Course Title: Astronomical Instrumentation
Course Instructor: Nicolas Erasmus
Lecture Hours: 14
Lab Hours: 15

1. **Course Overview:**
   This is an advanced course on optical astronomical instrumentation which aims to develop understanding of practical issues of instrument development in students. The course consists of 14 hours of lectures divided into 4 sections : detectors, optics, spectroscopy, and adaptive optics. Individual sections would have their associated laboratory sessions to be hosted at SAAO totalling 15 lab-hours. The sections are associated with preliminary assessment of assignments and quizzes, 2 tests. This course is geared towards making students knowledgeable for participating in instrumentation discussions as well as readying them to design instruments specific to different scientific goals.

2. **Course Break Down:**

   a. Detectors:

   Preliminary assessment method : 2 × End-of-Lecture Unprepared Pop Quiz
   Lecture Hours: 4 (2 lectures - 2 hours each)
   Lab Hours: 6 (2 lab practicals, - 3 hours each)

   Topics to be covered:

   i. Quantum Efficiency
   ii. Semiconductor
   iii. CCD and CMOS detectors
   iv. Charge Transfer
   v. Readout Electronics
   vi. Electronic Noise

   b. Optics:

   Preliminary assessment method : 1 × Home Assignment
   Lecture Hours: 4 (2 lectures - 2 hours each)
   Lab Hours: 6 (2 lab practicals, - 3 hours each)

   Topics to be covered:

   i. Geometric/ray optics
   ii. Aberrations
   iii. Designing optical systems
   iv. Interference
   v. Diffraction

   c. Spectroscopy:

   Preliminary assessment method : 1 × Home Assignment
   Lecture Hours: 4 (2 lectures - 2 hours each)
   Lab Hours: 3 (1 lab practical, - 3 hours)

   i. Anamorphic magnification
   ii. Diffraction grating
   iii. Echelles
   iv. Grating efficiency
   v. Integral field spectroscopy
   vi. Multi-object spectroscopy

   d. Adaptive Optics:

Preliminary assessment method :	1 × End-of-Lecture Unprepared Pop Quiz
Lecture Hours:	2 (1 lecture - 2 hours)
Lab Hours:	none

i. Atmospheric seeing
ii. Turbulence and mitigation
iii. Strehl Ratio
iv. AO systems (phase space)
v. AO systems (mode space)

3. Resources: (only for further reading)

a. Astronomical Optics by Daniel Schroeder
b. To Measure the Sky by Frederick Chromey
c. Detection of Light, by George H. Rieke

4. Breakdown of lab/practical tasks:

a.	Detectors A:	Measure Gain
b.	Detectors B:	TBD
c.	Optics A:	Measure spherical aberration
d.	Optics B:	Measure chromic aberration
e.	Spectroscopy:	Build your own spectrograph and measure resolving power

5. Requirements of attending the course:

a. Undergraduate physics
b. Basic Astronomy

6. Skills to be developed during the course:

a. Deriving instrument specific requirements from astronomical science goals
b. Ability to participate in instrument related discussion
c. Hands-on feeling for instrumentation design

7. Assessment:

Assignments:	10% (5% each)
Quizzes:	15% (5% each)
Attendance:	10%
Lab Practicals:	35% (7% each)
Test1:	15%
Test2:	15%
Total	100%