: Optical Astronomy

After completion of this module, you should be able to...

Theme 1: Light and Motion (Chromey Ch. 1, 4)

- 1.1. Explain how concept of light has changed through time.
- 1.2. Discuss how stellar magnitudes are measured.
- 1.3. Explain what stellar types are.
- 1.4. Discuss how objects in the sky are named (stars, comets, asteroids).
- 1.5. Know your way around the southern-hemisphere sky: Milky Way, Large & Small Magellanic Clouds, and major stars and constellations.

Theme 2: Celestial Motions and Coordinates

- 2.1. Explain the motion of stars across the sky, visible to observers on different positions on the Earth.
- 2.2. Explain the broad motions of the planets.
- 2.3. Explain what is meant by absolute magnitude.
- 2.4. Be able to explain the following terms: zenith, meridian, ecliptic, horizon, twilight, right ascension, declination, hour angle.
- 2.5. Explain the motions of the moon, and predict its behavior in the future.

Theme 3: Optics and Telescopes

- 3.1. Explain how telescope design has changed over the last 300 years.
- 3.2. Compare and contrast the features of a refractor, a reflector, and a catadioptric telescope.
- 3.3. Calculate the magnification, resolving power, and exit pupil size of a telescope.
- 3.4. Sketch optical diagrams of telescope layouts.
- 3.5. Discuss telescope mounts: equatorial vs. altitude-azimuth.
- 3.6. Understand the major issues involved in building large telescopes.

Theme 4: Instrumentation

- 4.1. Explain how a CCD detector is used in astronomy.
- 4.2. Know about how to use filters to observe astronomical objects, and choose filters appropriate to the target.
- 4.3. Understand basics of other instruments such as spectrometers and bolometers.

Theme 5: Data Acquisition and Reduction

- 5.1. Know the difference between dark frames, flat frames, bias frames, raw frames, and reduced data frames.
- 5.2. Discuss how to plan an observation.
- 5.3. Discuss how to calculate the proper exposure time.
- 5.4. Understand the major contributors to data quality, included thermal noise, cosmic rays, poisson noise, saturation, and drift.
- 5.5. Know the basics of light pollution, seeing, and telluric absorption, and how they affect observations.

Radio Astronomy course outline

Acceptable use policy: Student computing facilities, Department of Physics, University of Pretoria, 2015

The use of the computer facilities in the Physics Department are subject to the following conditions:

1. The computer facilities in the Department of Physics may be used for work related directly to a physics course for which a student has enrolled only.
2. Specifically, the printing, storing and downloading of work for private purposes or other departments' courses is not allowed. Contravention of this rule will be regarded as theft.
3. *Keep the code to the computer room secret and lock the computer room when you leave.*
4. Keep your password secret and do not leave your computer unattended while you are logged in.
5. Keep the computer room tidy. No eating or drinking (with the exception of water) is allowed.
6. Do not change or adjust any settings on the computer.
7. Do not install software on the computers without permission.
8. Please store your files on your Google Drive, where they are private and safe. Files stored on the computer hard drive may be deleted periodically.
9. Students & visitors that are not currently enrolled for a physics second or third year course are *not* allowed in the computer room.
10. Please note that room 5-52 is reserved for postgraduate materials modelling students while room 5-55 is reserved for undergraduate second and third year students.
11. Due to technical reasons, the computers in 5-55 cannot access the internet via the student cache
12. After use, computers should NOT be switched off, but be re-booted into linux, to allow the jobserver to send calculations to them.

Additionally, the use of the computer facilities at the University of Pretoria are subject to the "Code of Conduct for Computer Users" of UP:

1. No user may utilise the University's network, Tenet or the Internet to defame the name of the University or that of any other person.
2. One may not allow any other person to use their password or share their private account. It is their responsibility to protect their private account from unauthorised access.
3. Any attempt to circumvent system security, guess other passwords, or in any way gain unauthorised access to local or network resources is forbidden. Privacy of all other computer users must be respected regarding both programs and data.
4. Transferring copyrighted material to or from a University system, without express consent of the owner, is a violation of the law.
5. Use of Tenet or the Internet for direct commercial gain or profit is not allowed for users of the University's network.
6. Shared resources, eg. computer lab facilities, network bandwidth, printers, etc must be utilised as economically as possible, keeping in mind that course related work is given priority.
7. Never use computing facilities or resources to harass other users or to do mischief. Do not send messages to unwilling recipients!
8. The user has to ensure that no programs possibly containing code that is detrimental to the computing environment may be loaded on the system or executed.
9. The University disclaims any responsibility for irresponsible and/or illegal acts by users utilizing its network and computer resources.

Internet Access:

1. You will receive some credit to access the internet from lab 5-55. This access is for Physics-related work only. Should you abuse this privilege, your account will be blocked.
2. Internet usage from lab 5-55 will be logged.

Violations of this policy will be treated as academic misconduct, misdemeanour, or a crime as appropriate and dealt with by a disciplinary board. Misdemeanour or crime violation charges will be prosecuted to the fullest extent of the law and will result in the immediate and permanent loss of access to the systems or network.

I have read the above rules and undertake to obey them.

Name: _____

Signature: _____ Date: _____

Student no.: _____