Program Educational Objective & Learning Outcome

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Definition

- **Program Educational Objectives:**

  Statements that describe the expected accomplishments of graduates during the first few years after graduation
- **Learning outcomes:**

  Statements of what a learner knows, understands and is able to do on completion of a learning process, defined in terms of knowledge, skills and competences.
- **Knowledge:**

  Outcome of the assimilation of information through learning (theoretical and / or factual knowledge) .

- **Skills:**

  Ability to apply knowledge to complete tasks and solve problems (cognitive skills such as logical, intuitive and creative thinking and practical skills such as manual dexterity and the use of methods, materials, tools and instruments).

- **Competence:**

  Proven ability to use knowledge, skills and personal, social and / or methodological abilities, in work or study situations and in professional and / or personal development

Steps in Program Design Based on Learning Outcome

- Aims /general purposes/Prog. Edu. Objectives
- General competences/Academic and professional profiles
- Learning outcome at program level
- Program structure and module composition
- Module/course outcome
- Module contents
- Module assessment
- MAE of learning outcome

Structure of a learning outcome statement

- An action word that identifies the performance to be demonstrated
- A learning statement that specifies what learning will be demonstrated in the performance
- A broad statement of criterion or standard for acceptable performance

Characteristics of good learning outcome

- Specify the level, criterion or standard for the knowledge, skill and ability that the student must demonstrate
- Include conditions under which they should be able to deminstrate their knowledge, skill, abilities.
- Contain active verbs
- It can be measured by more that one assessment (ideally)
- Be written such that you do not join elements in one outcome statement that can not be assessed by a single method

PLO assessment

- Direct assessment:
  - Course portfolio
  - Course rubric
- Indirect assessment:
  - Student course evaluation
  - Graduate questioner
  - Alumni tracer study
  - User survey

KKNI

LEVEL 6

- **Mampu mengaplikasikan bidang keahliannya dan memanfaatkan IPTEKS pada bidangnya dalam penyelesaian masalah serta mampu beradaptasi terhadap situasi yang dihadapi.**
- Menguasai konsep teoritis bidang pengetahuan tertentu secara umum dan konsep teoritis bagian khusus dalam bidang pengetahuan tersebut secara mendalam, serta mampu memformulasikan penyelesaian masalah prosedural.
- **Mampu mengambil keputusan yang tepat berdasarkan analisis informasi dan data, dan mampu memberikan petunjuk dalam memilih berbagai alternatif solusi secara mandiri dan kelompok.**
- Bertanggung jawab pada pekerjaan sendiri dan dapat diberi tanggung jawab atas pencapaian hasil kerja organisasi.

LO Generik

- Penguasaan pengetahuan (teori & praktek)
- Mendisain
- Berkomunikasi
- Bekerjasama
- Manajerial & leadership
- Life-long learning
- Mengembangkan diri

Learning Outcome (Physics)

- **A. Knowledge and Understanding of:**
  - A1.The principles of Mechanics and Relativity, Quantum Atomic and Nuclear Physics, Condensed, Matter Physics, Oscillations and Waves, Electromagnetism, Optics, Thermodynamics and Statistical, Physics (QAP,IOP).
  - A2. The mathematical principles and techniques necessary for A1.
  - A3. The application of physics in a variety of contexts.
  - A4. The methods of solution of problems through the design and execution of practical experimental, and field investigations, and mathematical and computational models

Assessment (LO: A)

- Assessment of the knowledge base and subject understanding is through a combination of:
  - Assessed coursework which takes the form of essays, coursework reports, laboratory reports, oral examinations and presentations as appropriate to the units studied [A4-4]
  - Assessment is also through level 6 project [A1-4]

- **B. Cognitive (Intellectual or Thinking) Skills, able to:**
  - B1. Plan, conduct and report on a programme of research at undergraduate level including the formulation and testing of hypotheses. Critically evaluate arguments, assumptions and data, make judgements and frame questions to achieve a solution to a problem or identify a range of solutions.
  - B2. Select, apply and evaluate appropriate mathematical, scientific, laboratory and computer-based methods and principles in the analysis and solution of a variety of physical problems.
  - B3. Be creative and innovative in the analysis and solution of physical problems and presentation of results.

- B4. Generate, analyse and process data to test a hypothesis and to assess the reliability of data in order to critically assess the significance of results, and to generate, analyse and relate results from numerical modelling or experiment, to the relevant theory.
- B5. Work with confidence from basic core physics principles to develop an understanding of physical processes in a wide variety of contexts and, on the basis of such understanding, to propose and assess solutions to topical problems.
- B6. Contribute to debate on relevant issues and use specialist knowledge to propagate informed views.

Assessment (LO: B)

- Assessment of the cognitive skills is through a combination of:
  - Integrated scientific individual and group reports of investigations and solutions of laboratory, field and theoretical applied physics problems [B1-4]
  - Formal open and closed book examinations requiring time-limited intellectual response [B2, B3, B5]
  - Presentations requiring the transformation and representation of ideas in clear, concise and verbal and visual form [B3]
  - Extended project work requiring deeper intellectual reflection and knowledge of topical physical concerns and problems [B1-6].

- **C. Practical (Professional or Subject) Skills, able to:**
  - C1. Plan, conduct and report on practical laboratory, field or computational scientific investigations.
  - C2. Collect, record and analyse data using a variety of suitable techniques comparing real systems with theoretical or computational model predictions as appropriate
  - C3. Undertake field and laboratory investigations in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigations on the environment and human health.

- C4. Critically evaluate and use scientific literature appropriately and cite references correctly.
- C5. Identify and work towards targets for personal, academic and career development including commercial awareness and opportunities for enterprise.
- C6. Develop an adaptable and flexible approach to study and work.

Assessment (LO: C)

- Practical and professional skills are assessed through:
  - Coursework, laboratory and fieldwork tasks and reports, appropriate to the particular units [C1- C7].
  - Project reports and defended presentations [C1-C7].
  - Many of the laboratory and field exercises will constitute practical examples of developing professional practice.

- **D. Transferable (Graduate and Employability) Skills, able to:**
  - D1. Communicate appropriately to a variety of audiences in written, oral and graphical forms using a variety of media.
  - D2. Critically evaluate data considering methodology, accuracy, precision and uncertainty during planning, collection, recording and analysis of data in the field and laboratory.
  - D3. Retrieve, evaluate and combine data from a variety of sources.
  - D4. Identify individual and collective goals and responsibilities and perform in a manner appropriate to these roles.
  - D5. Recognise and respect the views of others and evaluate performances as an individual and a team member.
  - D6. Solve problems using theoretical, computational and practical techniques.

Assessment (LO: D)

- Transferable skill assessment is embedded in the formal assessment of most units through:
  - Open and closed book formal and in-class examination [D6].
  - A variety of individual and group [D4-5] coursework, computer-based assessments, report writing and oral and poster presentations [D1-6].
  - Use of Moodle VLE support improves students' IT skills and provides essential learning support, by way of formative and summative assessments and to facilitate collaborative engagement [D1-6].
  - Many transferrable and key skills are assessed in extended project work across the units [D1-6].

Unit Learning Outcomes Map[1]

UNITS																												
Level	Name	Code	Credit	Delivery	Core/ Option	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6
4	Introduction to Mathematical Physics 1	U20273	20	Year long	C	X	X				X	X																X
4	Introduction to Mathematical Physics 2	U20274	20	Year long	C	X	X				X	X																X
4	Introduction to Laboratory and Field Physics	U20275	20	Year long	C	X			X		X	X	X			X	X	X	X		X	X	X	X	X	X	X	X
4	Principles of Magnetism, Electricity and Electronics	U20276	20	Year long	C	X		X	X		X	X	X	X		X	X	X	X					X		X	X	X
4	Applications and Impacts of Physics	U20277	20	Year long	C			X			X			X	X				X	X	X		X		X	X	X	X
4	Applied Physics Modelling	U22655	20	Year long	C		X		X	X	X	X	X			X	X						X					
5	Mathematical Physics	U20278	20	Year long	C	X	X	X	X		X	X		X								X						X
5	Thermodynamics and Statistical Mechanics	U20279	20	Year long	C	X	X	X			X	X		X														X
5	Quantum, Atomic and Nuclear Physics	U20280	20	Year long	C	X			X		X			X		X	X											X
5	Waves and Optics	U20281	20	Year long	C	X		X	X		X	X		X		X	X	X	X			X	X	X		X	X	X
5	Practical Laboratory and Field Physics	U20282	20	Year long	C	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
5	Energy Resources	U20140	20	Year long	O			X						X	X	X	X	X	X				X	X				
5	Universe: Planetary Systems, Stars and Galaxies	U20509	20	Year long	O			X			X		X	X	X				X						X			X
6	Applied Physics Project	U20283	40	Year long	C(alt)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
6	Group Project	U23482	40	Year long	C(alt)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Unit Assessment Map

UNITS						COURSEWORK				EXAMINATION			
Level	Name	Code	Credit	Delivery	Core/ Option	Total %	Type of Artefact	Duration/ Length	Weighting %	Total %	Open/ Closed	Duration (hrs)	Weighting %
4	Introduction to Mathematical Physics 1	U20273	20	Sep-Dec	C	100	Portfolio In class test	1500 words 1.5 h	40 60				
4	Introduction to Mathematical Physics 2	U20274	20	Jan-Mar	C	40	Portfolio	1h	40	60		1.5	60
4	Principles of Magnetism, Electricity and Electronics	U20276	20	Year long	C	25	Lab report	750 words	25	75	closed	1.5	75
4	Applications and Impacts of Physics	U20277	20	Year long	C	100	Article Portfolio	1500 words 1500 words	50 50				
4	An introduction to Laboratory and Field Physics	U20275	20	Year long	C	100	Extended experiment and report Portfolio	1000 words 2000 words	25 75				
4	Applied Physics Modelling	U22655	20	Year long	C	100	Problem portfolio Report	1000 words 2000 words	35 65				
5	Mathematical Physics	U20278	20	Year long	C	50	In-class test	1.5 h	50	50	Open	1.5	50
5	Thermodynamics and Statistical Physics	U20279	20	Year long	C	50	Assignment		50	50	Closed	1.5	50
5	Waves & Optics	U20281	20	Year long	C	50	Design exercise and report	2000 words	50	50		1.5	50
5	Quantum, Atomic and Nuclear Physics	U20280	20	Year long	C	40	Portfolio	750 words	40	60	closed	2	60
5	Practical Laboratory and Field Physics	U20282	20	Year long	C	100	Lab report Portfolio CV and application form	1250 words 1000 words 750 words	50 40 10				

Another Examples of LO (Physics)

1. Commitment to Continuous Learning
2. Discipline Specific Knowledge and Skills
3. Critical, Analytical and Integrative Thinking
4. Problem Solving and Research Capability
5. Creative and Innovative
6. Effective Communication
7. Engaged and Ethical Local and Global citizens
8. Socially and Environmentally Active and Responsible
9. Capable of Professional and Personal Judgement and Initiative

Course Outcome (Quantum Mechanics)

1. be able to formulate and solve problems in quantum mechanics using Dirac notation
2. gain an understanding of the position representation in quantum mechanics
3. gain an understanding of the position representation
4. argue the importance of symmetry and conservation laws in quantum mechanics
5. explain physical phenomena in the modern language of quantum mechanics
6. analyse physical systems in a quantum mechanical way
7. gain an understanding of the basic principles of quantum optics
8. gain an understanding of quantum technology, including quantum optics.

Assessment Tasks

Task	Weight	Due Date	Linked Course Outcomes	Linked Learning Outcomes	Brief Description
Assignments	20%	see below	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4, 9	Assignments
Final Examination	50%	University Examination Period	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4	Final Examination
Project	30%	Week 13	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4, 5, 6, 7, 8, 9	Project

Course Outcome and Learning Outcome

- LO1: Commitment to Continuous Learning
  - be able to formulate and solve problems in quantum mechanics using Dirac notation
  - gain an understanding of the position representation in quantum mechanics
  - gain an understanding of the position representation
  - argue the importance of symmetry and conservation laws in quantum mechanics
  - explain physical phenomena in the modern language of quantum mechanics
  - analyse physical systems in a quantum mechanical way
  - gain an understanding of the basic principles of quantum optics
  - gain an understanding of quantum technology, including quantum optics.
- Assessment:
  - Assignments
  - Project

- LO6: Effective Communication
  - explain physical phenomena in the modern language of quantum mechanics
  - analyse physical systems in a quantum mechanical way
  - gain an understanding of the basic principles of quantum optics
  - gain an understanding of quantum technology, including quantum optics.
- Assessment
  - Project