AUSTRALIAN INSTITUTE OF PHYSICS
www.aip.org.au

PO Box 480
West Ryde
NSW 1685
Australia
Phone: 478 260 533
email: aip@aip.org.au
ACN: 004 466 509

Information for Australian universities seeking to have a bachelor degree[1] accredited by the Australian Institute of Physics[2]

Physics is the study of matter and energy and their interaction. Physical laws are universal and international in their application. A graduate physicist at bachelor level should demonstrate the ability to[3]:

- Comprehend and demonstrate knowledge and understanding of physics laws, concepts and principles;
- Apply physics principles to observe, describe, model, understand and explain the causes of problems, devise strategies to solve them and test the possible solutions;
- Use the tools (including mathematics), methodologies, language and conventions of physics to test and communicate ideas and explanations;
- Safely use laboratory apparatus for a measurement or experimental procedure and produce a quality record of experiment as it is conducted;
- Execute and analyse the results of an experiment, measurement or investigation, including the evaluation of the level of uncertainty of these results, a comparison of these results with expected outcomes, as well as theoretical and computational models or published data and, hence, an assessment of their significance;
- Competently use computing technology and appropriate software for the analysis of data, the simulation of physical systems and the retrieval of appropriate information;
- Present and interpret information graphically, undertaking numerical manipulation as needed;
- Communicate scientific information, in particular through scientific reports, to both expert and non-expert audiences;
- Work effectively and ethically in a multi-faceted scientific environment; and
- Be responsible, critically reflective, self-directed and motivated learners.

The accreditation of qualifications is overseen by the Australian Institute of Physics (AIP) Accreditation Manager, who reports to the Executive of the Institute.

(1) Assessment guidelines

It is expected that accredited qualifications will be a 3-year Bachelor degree with a major in Physics or related majors such as Theoretical Physics, Computational Physics, or Applied Physics, or another major involving substantial applications of Physics.

For 4-year Bachelor degrees that incorporate Honours in Physics (or Applied Physics) the requirements for accreditation will be comparable to those for a 3-year program. Please note that if the 3-year bachelor degree satisfies the requirements of the AIP there is no need to provide information regarding a separate honours program.

Other qualifications in which graduates obtain an overall level of physics that is at least the equivalent of the above may also receive AIP accreditation.

The following points give further details:

- As a minimum requirement, 1-year equivalent of the total degree program should be classifiable as physics, with three quarters of a year equivalent of "core principles of Physics" (as specified below) beyond the introductory degree program level, or such alternative arrangements as satisfy the Institute. An Accreditation Panel will expect to see evidence of sequential development of physics and mathematics knowledge and skills.
- The inclusion of substantial experimental experience is mandatory. It is ordinarily expected that physics graduates will have engaged with a minimum of 48 hours of laboratory at each of second and third level, or a clear equivalent. While simulations may have a role in experimental work, they should not dominate the

experimental laboratory experience. Majors such as Theoretical Physics, Computational Physics or Astrophysics may have some significant advanced activities in other relevant areas such as computational modelling or advanced mathematical approaches which can be considered as equivalent to 48 hours of laboratory. However, some laboratory component at advanced levels is still strongly recommended. To prepare for higher-level laboratory classes, a similar minimum number of hours is expected at first year level. There is a clear expectation that the level of content, techniques and skills, and the level of sophistication of the experiments (or the equivalent advanced activities) will be demonstrably increased as a student progresses in their degree.
- The mathematics components should reflect the importance of mathematics to physics and should require students to understand material beyond an introductory level. As a guide, a 3-year degree program should include appropriate problem-solving skills in Pure and/or Applied Mathematics including Calculus, Differential Equations, Vector Analysis, Linear Algebra and Complex Analysis.
- The degree should include a clear development sequence of physics computation skills, either studied as discrete subject(s)/unit(s) or embedded within physics subjects/units. Computational skill development should cover more than one area of physics computation, e.g. algorithm development, high-level data processing, and algebraic computing.
- The degree should include the development of skills in scientific communication including written and oral skills, and interpreting scientific literature.

Institutions should note that the requirements outlined here are a minimum and institutions are encouraged to offer programmes that exceed these significantly.

Core Principles of Physics:

- "Core principles of Physics" is taken to include a balance of topics such as: Classical Mechanics, Electromagnetism, Quantum Physics, Thermal Physics, Optics, Relativity, Nuclear and Particle Physics, Condensed Matter Physics, and Atomic Physics.
- It is recognised that this core material may in some cases also be embedded in topics such as Astrophysics, Atmospheric Physics, Biomechanics, Biophysics, Crystallography, Electronic Device Physics, Geophysics, Laser Science, Materials Science, Medical Physics, Nanoscience, Nanotechnology, Optoelectronics, Photonics, Plasma Physics, Space Science, or Surface Physics. Accreditation Panels will assess degree programs on the breadth and level of the physics and mathematics understanding and computational skills demonstrated by students rather than just on the description of the content.

(2) Issues considered in the accreditation process

In examining a degree program for accreditation purposes, the Accreditation Panel will consider the following input factors:
- the general academic practices and standards of the university;
- the objectives of the degree program and the methods adopted to achieve these objectives;
- the requirements for and standards of admission to the degree program;
- the duration of the degree program;
- the breadth, depth and balance in the subjects/units involved and the intellectual effort and demands of the degree program;
- the methods of assessment of student progress, including marking and feedback to students;
- the arrangements for practical training and experience as part of the degree program;
- the teaching staff conducting the degree program, their numbers, professional qualifications and experience and their educational expertise;
- the accommodation and facilities available including equipment, libraries, experimental and computing laboratories, workshops, etc.;
- the extent, quality and level of student feedback provided through program and subject/unit evaluation processes.

The primary output factor of concern to the Accreditation Panel is the quality of the student experience and the graduate abilities demonstrated, including at the threshold level. This will be assessed through interviews with students and consideration of student assessments.

Each university requesting accreditation of a degree program (or a suite of degree programs) will be required initially to provide the information listed below in a clear and concise form and subsequently to host a visit of one day's duration by an Accreditation Panel.

(3) Documentation and supporting information required from a university to support accreditation

Required one month before the date of the Accreditation Panel visit. (It is anticipated that much of the documentation required could be extracted by the university from existing handbooks, the university web site and similar publications.) Please use the following dot points, or a shortened version thereof, as section headings.

- A statement of the objectives of the degree program.
- A statement of the requirements for completion of the degree (or the degree sequence for which accreditation is sought).
- A demonstration that the minimum mandated: (i) physics, (ii) mathematics, (iii) computational physics and (iv) experimental physics studied in the degree program meets the AIP requirements (see section 1).
- Outlines of all subjects/units including objectives/outcomes and syllabi, classifiable as physics or mathematics, which could be included in a properly constituted degree program including details of texts, the relevant pre- and co-requisites and details of the methods and types of assessment used and their relative weightings.
- A tabulation of all the assessments in all the physics subjects/units indicating type, percentage, individual or group with group size, and hurdle requirements that are implemented. If a task is a group task also tabulate the components of individual and shared assessment in the outcome.
- Preferably, examination will correspond to around 60% or more of the assessment in a given subject/unit, be invigilated, and involve a hurdle requirement. A combination of invigilated tests and examinations (written and/or oral) totalling at least 60% of the assessment may be able to be shown as equivalent. In some advanced subjects/units, it may also be possible to include a higher proportion of identity-verified assessment of other formats such as project work. The submission needs to evidence how deep learning and hierarchical knowledge development and understanding is ensured in the graduate abilities over the full duration of the qualification, by every graduate. The AIP requires arrangements that ensure that the individual performance of each graduate is ascertained and evidenced. The standard and level of invigilated examination/tests are a key focus of the accreditation process. Identity verification procedures are an expectation of invigilated examinations/tests.
- A description of a typical program of study leading to the award of the degree.
- Brief (one page) resumes of the continuing and contract physics staff involved in teaching the degree program and a summary list of all physics teaching staff which includes their highest academic qualification, and professional memberships. If this qualification is not in physics then the highest physics qualification should also be given;
- A profile of the experience and qualifications of all staff involved in face-to-face teaching in the degree program for the current semester; this includes all sessional staff involved in the teaching program and is probably best presented as a matrix.
- A table of the physics and mathematics studied in the degree program and its assessment against the following list of competencies for a graduate physicist, showing how the assessment components address the 10 listed specific competencies. Note: text generated in addressing this item is expected to be useful to the discipline/school/department in subject/unit outlines. This articulation helps students evidence their graduate capabilities.

    1. Comprehend and demonstrate knowledge and understanding of physics laws, concepts and principles;
    2. Apply physics principles to observe, describe, model, understand and explain the causes of problems, devise strategies to solve them and test the possible solutions;
    3. Use the tools (including mathematics), methodologies, language and conventions of physics to test and communicate ideas and explanations;
    4. Safely use laboratory apparatus for a measurement or experimental procedure and produce a quality record of experiment as it is conducted;
    5. Execute and analyse the results of an experiment, measurement or investigation, including the evaluation of the level of uncertainty of these results, a comparison of these results with expected outcomes, as well as theoretical and computational models or published data and, hence, an assessment of their significance;
    6. Competently use computing technology and appropriate software for the analysis of data, the simulation of physical systems and the retrieval of appropriate information;
    7. Present and interpret information graphically, undertaking numerical manipulation as needed;
    8. Communicate scientific information, in particular through scientific reports, to both expert and non-expert audiences;
    9. Work effectively and ethically in a multi-faceted scientific environment; and
    10. Be responsible, critically reflective, self-directed and motivated learners.
- A table of learning activities and the set contact hours for students, both hours per week and number of weeks per semester/session the activity runs. If video recordings are used in a flipped class mode, report the typical length of the videos and the total hours of recordings students are required to engage with.
- Pass, withdrawal rates for the program and core subjects/units of the program.

- Marks/grade distribution profiles of core subjects/units of the program.
- The quality of student work and how this correlates with grades. This requires a **supporting portfolio of assessments**, preferably as an electronic folder/file resource, but some hardcopy samples may be sighted during the panel visit (see section 5). Note, there is insufficient time to review a complete portfolio of assessments during the panel visit so much of it needs to be provided as part of the submission. Core physics units will be evidenced by the collated assessments of individual students representative of a minimal pass, pass/credit, and distinction/high distinction (or equivalent in the grading system implemented by the institution). The collation for an individual (anonymised as appropriate) should indicate how the individual components combine to achieve a final grade. It is important that marks and feedback on all assessments can be reviewed. The assessments will vary for a given subject/unit, but a typical collation might contain the final examination paper, its marking schedule, marked student script, the same for any test(s), assignment sheets, assignment marking schedules, marked and assessed student assignments, contemporaneous laboratory record keeping (lab books), laboratory reports, project reports, etc.
- Graduate employment/study destinations.
- Gender and equity group distributions of the students, how these are changing in time and what programs or initiatives are in place to support these students.
- Evidence of a quality improvement process for the past 5 years. This should include a review of the recommendations in the previous accreditation report and how these have been acted upon, and the results of any internal evaluation data of courses/units/subjects/programs relevant to the degree program being accredited, and evidence of action taken in light of these results.
- Evidence of processes that are systematically implemented to ensure academic honesty and integrity is upheld throughout the degree(s)/program(s).
- Any other material considered relevant by the university.

If the university is unsure of any of these requirements they should contact the AIP Accreditation Manager[4].

(4) Accreditation process

The Accreditation will perform according to the following process:

- The Accreditation Manager (AM) appoints a three-member Accreditation Panel for each accreditation from members of the Accreditation Committee. The AM will ensure Accreditation Panel members have no conflicts of interest. One member will be asked to chair the Accreditation Panel. This will often be the AM. The three individuals from the Accreditation Committee will include at least one Accreditation Committee member from within the state in which the accreditation is to be carried out, and at least one member from another state.
- The Panel Chair contacts the Chair/Head of the relevant Academic Unit of the university seeking program accreditation and discusses the accreditation process and determines possible timelines.
- The Panel Chair writes to the Chair/Head of the Academic Unit and formally invites the university to put forward their degree program(s) for accreditation. This document is included with this invitation.
- The university responds formally to the Panel Chair's invitation agreeing to the timelines and process.
- The university transmits a soft copy submission to the Panel Chair and Accreditation Panel members in the manner required by the Institute (section 3). The submission should be provided at least one month before the date of the Accreditation Panel visit. Late submissions may incur an administrative fee (See section 7).
- The university arranges guest access to the physics (and mathematics, if possible) content of the online learning and teaching platform used in subject/unit delivery, to Accreditation Panel members, for a period beginning 2 weeks prior to the visit and continuing for about a month after the site visit.
- The one-day site visit takes place – see arrangements in section 5, below.
- The Panel Chair writes the draft report and after obtaining the agreement of the rest of the Panel, sends it to the university for Comment.
- The Panel Chair attempts as far as possible to get the agreement of the university on the contents of the report. When no further progress seems possible or necessary, the report is presented to the Accreditation Manager who then submits it to the AIP Registrar to schedule it for consideration by the Executive of the Institute for approval. In the event of a negative report or one lacking the agreement of the university concerned, the Accreditation Manager and Panel Chair will also advise the Executive of these matters and recommend on any relevant action as a consequence of the report.
- After approval of the Executive, the final report is signed by the AIP President and sent to the University. A covering letter is also sent advising the University of an appeals process in the event that it wishes to challenge any aspect of the report.

Should the university choose to withdraw their degree program(s) for accreditation at any time during the process, the AM will inform the AIP Executive in a timely manner.

(5) Arrangements for a site visit (& completion of the assessment portfolio)

During the site visit, the Accreditation Panel will wish to meet the Chair/Head of the Academic Unit or his/her nominee(s) in the first instance, to clarify any queries related to their examination of the documentation provided to the Panel. The Panel will also wish to meet: (i) staff involved in teaching the program(s), (ii) undergraduate students, and (iii) postgraduate students, in separate sessions. The panel welcomes the opportunity to meet with senior executives who make decisions affecting the degrees, to discuss AIP accreditation and to gauge support for physics.

The Panel will examine samples of assessment, as needed to complete the Assessment portfolio described in section 3. As noted there, this is preferred in electronic format, but long documents, such as laboratory logbooks, may be provided as hardcopy to be viewed during the panel visit. It is important that marks and feedback on all assessments can be reviewed.

The assessment portfolios for the units of study in the final year of the degree are particularly significant for accreditation purposes.

The Panel will tour the physical facilities available to students enrolled in the degree program, including laboratories, computing facilities, lecture theatres, libraries, technical workshops, etc. The Panel would particularly like to visit higher level (second and/or third year) laboratories and talk to undergraduate students in the laboratory. A sample program for a site visit is listed in Appendix D.

(6) Report

Following the site visit, the Accreditation Panel will produce a report which will be confidential between the Academic Unit of the University involved, the Panel and the Executive of the Institute.

The Panel Chair is expected to produce the first draft for discussion within one month of the site visit and if he/she is unable to do that he/she will ask another Panel member to write the draft. The report should be finalised within two months.

Once formally received by the university it is anticipated that the report will be made available to any of the staff within the academic unit involved in the accreditation.

(7) Fees and charges

The fee for an accreditation within Australia is $10,000 plus GST and this includes all travel and accommodation costs incurred by Accreditation Panel members. An administration fee applicable for late submissions of documentation of $500 plus GST may be applied subject to the circumstances.

(8) Appeal

An appeal of matters pertaining to an AIP Accreditation outcome will be considered by the AIP Executive after receiving a written submission from the university, and written comments on that submission from the Panel Chair, and, if required, from the Accreditation Manager. The university will have the right to have a member of the staff present its case of appeal in person to the AIP Executive provided that all costs associated with such presentation are met by the university.

(9) Notes and References

1. Updated December 2023. This regulations document is a living one subject to regular review and updating as approved by the AIP Executive. This version will be used for AIP Accreditations being initiated and completed from January 2024.
2. Physics bachelor degrees that meet the requirements for AIP Accreditation also satisfy the 2015 Australian Qualification Framework Level 7 (Bachelor Degree) given in Appendix A. The correlation between the AIP requirements and threshold learning outcomes requirements are detailed in Appendix C.
3. The characteristics of a graduate physicist are based on the UK Quality Control for Higher Education Subject Benchmark Statement - Physics, Astronomy, and Astrophysics (modified for Australia) available at https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-physics-astronomy-and-astrophysics.pdf
4. AIP Accreditation Manager (2023-2025) Professor Tim McIntyre, School of Mathematics and Physics, The University of Queensland, Qld 4072, Australia, t.mcintyre@uq.edu.au ; accreditation_chair@aip.org.au
5. General enquiries about AIP Accreditation can be sent to accreditation@aip.org.au

Appendix A
The current AQF Australian Qualification Framework (2nd Edition January 2013)

https://www.aqf.edu.au/framework/australian-qualifications-framework

AQF Level 7 – Bachelor Degree

The purpose of the Bachelor Degree qualification type is to qualify individuals who apply a broad and coherent body of knowledge in a range of contexts to undertake professional work and as a pathway for further learning.

Bachelor Degree qualifications are located at level 7 of the Australian Qualifications Framework.

Bachelor Degree qualifications must be designed and accredited to enable graduates to demonstrate the learning outcomes expressed as knowledge, skills and the application of knowledge and skills specified in the level 7 criteria and the Bachelor Degree descriptor.
https://www.aqf.edu.au/framework/australian-qualifications-framework

AQF level 7 criteria

Summary

Graduates at this level will have broad and coherent knowledge and skills for professional work and/or further learning.

Knowledge

Graduates at this level will have broad and coherent theoretical and technical knowledge with depth in one or more disciplines or areas of practice.

Skills

Graduates at this level will have well-developed cognitive, technical and communication skills to select and apply methods and technologies to:

- analyse and evaluate information to complete a range of activities
- analyse, generate and transmit solutions to unpredictable and sometimes complex problems
- transmit knowledge, skills and ideas to others

Application of knowledge and skills

Graduates at this level will apply knowledge and skills to demonstrate autonomy, well-developed judgement and responsibility:

- in contexts that require self-directed work and learning
- within broad parameters to provide specialist advice and functions

Appendix B
Higher Education Standards Framework (Threshold Standards) 2021
(Excerpt – Section 3 Teaching)

The Higher Education Standards Framework describes threshold standards for the delivery of education by higher education providers registered under the TEQSA Act. The extract below relates to teaching standards. See

https://www.legislation.gov.au/Details/F2022C00105/Html/Text#_Toc67664702

3 Teaching

3.1 Course Design

1. The design for each course of study is specified and the specification includes:
   a. the qualification(s) to be awarded on completion
   b. structure, duration and modes of delivery
   c. the units of study (or equivalent) that comprise the course of study
   d. entry requirements and pathways
   e. expected learning outcomes, methods of assessment and indicative student workload
   f. compulsory requirements for completion
   g. exit pathways, articulation arrangements, pathways to further learning, and
   h. for a course of study leading to a Bachelor Honours, Masters or Doctoral qualification, includes the proportion and nature of research or research-related study in the course.

2. The content and learning activities of each course of study engage with advanced knowledge and inquiry consistent with the level of study and the expected learning outcomes, including:
   a. current knowledge and scholarship in relevant academic disciplines
   b. study of the underlying theoretical and conceptual frameworks of the academic disciplines or fields of education or research represented in the course, and
   c. emerging concepts that are informed by recent scholarship, current research findings and, where applicable, advances in practice.

3. Teaching and learning activities are arranged to foster progressive and coherent achievement of expected learning outcomes throughout each course of study.

4. Each course of study is designed to enable achievement of expected learning outcomes regardless of a student's place of study or the mode of delivery.

5. Where professional accreditation of a course of study is required for graduates to be eligible to practise, the course of study is accredited and continues to be accredited by the relevant professional body.

3.2 Staffing

1. The staffing complement for each course of study is sufficient to meet the educational, academic support and administrative needs of student cohorts undertaking the course.

2. The academic staffing profile for each course of study provides the level and extent of academic oversight and teaching capacity needed to lead students in intellectual inquiry suited to the nature and level of expected learning outcomes.

3. Staff with responsibilities for academic oversight and those with teaching and supervisory roles in courses or units of study are equipped for their roles, including having:
   a. knowledge of contemporary developments in the discipline or field, which is informed by continuing scholarship or research or advances in practice
   b. skills in contemporary teaching, learning and assessment principles relevant to the discipline, their role, modes of delivery and the needs of particular student cohorts, and
   c. a qualification in a relevant discipline at least one level higher than is awarded for the course of study, or equivalent relevant academic or professional or practice based experience and expertise, except for staff supervising doctoral degrees having a doctoral degree or equivalent research experience.

4. Teachers who teach specialised components of a course of study, such as experienced practitioners and teachers undergoing training, who may not fully meet the standard for knowledge, skills and qualification or experience required for teaching or supervision (3.2.3) have their teaching guided and overseen by staff who meet the standard.

5. Teaching staff are accessible to students seeking individual assistance with their studies, at a level consistent with the learning needs of the student cohort.

3.3 Learning Resources and Educational Support

1. The learning resources, such as library collections and services, creative works, notes, laboratory facilities, studio sessions, simulations and software, that are specified or recommended for a course of study, relate directly to the learning outcomes, are up to date and, where supplied as part of a course of study, are accessible when needed by students.
2. Where learning resources are part of an electronic learning management system, all users have timely access to the system and training is available in use of the system.
3. Access to learning resources does not present unexpected barriers, costs or technology requirements for students, including for students with special needs and those who study off campus.
4. Students have access to learning support services that are consistent with the requirements of their course of study, their mode of study and the learning needs of student cohorts, including arrangements for supporting and maintaining contact with students who are off campus.

Appendix C
Mapping of the AIP requirements for accreditation of a degree with a major in Physics (or equivalent) to Threshold Learning Outcomes

Threshold learning outcomes for students graduating with a physics major from an Australian university are published in *Australian Physics*, 50(3), pp 89-93, May-Jun 2013. The document is also available at the following link:

https://www.acds.edu.au/wp-content/uploads/Physics-TLOs_Aust-Phys-50-3_published-2013.pdf

A mapping of the description of a graduate physicist at the bachelor level (as introduced in this accreditation document) to the threshold learning outcomes is given below.

- Comprehend and demonstrate knowledge and understanding of physics laws, concepts and principles;
  (*TLO 2: Scientific Knowledge*)
- Apply physics principles to observe, describe, model, understand and explain the causes of problems, devise strategies to solve them and test the possible solutions;
  (*TLO 3: Inquiry and problem solving*)
- Use the tools (including mathematics), methodologies, language and conventions of physics to test and communicate ideas and explanations;
  (*TLO 3: Inquiry and problem solving*)
- Safely use laboratory apparatus for a measurement or experimental procedure and produce a quality record of experiment as it is conducted;
  (*TLO 3: Inquiry and problem solving*)
- Execute and analyse the results of an experiment, measurement or investigation, including the evaluation of the level of uncertainty of these results, a comparison of these results with expected outcomes, as well as theoretical and computational models or published data and, hence, an assessment of their significance;
  (*TLO 3: Inquiry and problem solving*)
- Competently use computing technology and appropriate software for the analysis of data, the simulation of physical systems and the retrieval of appropriate information;
  (*TLO 3: Inquiry and problem solving*)
- Present and interpret information graphically, undertaking numerical manipulation as needed;
  (*TLO 4: Communication*)
- Communicate scientific information, in particular through scientific reports, to both expert and non-expert audiences;
  (*TLO 4: Communication*)
- Work effectively and ethically in a multi-faceted scientific environment;
  (*TLO 5: Personal and professional responsibility*)
- Be responsible, critically reflective, self-directed and motivated learners.
  (*TLO 5: Personal and professional responsibility*)

Appendix D
Sample Schedule for the AIP Accreditation Panel Site Visit

09:00	Arrival and preliminary panel discussion (AIP Panel only)
09:30	Meet with Head of School and Head of Teaching, overview of teaching programs
10:00	Meeting with unit coordinators
10:30	Morning tea with staff
11:00	Meeting with teaching staff
11:30	Meeting with undergraduate students
12:00	Meeting with honours and PhD students
12:30	Lunch, panel review of assessment portfolio & lab books (AIP Panel only)
13:30	Laboratory tours – active classes
15:00	Meeting with Senior Executive (e.g. Dean - T&L & Research)
15:30	Afternoon tea with teaching staff
16:00	Panel discussion on report (AIP Panel only)
16:30	Final briefing to Head of School and Head of Teaching
17:00	Day close