



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

PROGRAMME DOCUMENT

PROGRAMME TITLE(S)

HNC ORDNANCE, MUNITIONS AND EXPLOSIVES

**BEng (HONS) ORDNANCE, MUNITIONS AND
EXPLOSIVES**

**BEng (HONS) ORDNANCE, MUNITIONS AND
EXPLOSIVES (SAFETY)**

**(INCLUDES A 5-YEAR DEGREE APPRENTICESHIPS
ROUTE and MODULAR ENROLMENT FOR
SPECIFIED MODULES)**

**Academic Discipline of Applied Computing
Wales Institute of Science and Art**

Validated August 2022

**Updated October 2022, May 2023, August 2023, January 2024, May 2024,
February 2025**

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1.1 Overview of the proposal

This section provides an overview of each award/programme title and its associated intermediate and exit awards.

Awarding Institution/Body:	University of Wales Trinity Saint David	University of Wales Trinity Saint David	University of Wales Trinity Saint David
PSRB(s) associated with final award:	Institute of Explosives Engineers – Technical membership on completion	Institute of Explosives Engineers – Technical membership on completion	Institute of Explosives Engineers – Technical membership on completion
Other accreditation:	N/A	N/A	N/A
Teaching Institution:	University of Wales Trinity Saint David	University of Wales Trinity Saint David	University of Wales Trinity Saint David
Award Title:	Higher National Certificate	BEng Bachelor of Engineering	BEng Bachelor of Engineering
Programme title/name:	Ordnance, Munitions and Explosives	Ordnance, Munitions and Explosives	Ordnance, Munitions and Explosives (Safety)
Intermediate Award 1 (enrolable awards):	Choose an item.	Choose an item.	Choose an item.
	If programme title differs to the main award, specify	If programme title differs to the main award, specify	If programme title differs to the main award, specify
Intermediate Award 2 (enrolable awards):	Choose an item.	Choose an item.	Choose an item.
	If programme title differs to the main award, specify	If programme title differs to the main award, specify	If programme title differs to the main award, specify
Intermediate Award 3 (enrolable awards):	Choose an item.	Choose an item.	Choose an item.

	If programme title differs to the main award, specify		If programme title differs to the main award, specify		If programme title differs to the main award, specify	
Exit Award 1 (awarded on early exit of main programme):	Choose an item.		Diploma of Higher Education		Diploma of Higher Education	
	If programme title differs to the main award, specify		If programme title differs to the main award, specify		If programme title differs to the main award, specify	
Exit Award 2 (awarded on early exit of main programme):	Choose an item.		Certificate of Higher Education		Certificate of Higher Education	
	If programme title differs to the main award, specify		If programme title differs to the main award, specify		If programme title differs to the main award, specify	
	If programme title differs to the main award, specify		If programme title differs to the main award, specify		If programme title differs to the main award, specify	
Programme JACS or HECoS Code:	100163		100163		100163	
Mode of attendance: (tick all that apply)	☐	Full-time	☒	Full-time	☐	Full-time
	☒	Part-time	☒	Part-time	☒	Part-time
	☒	Apprenticeship	☒	Apprenticeship	☒	Apprenticeship
Mode of study: (tick all that apply)	☒	On-campus	☒	On-campus	☒	On-campus
	☐	Distance learning	☐	Distance learning	☐	Distance learning
	☐	Blended (On-campus)	☐	Blended (On-campus)	☐	Blended (On-campus)
	☐	Other (specify)	☐	Other (specify)	☐	Other (specify)
Duration:	☐	Standard (AQH 6.3.2)	☒	Standard (AQH 6.3.2)	☐	Standard (AQH 6.3.2)
	☒	Non-standard (specify) 30 months	☒	Non-standard (specify)	☒	Non-standard (specify)

				<u>Degree Apprenticeships 5 years</u> <u>Part-time infill with the Degree Apprenticeships (5 years)</u>		<u>Degree Apprenticeships 5 years</u> <u>Part-time infill with the Degree Apprenticeships (5 years)</u>
Location(s) of delivery:	Swansea		Swansea		Swansea	
Language of delivery: (tick all that apply)	☒	English	☒	English	☒	English
	☐	Welsh	☐	Welsh	☐	Welsh
	☒	English and Welsh (bilingually)	☒	English and Welsh (bilingually)	☒	English and Welsh (bilingually)
	☐	Other (specify)	☐	Other (specify)	☐	Other (specify)
QAA Subject Benchmarking Statement(s):	Subject Benchmark Statement for Engineering (October 2019) See: https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-engineering.pdf?sfvrsn=1f2c881_16		Subject Benchmark Statement for Engineering (October 2019) See: https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-engineering.pdf?sfvrsn=1f2c881_16		Subject Benchmark Statement for Engineering (October 2019) See: https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-engineering.pdf?sfvrsn=1f2c881_16	
Other external benchmarks:	Engineering Council Accreditation of Higher Education Programmes: UK Standard for Professional Engineering Competence http://www.engc.org.uk/EngCDocuments/Internet/Website/Accreditation%20of%20Higher%20Education		Engineering Council Accreditation of Higher Education Programmes: UK Standard for Professional Engineering Competence http://www.engc.org.uk/EngCDocuments/Internet/Website/Accreditation%20of%20Higher%20Education		Engineering Council Accreditation of Higher Education Programmes: UK Standard for Professional Engineering Competence http://www.engc.org.uk/EngCDocuments/Internet/Website/Accreditation%20of%20Higher%20Education	

	tion%20Programmes%20third%200edition%20(1).pdf • UK-spec UK standard for professional engineering competence http://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC%20third%20edition%20(1).pdf • “Guidance on how to meet the Learning Outcome requirements for Accreditation”, IET http://www.theiet.org/academics/accreditation/policy-guidance/, [accessed 14/11/2017] • QAA The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies November 2014 • QAA Education for Sustainable Development: Guidance for UK Higher Education Providers June 2014 • QAA Enterprise and Entrepreneurship Education: Guidance for UK Higher Education Providers September 2012 • Well-being of Future Generations (Wales) Act 2015	tion%20Programmes%20third%200edition%20(1).pdf • UK-spec UK standard for professional engineering competence http://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC%20third%20edition%20(1).pdf • “Guidance on how to meet the Learning Outcome requirements for Accreditation”, IET http://www.theiet.org/academics/accreditation/policy-guidance/, [accessed 14/11/2017] • QAA The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies November 2014 • QAA Education for Sustainable Development: Guidance for UK Higher Education Providers June 2014 • QAA Enterprise and Entrepreneurship Education: Guidance for UK Higher Education Providers September 2012 • Well-being of Future Generations (Wales) Act 2015	tion%20Programmes%20third%200edition%20(1).pdf • UK-spec UK standard for professional engineering competence http://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC%20third%20edition%20(1).pdf • “Guidance on how to meet the Learning Outcome requirements for Accreditation”, IET http://www.theiet.org/academics/accreditation/policy-guidance/, [accessed 14/11/2017] • QAA The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies November 2014 • QAA Education for Sustainable Development: Guidance for UK Higher Education Providers June 2014 • QAA Enterprise and Entrepreneurship Education: Guidance for UK Higher Education Providers September 2012 • Well-being of Future Generations (Wales) Act 2015
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Note: Only students from Defence Nuclear Organisation (DNO) will be permitted to enrol on BEng Ordnance, Munitions and Explosives (Safety)

1.2 Module Summary Table

							HNC Ordnance Munitions & Explosives	BEng (Hons) Ordnance, Munitions & Explosives (Inc 5-year Degree Apprenticeships route)	BEng (Hons) Ordnance, Munitions & Explosives (Safety) (5-year Degree Apprenticeships route for DNO students only)	Occasional Modules	
JACS/ HECoS code and HESA Cost Centre	Module Code 1. Specify language of delivery if not English. 2. Specify mode of study if modules are not all the same mode.	Module Title	New or Existing (Revised) (ER) (list old module code) or Existing (Format updated) (EF) or Existing (Unchanged) (EU)	Credits	Level	Assessment summary	Module status CP = Component Pass CR = Core CM = Compulsory O = Optional	Module status CP = Component Pass CR = Core CM = Compulsory O = Optional	Module status CP = Component Pass CR = Core CM = Compulsory O = Optional	Module status CP = Component Pass CR = Core CM = Compulsory O = Optional	Is module shared with other programmes not included in this document? Y/N If Y, specify
100163 - 119	ACDB4011	Chemistry (OME)	ER (ACDA4011)	20	4	Component 1 – 50% Coursework: Portfolio (combination of quizzes, practical work, report) (2,000 words) Component 2 – 50% Written Exam (2 hours)	CR	CR	CR		

100163 - 119	ACDA4018	Fundamentals of Electrical and Electronic Systems	New	10	4	Component 1 – 100% Practical : Build a circuit with logbook (2,000 words equivalent)	CM	CM			
100163 - 119	ACDA4020	Human Factors in High Hazard Environments	New	10	4	Component 1 – 100% Coursework: Report (2,000 words)			CM	O	
100163 - 119	ACDA4008	Mathematics	EU	20	4	Component 1 – 50% Written exam (1.5 hrs) Component 2 – 50% Written exam (1.5 hrs)	CR	CR	CR		Y with Electrical portfolio
100163 - 119	ACDB4007	Physics (OME)	ER (ACDA4007)	20	4	Component 1 – 50% Written Exam 2 hours Component 2 – 50% Coursework : Written Lab Report (1,500 words)	CR	CR	CR		
100163 - 119	ACDA4019	Principles of OME	New	20	4	Component 1 – 50% Coursework : Report (2,000 words) Component 2 – 50% Written Exam (2 hours)	CR	CR	CR	O	

100163 - 119	ACDB4005	Principles of Systems Engineering	ER (ACDA4005)	20	4	Component 1 – 100% Coursework : Portfolio (4,000 words)	CR	CR	CR	O	
100163	ACDB4010	Study Skills	ER (ACDA4010)	10	4	Component 1 – 100% Coursework : Portfolio (2,000 words)	CR	CR	CR		
100163 - 119	ACDB5015	Advanced Physics of OME	ER (ACDA5015)	20	5	Component 1 – 100% Coursework : Laboratory Report (5,000 words)		CR	CR	O‡	
100163 - 119	ACDB5007	Computer Aided Engineering	ER (ACDA5007)	20	5	Component 1 – 100% Coursework : Assignment Report (5,000 words)		CM		O‡	
100163 - 119	ACDC5009	Electromagnetic Radiation	ER (ACDA5009)	20	5	Component 1 – 50% Coursework : Report (2,500 words) Component 2 – 50% Written Exam (2 hours)		CM	CM	O‡	Y with Electrical portfolio
100163 - 119	ACDA5020	Independent Professional Placement	New	0	5	Component 1 – 100% Portfolio: Minimum of 3 elements (equivalent to 5000 words)		CM	CM		

100163 - 119	ACDB5011	Instrumentation and Control	ER (ACDA5011)	10	5	Component 1 – 100% Coursework : Report (2,500 words)		CM			
100163 - 119	ACDA5023	Nuclear Safety	New	10	5	Component 1 – 100% Coursework: Report (2,500 words)			CM	O†	
100163 - 119	ACDB5013	Safety and Hazard Assessment	ER (ACDA5013)	10	5	Component 1 – 100% Coursework : Case Study/Report (2,500 words per person)		CR	CR	O	
100163 - 119	ACDA5021	Systems Engineering	New	20	5	Component 1 – 100% Coursework : Portfolio - Group work (5,000 words equivalent)		CR	CR	O‡	
100163 - 119	ACDA5024	Technical Authoring	New	20	5	Component 1 – 50% Coursework: Technical Report (2,500 words) Component 2 – 50% Coursework – Formal Presentation (20 minutes)			CM	O	
100163 - 119	ACDA5022	Work-Based Group Project	New	20	5	Component 1 – 100% Coursework : Portfolio of work (5,000	CM	CM	CM		

						words equivalent)					
100163 - 119	ACDA6020	Advanced Chemistry of OME	New	20	6	Component 1 – 100% Coursework : Portfolio – Group Presentation, Lab Report and Practical (6,000 words equivalent)		CR		O†	
100163 - 119	ACDA6021	Data Capture and Evaluation	New	20	6	Component 1 – 50% Coursework : Essay (3,000 words) Component 2 – 50% Coursework : Written Lab Report (3,000 words equivalent)		CM	CM	O†	
100163 - 119	ACDA6023	End Point Assessment (EPA) for Degree Apprentices	New	0	6	Component 1 – 100% Coursework : Detailed assessment criteria as outlined in the End Point Assessment plan of the relevant Apprenticeship Standard (England)		CR*	CR		N

100163 - 119	ACCA6020	Independent Project	EU	40	6	Component 1 – 100% Coursework : Portfolio (10,000 words equivalent)		CM	CM		Y UG Electrical portfolio
100163 - 119	ACDA6022	OME Safety Management and Legislation	New	20	6	Component 1 – 100% Coursework : Case Study/Incident Investigation Report (6,000 words)		CR	CR	O	
100163 - 119	ACDB6016	Materials Science	ER	20	6	Component 1 – 50% Exam (2 hours) Component 2 – 50% Coursework : Report (2,500 words equivalent)			CM	O‡	
100163 - 119	ACDB6008	Scientific Principles of OME Design	ER (ACDA6008)	20	6	Component 1 – 50% Written Exam (2 hours) Component 2 – 50% Coursework : Report (3,000 words)		CR	CR	O‡	

N - New

EU – Existing Unchanged (no changes made, date remains as per last validation)

ER – Existing Revised (date to be changed to this point of validation, new code to be allocated if it meets the criteria defined in Appendix PV9, if so, note the existing module code in brackets e.g. ABCD1234 (formerly ABCD1000))

EF – Existing Format updated only (no changes made other than to place an existing module on the current module template – date remains as per last validation unless it is 5 years old and this is the official revalidation point)

* - ACDA6023 End Point Assessment (EPA) for Degree Apprentices is only core for the PT Apprenticeship provision, the validated FT will not require this module.

- † - ACDA5023 open to Defence Nuclear Organisation (DNO) employees only
- ‡ - Modules open to suitably qualified students who meet higher entry requirements:
 - ACDB5015 Advanced Physics of OME (Level 4 Physics required for entry)
 - ACDB5007 Computer Aided Engineering (Level 4 Mathematics and Physics required for entry)
 - ACDC5009 Electromagnetic Radiation (Level 4 Physics required for entry)
 - ACDA5021 Systems Engineering (Level 4 Mathematics required for entry)
 - ACDA6020 Advanced Chemistry of OME (Level 4 Chemistry required for entry)
 - ACDA6021 Data Capture and Evaluation (Level 4 Mathematics and Physics required for entry)
 - ACDB6016 Materials Science (Level 4 Mathematics and Physics required for entry)
 - ACDB6008 Scientific Principles of OME Design (Level 4 Mathematics and Chemistry required for entry)

1.3 Archiving of Modules

Can any existing modules be deleted and archived as a result of this proposal? YES ☒ / NO ☐

If YES, please list the relevant modules below and indicate when each existing module may be archived (if a module is being revised for the following year, you may need to keep the current version live until the end of the academic year, while students remain in the system):

<i>Module Code</i>	<i>Module Title</i>	<i>Date to be archived (MM/YYYY)*</i>
ACDA4011	Chemistry (OME)	09/2022
ACDA4007	Physics (OME)	09/2022
ACDA4005	Principles of Systems Engineering	09/2022
ACDA4010	Study Skills	09/2022
ACDA4014	Applied Design Project	09/2022
ACDA5010	Principles of OME	09/2022
ACDA5014	Advanced Chemistry of OME	09/2022
ACDA5015	Advanced Physics of OME	06/2025
ACDA5007	Computer Aided Engineering	06/2025
ACDA5009	Electromagnetic Radiation	06/2025
ACDA5011	Instrumentation and Control	06/2025
ACDA5013	Safety and Hazard Assessment	06/2025
ACDA6006	System Engineering	06/2025
ACDA6007	Remote Sensing and Imaging	06/2025
ACDA6009	Structural Mechanics	06/2025

ACDA6010	OME Technical Research & Development	06/2025
ACDA6011	OME Manufacturing & Processing	06/2025
ACDA6012	OME Breakdown & Disposal	06/2025
ACDA6013	OME Test & Evaluation	06/2025
ACDA6014	OME Law & Safety Management	06/2025
ACDA6015	Technical Authoring	06/2025
ACDA6016	Material Science	06/2025
ACDA6017	OME Major Project	06/2025
ACDA6008	Scientific Principles of OME Design	06/2025

1.4 Transition Arrangements for Students

Please provide an explanation of the transition arrangements for each level of the programme for each cohort (including dates of transition):

NEW STUDENTS

New students	Intake month and year i.e. when the programme will be introduced	Notes/explanation <i>If the programme has more than one intake annually, please explain the arrangements for each intake</i>
Level 4 FT	September 2023	Students will start new programme structure from September 2023
Level 4 PT	September 2022	Students will start new programme structure from September 2022

CURRENT STUDENTS

If current students are to be transitioned to the proposed programme, please provide an explanation of the transition arrangements for each level of the programme for each cohort (including dates of transition).

Please tick to confirm:

☒	Mapping of module equivalency has taken place (i.e. that the modules already undertaken taken by the student are equivalent to the learning that they would have undertaken in the proposed programme)
☒	Students will be informed/consulted about any material changes to the programme and their written consent to transition will be obtained.

Current students and direct entry	Month and year i.e. when the students will transition from the current version of the programme to the proposed version	Notes/explanation <i>If the programme has more than one intake annually, please explain the arrangements for each intake</i>
Level 4 PT	January 2021 and September 2021	Students who started their studies in January 2021 would have completed 110 credits of Level 4 modules by end of the 2021/22 academic year. The remainder of Level 4 and further levels will be studied under the new structure. Students who started their studies in September 2021 would have completed 70 credits of Level 4 modules by the end of the 2021/22 academic year. The remainder of Level 4 and further levels will be studied under the new structure. This was approved and agreed with the employers.
Level 4 HNC PT	May 2021 and September 2021	By end of the 2021/22 academic year, students would have completed 50 credits at level 4. The remainder of level 4 will be studied on the new structure. This was approved and agreed with the employers.
Level 4 DNO students (current Year 1)	September 2023	The remainder of Level 4 and further levels will be studied on the new pathway – there are no underpinning modules involved. This has been approved and agreed with the employers
Level 4/5 DNO students (current Year 2)	September 2023	The remainder of Level 5 and Level 6 will be studied on the new pathway (there are no underpinning modules involved). This has been approved and agreed with the employers
Level 5 PT	September 2019	Students who started in September 2019 would stay on the current programme structure.
Level 5 FT	Not applicable	
Level 6 PT	September 2018	Students who started in September 2018 would stay on the current programme structure.
Level 6 PT	Not applicable	
Level 7 FT	Not applicable	
Level 7 PT	Not applicable	

2 Programme 1: Higher National Certificate (HNC) Ordnance, Munitions & Explosives

2.1 Programme Structure

<i>Programme duration :</i>	30 months part-time
<i>Mode of study/delivery:</i>	On-campus
<i>Pattern of attendance (Full-time and/or part-time):</i>	Part-time
<i>Credits and levels:</i>	140 credits
<i>Pattern of delivery:</i>	Three semesters per academic year. Students would study 70 credits per academic year
<i>Intake points and instances of module delivery:</i>	September, January and May
<i>Module size:</i>	All modules are either 10 or 20 credits
<i>Balance of component pass, core, compulsory and optional modules:</i>	Six core and two compulsory modules
<i>Pre-requisite modules (please state module codes for the module and its pre-requisite):</i>	All Level 4 modules shall be completed before taking ACDA5022 Work-based Group Project.

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TYPICAL DELIVERY PLAN

The tables below indicate the typical delivery schedules for the programme for each pattern of attendance. The team reserves the right to re-organise the delivery of modules per semester, in accord with resource availability and employers requests (which will be accommodated where feasible).

Part-time study

Module Code	Module Title	Module type (Component Pass, Core, Compulsory, Optional)	Credits
Year 1	Level 4		Sept. to Jan.
ACDB4010	Study Skills	Core	10
ACDA4008	Mathematics	Core	20
Year 1	Level 4		Feb. to Aug.
ACDB4007	Physics (OME)	Core	20
Year 1	Level 4		Feb. to May.
ACDA4018	Fundamentals of Electrical and Electronic Systems	Compulsory	10
Year 2	Level 4		Sept. to May.
ACDB4011	Chemistry (OME)	Core	20
Year 2	Level 4		Sept. to Jan.
ACDB4005	Principles of Systems Engineering	Core	20
Year 2	Level 4		Feb. to Aug.
ACDA4019	Principles of OME	Core	20
Year 2/3	Level 5		Jun. to Jan.
ACDA5022	Work-based Group Project	Compulsory	20

Degree Apprenticeship students must also complete an End-Point Assessment (EPA) which is part of the apprenticeship standards that to be done after completing all taught modules.

2.2 Programme Aims

The programme has the following general educational and specific aims:

- To develop in students a systematic understanding of key aspects of a range of concepts, principles, and technologies associated with OME some of which may be at the forefront of the discipline.
- To develop students understanding of the quantitative methods, mathematical principles and methods related to OME
- To encourage students to manage their own learning and development, including the time management and organisational skills required for employment whilst recognising the need for lifelong learning.
- To provide an opportunity for students to synthesise their knowledge, skills and ideas in the implementation of a suitable and appropriate Project

2.3 Programme Learning Outcomes

Main Award: Higher National Certificate (HNC)

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME.
KU2	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS1	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS2	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS3	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

3 Programme 2: BEng Ordnance, Munitions & Explosives

3.1 Programme Structure

<i>Programme duration:</i>	Four academic years of full-time study with year 3 as placement year <i>Five years for the part-time and Degree Apprenticeships route</i>
<i>Mode of study/delivery:</i>	On-campus
<i>Pattern of attendance (Full-time and/or part-time):</i>	Full-time, Part-time and Degree Apprenticeships
<i>Credits and levels:</i>	120 credits per level (levels 4, 5 and 6) BEng: 360 credits in total. DipHE: 240 credits in total CertHE: 120 credits in total
<i>Pattern of delivery:</i>	Three semesters per academic year. Students would study 70 to 80 credits per year (September to August). Students studying on the full-time, part-time and Degree Apprenticeship routes will be taught together in blocks of two weeks.
<i>Intake points and instances of module delivery:</i>	Full-time intake in September. Degree Apprenticeships and part-time intake in September, January and May. September is the standard intake, but January and May would be offered as an alternative intake point depending on industry demands.
<i>Module size:</i>	All modules are of either 10 or 20 credits except the 40-credit Independent Project at Level 6. The End Point Assessment (EPA) for Degree Apprentices is 0 credits.
<i>Balance of component pass, core, compulsory and optional modules:</i>	At Levels 4, 5 and 6, all modules are either core or compulsory.
<i>Pre-requisite modules (please state module codes for the module and its pre-requisite):</i>	ACDB4007 Physics (OME) – ACDB5015 Advanced Physics of OME ACDB4011 Chemistry (OME) – ACDA6020 Advanced Chemistry of OME ACDA4005 Principles of System Engineering – ACDA5021 Systems Engineering ACDB5013 Safety and Hazard Assessment – ACDA6022 OME Safety Management and Legislation

	To undertake ACDA6023 End Point Assessment (EPA) for Degree Apprentices, the student has to meet the gateway requirements of the Apprenticeship Standard (England). All other modules are independent of others.
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TYPICAL DELIVERY PLAN

The tables below indicate the typical delivery schedules for the programme for each pattern of attendance. The team reserves the right to re-organise the delivery of modules per semester, in accord with resource availability and employers requests (which will be accommodated where feasible).

Full-time study

Module Code	Module Title	Module type (component pass, core, compulsory, optional)	Credits
Year 1	Level 4	Semester 1	Sept. to Jan.
ACDB4010	Study Skills	Core	10
ACDA4008	Mathematics	Core	20
ACDB4005	Principles of Systems Engineering	Core	20
Year 1	Level 4	Semester 2	Feb. to May
ACDB4007	Physics (OME)	Core	20
ACDB4011	Chemistry (OME)	Core	20
ACDA4019	Principles of OME	Core	20
Year 1	Level 4/5	Semester 3	Jun. to Aug.
ACDA4018	Fundamentals of Electrical and Electronic Systems	Compulsory	10
Year 2	Level 5	Semester 1	Sept. to Jan
ACDC5009	Electromagnetic Radiation	Compulsory	20
ACDB5011	Instrumentation and Control	Compulsory	10
ACDB5015	Advanced Physics of OME	Core	20
Year 2	Level 5	Semester 2	Feb. to May.
ACDB5007	Computer Aided Engineering	Compulsory	20
ACDA5021	Systems Engineering	Core	20
ACDA5022	Work-based Group project	Compulsory	20
Year 2	Level 5	Semester 3	Jun. to Aug
ACDB5013	Safety and Hazard Assessment	Core	10
Year 3		All Semester	Sept. to Aug.
ACDA5020	Independent Professional Placement	Compulsory	0
Year 4	Level 6	Semester 1	Sept. to Jan
ACDA6020	Advanced Chemistry of OME	Core	20
ACDA6021	Data Capture and Evaluation	Compulsory	20
ACDA6022	OME Safety Management and Legislation	Core	20
Year 4	Level 6	Semester 2	Feb. to May.
ACDB6008	Scientific Principles of OME Design	Core	20
ACCA6020	Independent Project	Compulsory	40

Part-time and Degree Apprenticeships Study

Module Code	Module Title	Module type (component pass, core, compulsory, optional)	Credits
Year 1	Level 4	Semester 1	Sept. to Jan.
ACDB4010	Study Skills	Core	10
ACDA4008	Mathematics	Core	20
Year 1	Level 4	Semester 2	Feb. to May
ACDB4007	Physics (OME)	Core	20
ACDB4011	Chemistry (OME)	Core	20
Year 1	Level 4	Semester 3	Jun. to Aug.
ACDA4018	Fundamentals of Electrical and Electronic Systems	Compulsory	10
Year 2	Level 4/5	Semester 1	Sept. to Jan.
ACDB4005	Principles of Systems Engineering	Core	20
ACDC5009	Electromagnetic Radiation	Compulsory	20
Year 2	Level 4/5	Semester 2	Feb. to May
ACDA4019	Principles of OME	Core	20
ACDB5007	Computer Aided Engineering	Compulsory	20
Year 2	Level 5	Semester 3	Jun. to Aug.
ACDB5013	Safety and Hazard Assessment	Core	10
Year 3	Level 5	Semester 1	Sept. to Jan.
ACDB5011	Instrumentation and Control	Compulsory	10
ACDB5015	Advanced Physics of OME	Core	20
Year 3	Level 5	Semester 2/3	Feb. to Aug
ACDA5022	Work-based Group project	Compulsory	20
Year 3	Level 5	Semester 2	Feb. to May
ACDA5021	Systems Engineering	Core	20
Year 4	Level 6	Semester 1	Sept. to Jan.
ACDA6020	Advanced Chemistry of OME	Core	20
ACDA6021	Data Capture and Evaluation	Compulsory	20
Year 4/5	Level 6	Semester 2/3/1/2	Feb. to May
ACCA6020	Independent Project	Compulsory	40
Year 4	Level 6	Semester 2	Feb. to May
ACDB6008	Scientific Principles of OME Design	Core	20
Year 5	Level 6	Semester 1	Sept. to Jan.
ACDA6022	OME Safety Management and Legislation	Core	20
Year 5	Level 6	Semester 2	Jan. to Sept.
ACDA6023	End Point Assessment (EPA) for Degree Apprentices	Core	0

3.2 Programme Aims

The programme has the following general educational and specific aims:

- To develop in students a systematic understanding of key aspects of a range of concepts, principles, and technologies associated with OME, some of which may be at the forefront of the discipline
- To develop students' understanding of the quantitative methods, mathematical principles and methods related to OME
- To promote a critical understanding of key themes in engineering industries and the applications of this knowledge
- To encourage students to manage their own learning and development, including the time-management and organisational skills required for employment, whilst recognising the need for lifelong learning
- To provide an opportunity for students to synthesise their knowledge, skills and ideas in the implementation of a suitable and appropriate Project
- To integrate appropriate design, technologies and commercial aspects to develop an ability to provide innovative, targeted solutions to problems that are environmentally sustainable within OME scenarios
- To provide students with a systematic understanding of the comprehensive knowledge and skills needed to collect, interpret, analyse, synthesise and communicate data using appropriate methods to demonstrate academic rigour

3.3 Programme Learning Outcomes

Main Award: BEng

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME.
KU2	Consistently apply and integrate theoretical and practical aspects of OME
KU3	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME
KU4	Knowledge and understanding of the internal and external regulatory environment pertinent to the sector.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems
CS2	Apply quantitative and computational methods to solve problems in the field of OME
CS3	Critically evaluate and solve open-ended problems that demonstrate an ability to work with technical uncertainty

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS1	Implementation of safe working systems via the interpretation of hazard data, identification of environmental effects and potentially dangerous events.
PS2	Ability to systematically apply scientific/engineering and commercial knowledge to take an OME idea from concept to implementation.
PS3	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS2	Create appropriate documentation on relevant supporting evidence
KS3	Consider professional, commercial, legal, social and ethical issues including sustainability.
KS4	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS5	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Intermediate/Exit Awards

Intermediate/Exit Award 1: DipHE

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME.
KU2	Consistently apply and integrate theoretical and practical aspects of OME
KU3	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems
CS2	Apply quantitative and computational methods to solve problems in the field of OME
CS3	Critically evaluate and solve open-ended problems that demonstrate an ability to work with technical uncertainty

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS1	Implementation of safe working systems via the interpretation of hazard data, identification of environmental effects and potentially dangerous events.
PS3	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS2	Create appropriate documentation on relevant supporting evidence
KS4	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS5	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Intermediate/Exit Award 2: CertHE

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME.
KU3	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS3	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS4	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS5	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

4 Programme 3: BEng Ordnance, Munitions & Explosives (Safety)

4.1 Programme Structure

<i>Programme duration:</i>	<i>Five years for the part-time and Degree Apprenticeships route</i>
<i>Mode of study/delivery:</i>	On-campus
<i>Pattern of attendance (Full-time and/or part-time):</i>	Degree Apprenticeships and PT (DNO only)
<i>Credits and levels:</i>	120 credits per level (levels 4, 5 and 6) BEng: 360 credits in total. DipHE: 240 credits in total CertHE: 120 credits in total
<i>Pattern of delivery:</i>	Three semesters per academic year. Students would study 70 to 80 credits per year (September to August). Students will be taught together in blocks of two weeks.
<i>Intake points and instances of module delivery:</i>	Degree Apprenticeships and part-time intake in September, January and May. September is the standard intake, but January and May would be offered as an alternative intake point depending on industry demands.
<i>Module size:</i>	All modules are of either 10 or 20 credits except the 40-credit Independent Project at Level 6. The End Point Assessment (EPA) for Degree Apprentices is 0 credits.
<i>Balance of component pass, core, compulsory and optional modules:</i>	At Levels 4, 5 and 6, all modules are either core or compulsory.
<i>Pre-requisite modules (please state module codes for the module and its pre-requisite):</i>	ACDB4007 Physics (OME) – ACDB5015 Advanced Physics of OME ACDA4005 Principles of System Engineering – ACDA5021 Systems Engineering ACDB5013 Safety and Hazard Assessment – ACDA6022 OME Safety Management and Legislation To undertake ACDA6023 End Point Assessment (EPA) for Degree Apprentices, the student has to meet the gateway requirements of the Apprenticeship Standard (England). All other modules are independent of others.

TYPICAL DELIVERY PLAN

The tables below indicate the typical delivery schedules for the programme for each pattern of attendance. The team reserves the right to re-organise the delivery of modules per semester, in accord with resource availability and employers' requests (which will be accommodated where feasible).

Part-Time and Degree Apprenticeships Study (DNO students only)

Module Code	Module Title	Module type (component pass, core, compulsory, optional)	Credits
Year 1	Level 4	Semester 1	Sept. to Jan.
ACDB4010	Study Skills	Core	10
ACDA4008	Mathematics	Core	20
Year 1	Level 4	Semester 2	Feb. to May
ACDB4007	Physics (OME)	Core	20
ACDB4011	Chemistry (OME)	Core	20
Year 1	Level 4	Semester 3	Jun. to Aug.
ACDA4020	Human Factors in High Hazard Environments	Compulsory	10
Year 2	Level 4/5	Semester 1	Sept. to Jan.
ACDB4005	Principles of Systems Engineering	Core	20
ACDC5009	Electromagnetic Radiation	Compulsory	20
Year 2	Level 4/5	Semester 2	Feb. to May
ACDA4019	Principles of OME	Core	20
ACDA5024	Technical Authoring	Compulsory	20
Year 2	Level 5	Semester 3	Jun. to Aug.
ACDB5013	Safety and Hazard Assessment	Core	10
Year 3	Level 5	Semester 1	Sept. to Jan.
ACDA5023	Nuclear Safety	Compulsory	10
ACDB5015	Advanced Physics of OME	Core	20
Year 3	Level 5	Semester 2/3	Feb. to Aug
ACDA5022	Work-based Group project	Compulsory	20
Year 3	Level 5	Semester 2	Feb. to May
ACDA5021	Systems Engineering	Core	20
Year 4	Level 6	Semester 1	Sept. to Jan.
ACDB6016	Materials Science	Compulsory	20
ACDA6021	Data Capture and Evaluation	Compulsory	20
Year 4/5	Level 6	Semester 2/3/1/2	Feb. to May
ACCA6020	Independent Project	Compulsory	40
Year 4	Level 6	Semester 2	Feb. to May
ACDB6008	Scientific Principles of OME Design	Core	20
Year 5	Level 6	Semester 1	Sept. to Jan.
ACDA6022	OME Safety Management and Legislation	Core	20
Year 5	Level 6	Semester 2	Jan. to Sept.
ACDA6023	End Point Assessment (EPA) for Degree Apprentices	Core	0

4.2 Programme Aims

The programme has the following general educational and specific aims:

- To develop in students a systematic understanding of key aspects of a range of concepts, principles, and technologies associated with OME and safe systems of work, which may be at the forefront of the discipline
- To develop students' understanding of the quantitative methods, mathematical principles and methods related to OME
- To promote a critical understanding of key themes in engineering industries and the applications of this knowledge including chemical and nuclear energetics
- To encourage students to manage their own learning and development, including the time-management and organisational skills required for employment, whilst recognising the need for lifelong learning
- To provide an opportunity for students to synthesise their knowledge, skills and ideas in the implementation of a suitable and appropriate Project
- To integrate appropriate design, technologies and commercial aspects to develop an ability to provide innovative, targeted solutions to problems that are environmentally sustainable within OME and safety-related scenarios
- To provide students with a systematic understanding of the comprehensive knowledge and skills needed to collect, interpret, analyse, synthesise and communicate data using appropriate methods to demonstrate academic rigour

4.3 Programme Learning Outcomes

Main Award: BEng

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME and safety.
KU2	Consistently apply and integrate theoretical and practical aspects of OME and safety
KU3	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME and safety
KU4	Knowledge and understanding of the internal and external regulatory environment pertinent to the sector.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems and associated human factors
CS2	Apply quantitative and computational methods to solve problems in the field of OME and safety

CS3	Critically evaluate and solve open-ended problems that demonstrate an ability to work with technical uncertainty
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS1	Implementation of safe working systems via the interpretation of hazard data, identification of environmental effects and potentially dangerous events.
PS2	Ability to systematically apply scientific/engineering and commercial knowledge to take an OME idea from concept to implementation.
PS3	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems, including safe systems at work

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS2	Create appropriate documentation on relevant supporting evidence
KS3	Consider professional, commercial, legal, social and ethical issues including sustainability.
KS4	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS5	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Intermediate/Exit Awards

Intermediate/Exit Award 1: DipHE

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME and safety.
KU2	Consistently apply and integrate theoretical and practical aspects of OME and safety
KU3	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME and safety

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems and associated human factors
CS2	Apply quantitative and computational methods to solve problems in the field of OME and safety
CS3	Critically evaluate and solve open-ended problems that demonstrate an ability to work with technical uncertainty

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS1	Implementation of safe working systems via the interpretation of hazard data, identification of environmental effects and potentially dangerous events.
PS3	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems, including safe systems at work

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS2	Create appropriate documentation on relevant supporting evidence
KS4	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS5	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Intermediate/Exit Award 2: CertHE

Knowledge and understanding (KU)

KU1	Develop an understanding of the scientific principles, methodologies, mathematical methods, and statistical methods associated with the field of OME and safety.
KU3	Understand and evaluate requirements and user needs in defining a problem and implementing a solution in the field of OME and safety

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Cognitive (thinking) skills (CS)

CS1	Understand OME concepts, principles, analytical methods and modelling techniques to identify, classify and describe the performance of systems and associated human factors
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Practical skills (PS)

PS3	Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions to problems, including safe systems at work
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Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

Key skills (KS)

KS1	Work as an individual and as a member of a team, demonstrating initiative and personal responsibility
KS4	Communicate knowledge and conclusions clearly to technical and non-technical audiences.
KS5	Manage own learning and development, including project management, risk management and organisational skills.

Each of the above PLOs is covered by at least two modules at the appropriate level (taking into account individual patterns of study)

5 **Module Details**

Module Code	ACDB4005
Title	Principles of Systems Engineering
Date	17/08/2022
Level	4
Credits	20
Pre-Requisites	None

AIM(S)

- To provide the students with the principles and systematic underpinning concepts of the systems engineering

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate an understanding of principles of systems engineering, including needs analysis, developing options, assessing risk and constraints.
- Communicate their knowledge of systems thinking and design approach.

INDICATIVE CONTENT

- Systems and the Structure of Complex Systems.
- Systems Development Processes, including purpose, context and interaction.
- Engineering Design Methods and Tools
- Requirements Capture and Analysis.
- Functions and Functionality.
- Concept Design, including the relationship of System, Subsystem and component.
- Integration and Evaluation, Validation and Verification.
- Robust Design

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1 (Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio	The assignment will consist of a portfolio-based report on the design of a typical munition or related device, applying the principles of systems engineering (4,000 words)	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB4005	
Module Title	Principles of Systems Engineering	
Classification	Reading List entry	Electronic*
Essential	Kossiakoff, A., Sweet, W., Seymour, S. and Biemer, S. (2011) <i>Systems Engineering Principles and Practice</i> , New Jersey : Wiley-Blackwell	☒
Essential	Leveson, N.G and Moses, J. (2017) <i>Engineering a safer world: Systems thinking applied to safety (Engineering systems)</i> , MIT Press	☒
Further	Blanchard, B. (2009) <i>Systems Engineering Management - 4th ed</i> , New Jersey : John Wiley	☐
Further	Kasser, J. (2013) <i>Holistic Thinking: Creating Innovative Solutions to Complex Problems</i> , CreateSpace Independent Publishing Platform	☐
Further	Hitchins, D.K. (2007) <i>System Engineering: A 21st century systems methodology</i> , Wiley. ISBN: 978-0-470-05856-5	☒
Further	Checkland, P. (1999) <i>Systems Thinking, Systems practice: Includes a 30-year retrospective</i> , Wiley.	☒
Further	Ramage, M. and Shipp, K. (2009) <i>Systems Thinkers</i> , Springer.	☒
Further	ACM Transactions on Information Systems	☒
Further	Journal of Data and Information Quality	☒
Further	Journal of the ACM	☒
Further	Journal of Systems Engineering and Electronics	☒

Module Code	ACDB4007
Title	Physics (OME)
Date	17/08/2022
Level	4
Credits	20
Pre-Requisites	None

AIM(S)

- To provide a basic understanding of the principles and applications associated with general aspects of physics.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate an understanding of basic mechanical and thermal aspects of physics and engineering science relevant to OME, with complementary analysis of appropriate problem examples.

INDICATIVE CONTENT

- Mechanics
 - Static equilibrium; Free Body Diagrams, resolution of vectors;
 - Material models; Dependence of stress on strain and strain-rate.
 - Dynamics of translational and rotational motion: Newton's Laws, Moment of Inertia
 - Simple Harmonic Motion
- Thermal Physics
 - concept of temperature equilibrium
 - Specific Heat, Fourier's Law
 - Thermal diffusion, convection and radiation
- Introduction to equations of state for fluids
- Computational modelling of ballistic impact

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Exam	2 hours	50%

Assessment Component 2

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Lab Report	1,500 words	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB4007	
Module Title	Physics (OME)	
Classification	Reading List entry	Electronic*
Essential	Beer, F., Johnson, E. et al, (2015) <i>Mechanics of Materials</i> , New York : McGraw-Hill	☒
Further	Benham, P.P., Crawford, R.J. and Armstrong, C.G. (2006) <i>Mechanics of Engineering Materials</i> , New Jersey : Prentice Hall	☐
Further	Bolton, W. (2006) <i>Mechanical Science - 3rd ed</i> , New Jersey : Wiley-Blackwell	
Further	Bacon, D.H. (1998) <i>Mechanical Technology</i> , Oxford : Butterworth-Heinemann	☒
Further	Online resources: Abaqus Online material IEEE Xplore, Science Direct	☒

Module Code	ACDA4008
Title	Mathematics
Date	15/08/2018
Level	4
Credits	20
Pre-Requisites	None

AIM(S)

- To provide in-depth coverage of important mathematical ideas and techniques necessary for an understanding of the mathematics encountered in sister modules.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Apply appropriate mathematical techniques to the solution of mathematical problems.

INDICATIVE CONTENT

- Fundamental Algebra/Trigonometry: Solution of Equations, matrix methods, complex numbers.
- Vector Analysis: vector rules and notation as applied to static and dynamic vector quantities.
- The Calculus: the methods of differentiation and integration, partial differentiation, 1st order differential equations.
- Statistics: Probability theory and statistical analysis.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written exam	1.5 hours	50%

Assessment Component 2

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written exam	1.5 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	100%
Coursework	0%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA4008	
Module Title	Mathematics	
Classification	Reading List entry	Electronic*
Essential	Stroud, K. A. and Booth, D. J. (2013) <i>Engineering Mathematics</i> 7 th Ed London: Palgrave	☐
Further	Bird, J. O. (2010) <i>Higher Engineering Mathematics</i> 8 th Ed Oxford: Newnes	☒
Further	Singh, K. (2011) <i>Engineering Mathematics Through Applications</i> , London: Palgrave	☐
Further	Websites http://www.khanacademy.org	☐

Module Code	ACDB4010
Title	Study Skills
Date	17/08/2022
Level	4
Credits	10
Pre-Requisites	None

AIM(S)

- To provide students with the essential knowledge and techniques that underpin and enhance the learning process. Students will be encouraged to develop a positive and reflective approach to learning, and to take responsibility for their own learning. Such skills promote a deeper understanding of the topics studied throughout the Higher Education programme; they support sustainable lifelong learning, and are the transferable skills desired in the employment context.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate transferable skills in a learning environment.
- Apply an academic, positive and professional approach to their studies

INDICATIVE CONTENT

- Understanding the learning process e.g. definitions, the learning process, learning styles, self-belief, confidence and positive engagement, reflection, life-long learning.
- Gathering relevant information e.g. note taking, using the library and online resources.
- Communicating and presenting information e.g. presentation techniques and styles.
- Academic and Professional writing e.g. planning and structuring reports, linking ideas, using facts, opinions, analytical thinking.
- Standard referencing systems e.g. Harvard and Numeric system.
- Revision and examination techniques e.g. preparation, organisation, memory aids.
- Identifying skills e.g. self-evaluation, skills needed for higher education, transferable skills, action plans for personal development.
- Employability skills and competencies, professional presentation and self-promotion, e-Portfolio, choosing the right jobs and employers.

- Successful Self-management e.g. time management, organising space and resources, positive attitude, emotional intelligence, managing change, stress management.
- Successful Problem-solving e.g. action-plans, solution-focused thinking, thinking outside the box, creative problem-solving techniques.
- People skills: evaluating people skills, intelligence types, collaboration and team-working, leadership.
- Professional, legal, ethical and sustainability issues related to Higher Education, Employment, and Professional Practice.
- Introduction to statistics

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	24%
Independent learning	76	76%
Placement learning	0	0%
TOTAL	100	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio	Equivalent to 2,000 words	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB4010	
Module Title	Study Skills	
Classification	Reading List entry	Electronic*
Essential	Cottrell, S. (2015) <i>Skills for Success: Personal Development and Employability - 2nd ed</i> , London : Palgrave Macmillan	☒
Essential	Cottrell, S. (2013) <i>The Study Skills Handbook – 4th ed</i> , London : Palgrave Macmillan	☐
Further	Smale, B. and Fowlie, J. (2015) <i>How to Succeed at University: an Essential Guide to Academic Skills and Personal Development</i> , London : Sage Publications Ltd	☒
Further	Cottrell, S. (2017) <i>Critical Thinking Skills: Developing Effective Analysis and Argument – 2nd ed</i> , London : Palgrave Macmillan	☐
Further	Duquenoy, P. (2007) <i>Ethical, Legal and Professional Issues in Computing - 1st ed</i> , Boston, Mass : Thomson Learning	☐
Further	Emden, J. and Becker, L. (2016) <i>Presentation Skills for Students – 2nd ed</i> , London : Palgrave Macmillan	☐
Further	Pears, R. and Shields, G. (2016) <i>Cite Them Right: The Essential Referencing Guide – 8th ed</i> , London : Palgrave Macmillan.	☐
Further	Pedler, M., Burgoyne, J. and Boydell, T. (2013) <i>A Manager's Guide to Self Development</i> , New York : McGraw Hill	☒
Further	International Journal for Academic Development	☐
Further	Journal of the International Consortium for Educational Development	☐
Further	International Journal of Training and Development	☐
Further	http://www.skills4study.com	☒
Further	http://www.palgrave.com/skills4study	☒
Further	http://www.cipd.co.uk	☒
Further	http://www.ltscotland.org.uk/studyskills	☒
Further	http://www.bized.co.uk/reference/studyskills/index.htm	☒
Further	http://www.how-to-study.com	☒
Further	http://www.employment-studies.co.uk	☒

Module Code	ACDB4011
Title	Chemistry (OME)
Date	17/08/2022
Level	4
Credits	20
Pre-Requisites	None

AIM(S)

- To develop in the student an understanding of the basic chemistry and chemical mechanisms involved in the broad range of energetic and related materials used in OME.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Evaluate and communicate an understanding of reaction chemistry, the concepts of fuels and oxidisers, oxygen balance, energy, heat flow and energy release
- Utilise data and information to formulate a plan that delivers the desired effect from an OME device

INDICATIVE CONTENT

- Atomic and molecular structures
 - Solid, liquid and gaseous states
 - Phase transformations
 - Bonding
- Chemical reactions.
- Fuels, oxidising agents and related materials used in OME
- Physical and chemical mechanisms and kinetics involved in OME
- Introduction to Materials Science
- Introduction to materials selection for OME devices
- OME effects
 - Flame, heat, light, sound and pressure effects

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio (combination of quizzes, practical work, report)	2,000 words equivalent	50%

Assessment Component 2

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Exam	2 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB4011	
Module Title	Chemistry (OME)	
Classification	Reading List entry	Electronic*
Essential	Akhavan, J. (2022) <i>The Chemistry of Explosives: Edition 4</i> Cambridge : Royal Society of Chemistry	☒
Essential	JSP 333: <i>Services textbook of explosives</i> , Ministry of Defence, 2020	☐
Further	Atkins, P. (2013) <i>Reactions – The Private Life of Atoms</i> , Cambridge : Royal Society of Chemistry	☒
Further	Hall, C. (2014) <i>Materials – A Very Short Introduction</i> , Cambridge : Royal Society of Chemistry	☐
Further	Wayne, R.P. (1994) <i>Chemical Instrumentation - Oxford Chemistry Primers</i> , Oxford : OUP	☐
Further	Metcalf, I.S. (1997) <i>Chemical Reaction Engineering – a First Course - Oxford Chemistry Primers</i> , Oxford : OUP	☐
Further	Lawrence, N., Wadhawan, J. and Compton, R. (1999) <i>Foundations of Physical Chemistry: Worked Examples - Oxford Chemistry Primers</i> , Oxford : OUP	☐
Further	Ritchie, G. and Sivia, D.S. (2000) <i>Foundations of Physics for Chemists - Oxford Chemistry Primers</i> , Oxford : OUP	☐
Further	Sivia, D.S. and Rawlings, S.G. (1999) <i>Foundations of Science Mathematics - Oxford Chemistry Primers</i> , Oxford : OUP	☐
Further	Winterton, R.H.S. (1997) <i>Heat Transfer - Oxford Chemistry Primers</i> , Oxford : OUP	☐
Further	Brouard, M. (1998) <i>Reaction Dynamics - Oxford Chemistry Primers</i> , Oxford : OUP	☐

Module Code	ACDA4020
Title	Human Factors in High Hazard Environments
Date	11/07/2023
Level	4
Credits	10
Pre-Requisites	None

AIM(S)

- To develop in the student an understanding of environmental, organisational, and job factors, and human and individual characteristics which influence behaviour at work in a way that can impact upon health and safety.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- demonstrate a knowledge and understanding of the underlying concepts and principles of human factors and how they can impact upon health and safety;
- evaluate and apply the concepts and principles of human factors in OME related scenarios to underpin safe systems of work.

INDICATIVE CONTENT

- Introduction to human factors in the OME environment.
- Understanding human factors in occupational safety.
- Definitions, concepts and history.
- OME Human Factors, management and the organization.
- Human performance in OME operations.
- Fatigue and stress and how to manage them.
- Human information processing and operational decision-making.
- Human error and threat management.
- Threat and Error Management (TEM) in the work place.
- Resource management training.
- Automation in the workplace – do we need people within the system?
- The design of Standard Operating Procedures (SOPs) and checklists.
- Case Studies.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	24%
Independent learning	76	76%
Placement learning	0	0
TOTAL	100	100%

ASSESSMENT

Assessment Component 1

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	2,000-words equivalent	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA4020	
Module Title	Human Factors in High Hazard Environments	
Classification	Reading List entry	Electronic*
Essential	Flin, Rhona H. (2008) <i>Safety at the Sharp End – A guide to non-technical skills</i> . CRC Press, London.	☐
Essential	Dekker S. (2014) <i>The field guide to understanding human error</i> . Routledge, London.	☐
Essential	Shorrock S. (2016) <i>Human Factors and Ergonomics in Practice – Improving system performance and human well-being in the real world</i> . Routledge, London.	☐

Module Code	ACDA4018
Title	Fundamentals of Electrical and Electronic Systems
Date	17/08/2022
Level	4
Credits	10
Pre-Requisites	None

AIM(S)

- To provide the student with a sound knowledge of fundamental of electrical and electronics system and to apply this knowledge in a practical environment.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Perform electrical and/or electronic measurements, record and analyse data and produce a report.

INDICATIVE CONTENT

- Ohm's Law
- Series/parallel connections for R,L and C
- KVL and KCL
- Potential and Current divider networks
- Voltage and Current sources
- AC fundamentals
- Sinusoidal properties
- Resistance, Reactance and Impedance
- Single phase AC circuits
- Maximum Power Transfer
- Tuned Circuits
- Semiconductors, diodes and transistors, Thyristors, Diacs and Triacs

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	24%
Independent learning	76	76%
Placement learning	0	0
TOTAL	100	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☐ Coursework ☒ Practical

Mode of assessment	Volume	Weighting
Build a circuit with logbook	2,000-words equivalent	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	0%
Practical	100%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA4018	
Module Title	Fundamentals of Electrical and Electronic Systems	
Classification	Reading List entry	Electronic*
Essential	Bird, J. (2014) <i>Electrical Circuit Theory and Technology - 5th ed</i> , Abingdon-on-Thames : Routledge	☒
Further	Floyd, T.L. (2012) <i>DC/AC Fundamentals: A Systems Approach</i> , New Jersey : Prentice Hall	☐
Further	Sinclair, I. and Dutton, J. (2007) <i>Practical Electronics Handbook</i> , Oxford : Newnes	☒
Further	Journals Elektor Electronics World IEEE Xplore ACM Digital Library	☒
Further	Websites Various online video lectures MIT Open Courseware http://vl.fmnet.info/safety/ http://mingo.info-science.uiowa.edu/soft-eng/ http://www.fmeurope.org/	☒

Module Code	ACDA4019
Title	Principles of OME
Date	17/08/2022
Level	4
Credits	20
Pre-Requisites	None

AIM(S)

- To develop in the student an understanding of the types of energetic materials, the purpose for which they are used, their safe handling, movement and their responses to different stimuli.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate knowledge and underlying concepts and principles of explosive types and their different requirements as part of an explosive train.
- Evaluate and apply the concepts and principles of explosives to design a suitable explosives train and reliably initiate OME devices safely and correctly.

INDICATIVE CONTENT

- Types of explosives
- Hazards of explosives
- Principles of Initiators
- Pyrotechnic effects
- Principles of Propellants
- Boosters and Secondary explosives
- Explosives effects and OME natures
- Explosive train design
- Introduction to detonation and deflagration
- Reliability and ageing

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	2,000 words	50%

Assessment Component 2

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Exam	2 hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA4019	
Module Title	Principles of OME	
Classification	Reading List entry	Electronic*
Essential	Akhavan, J. (2011) <i>The Chemistry of Explosives</i> , Cambridge : Royal Society of Chemistry	☒
Essential	Meyer, R., Kohler, J. and Homburg, A. (2016) <i>Explosives</i> New Jersey : John Wiley	☒
Further	Agrawal, J.P. (2010) <i>High Energy Materials</i> , New Jersey : John Wiley	☐
Further	Klapötke, T.M. (2017) <i>Chemistry of High Energy Materials</i> , Berlin : de Gruyter	☒
Further	Maytas, R. and Pachman, J. (2013) <i>Primary Explosives</i> , New York : Springer	☒
Further	Janssen, T.J. (2011) <i>Explosive Materials: Classification, Composition and Properties</i> , Hauppauge, NY : Nova Science Publishers	☐

Module Code	ACDB5007
Title	Computer Aided Engineering
Date	17/08/2022
Level	5
Credits	20
Pre-Requisites	None

AIM(S)

- To introduce students to a range of Computer Aided Engineering (CAE) methods and their applicability.
- To introduce the idea of verification and validation of CAE solutions and the relation to OME.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate knowledge and critical understanding of CAE tools and their limitations.
- Proficiently use CAE tools to analyse and solve problems.

INDICATIVE CONTENT

- Introduction to Finite Element Analysis including the benefits of using CAE models in test & evaluation
- The finite element method and its relation to other numerical simulation methods including finite difference
- The Lagrangian and Eulerian frameworks
- Verification and Validation
- Three-dimensional vector systems and their relation to numerical simulations
 - (i) Example of using symmetry to aid analysis: principal planes and principal stresses
 - (ii) Use of thin and thick-walled pressure vessels as an example of verification and validation by relation to exact analytic solutions
 - (iii) EM Example: predict the radiation pattern of a dipole antenna using method of moments and finite element analysis (e.g. using FeKo), and compare results to analytic solution.
- Computer aided design
- 3D Parametric Modelling
- Assemblies in CAD

- Manufacturing drawings
- Motion simulation
- Finite element analysis in CAD
- Pre- and post-processing and its relation to data visualisation
- Fast-running engineering models and their utility

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Assignment Report	5,000 Words equivalent	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB5007	
Module Title	Computer Aided Engineering	
Classification	Reading List entry	Electronic*
Essential	Bird, J.O. and Ross, C. (2014) <i>Mechanical Engineering Principles – 3rd ed</i> , Abingdon-on-Thames : Routledge	☒
Further	MacDonald, B.J. (2020) <i>Practical Stress Analysis with Finite Elements – 3rd ed</i> , Dublin : Macdohnil	☐
Further	Beer, F., Johnson, E. et al (2015) <i>Mechanics of Materials</i> , New York : McGraw-Hill	☒
Further	Benham, P.P., Crawford, R.J. and Armstrong, C.G. (2006) <i>Mechanics of Engineering Materials</i> , New Jersey : Prentice Hall	☐
Further	Bacon, D.H. (1998) <i>Mechanical Technology</i> , Oxford : Butterworth-Heinemann	☒

Module Code	ACDC5009
Title	Electromagnetic Radiation
Date	03/10/2022
Level	5
Credits	20
Pre-Requisites	None

AIM(S)

- To develop a comprehensive understanding of the theoretical and practical aspects of electromagnetics
- To develop an ability to interpret results gained from electromagnetic simulation

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Provide evidence of a systematic understanding of the scientific concepts underpinning magneto-static and AC time-harmonic problems;
- Analyse results obtained from the application of specific electromagnetic modelling techniques and correlate those results with physical characteristics.

INDICATIVE CONTENT

- Electromagnetic Theory
- Simulation and modelling of electromagnetic systems using a range of software tools;
- Electromagnetic spectrum
- Electromagnetic wave properties
- Wave guides
- Waves and beams, phased array systems, tracking systems
- Material Properties, Magnetization and Hysteresis, Magnetic Circuit Theory, Electromagnetic Induction, Maxwell's Equations, Complex Impedance and Transient Circuit Theory
- Electromagnetic compatibility testing
- Ionising and non-ionising radiation
- Radar Hardware
- Lasers: properties, hazards and selection
- Doppler effects

- Hazards, health and safety
- Issues arise with EMC

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	2,500 Words	50%

Assessment Component 2

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Exam	2 Hours	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDC5009	
Module Title	Electromagnetic Radiation	
Classification	Reading List entry	Electronic*
Essential	Edminister, J.A. and Mahmood, N. (2018) <i>Electromagnetics - Schaum's Outline Series</i> , New York : McGraw-Hill	☒
Further	UK Ministry of Defence (2005) <i>JSP 390 Military Laser Safety</i> , London : Joint Services Publications (JSP)	☐
Further	UK Ministry of Defence (2020) <i>JSP 375 Management of Health and Safety in Defence</i> , London : Joint Services Publications (JSP)	☐

Further	Journals <i>IEEE Xplore</i> <i>ACM Digital Library</i>	☒
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Module Code	ACDB5011
Title	Instrumentation and Control
Date	17/08/2022
Level	5
Credits	10
Pre-Requisites	None

AIM(S)

- To develop an understanding of instrumentation and control systems in terms of measurement systems, instrument design and system responses through the use of practical exercises and software simulation.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse the range of responses of specified instrumentation and control system scenarios in order to develop solutions to specified problems;
- Create with simulation software mathematical models of control and instrumentation systems, solve their time response and compare their transient and steady-state responses with given specifications.

INDICATIVE CONTENT

- Transducers, sensors and actuators
- Characteristics of measurement systems
- Control mechanisms
- Display devices and recorders
- Data acquisition system and signal conditioning

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	24%
Independent learning	76	76%
Placement learning	0	0%
TOTAL	100	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	2,500 words	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB5011	
Module Title	Instrumentation and Control	
Classification	Reading List entry	Electronic*
Essential	Nise, N.S. (2013) <i>Control Systems Engineering; International Student Version - 7th ed</i> , New Jersey : John Wiley	☐
Further	Dorf, R.C. and Bishop, R.H. (2016) <i>Modern Control Systems: International Version</i> , New Jersey : Pearson	☐
Further	Distenfans, J., Stubberd, A. and Williams, I. (2013) <i>Schaum's Outline of Feedback and Control Systems - 2nd ed</i> , New York : Schaum's Outlines	☐
Further	Franklin, G.F., Powell, J.D. and Emami-Naeini, A. (2014) <i>Feedback Control of Dynamic Systems, 7th ed</i> , New Jersey : Pearson	☒
Further	Patranabis, A. (2011) <i>Instrumentation and Control</i> , New Jersey : Prentice Hall	☒
Further	Prasad, J., Jayaswal, M. and Priye, V. (2013) <i>Instrumentation and Process Control</i> , New Delhi, India : IK International Publishing	☒
Further	Ogata, K. (2015) <i>Modern Control Engineering; International Version - 5th ed</i> , New Jersey : Pearson	☐
Further	Journals IEEE Xplore ACM Digital Library	☒

Module Code	ACDA5020
Title	Independent Professional Placement
Date	17/08/2022
Level	5
Credits	0
Pre-Requisites	None

AIM(S)

- To introduce the student to real experience of the commercial context of the OME industry in terms of business environments including: interpersonal skills, management organisation and administration, regulation and legislation, finances and marketing within applied creative practice.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Show detailed knowledge and advanced understanding of the relationship between an OME organisation and the commercial, socio-economic and environmental context in which it is found.
- Apply subject specific skills and cognitive skills in recognising and evaluating creative methods, planning, marketing, costing and monitoring projects, motivational approaches and team dynamics.
- Take personal responsibility for the development of key transferable skills in self-management, organisational skills, leadership and decision making, self-reflection and communication skills.

INDICATIVE CONTENT

- Business organisation and the commercial environment.
- The OME industries in the UK and global economy.
- Sustainable practices.
- Regulation and legislation.
- Business ethics and the designer's responsibility to society.
- Management and leadership.
- Financial management.
- Project planning and management.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	-	-
Independent learning	-	-
Placement learning	600	100%
TOTAL	600	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Placement Portfolio	Minimum of 3 elements (equivalent to 5000 words)	100%

Note: this sandwich placement is not awarded a mark. It is either Pass or Fail

Assessment Summary

Activity type	Percentage
Written exam	
Coursework	100%
Practical	
TOTAL	100%

INDICATIVE READING LIST

Specific to the requirements of the placement provider and activities of the student as agreed with the Placement Coordinator.

Module Code	ACDB5013
Title	Safety and Hazard Assessment
Date	17/08/2022
Level	5
Credits	10
Pre-Requisites	None

AIM(S)

- To develop an understanding of safety and hazard assessment

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse the requirements for Safety Led Design, hazard identification (HazID) and hazard operability (HazOp)
- Effectively communicate to specialist and non-specialist audiences the outcomes of HazID & HazOp processes.
- Demonstrate an awareness of the legislation relevant to the manufacture, storage, transportation and use of explosives.

INDICATIVE CONTENT

- Safety Led Design
- Explosives legislation
- HazID and HazOp.
- Hazard and Risk Assessment.
- Principles of ALARP.
- Safety Cases.
- Explosives Legislation

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	24%
Independent learning	76	76%
Placement learning	0	0%
TOTAL	100	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Case Study/Report	Produce a report as part of a small group (2,500 words per person) an output of a safety case. Each student's contribution is assessed; group marks are not used.	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB5013	
Module Title	Safety and Hazard Assessment	
Classification	Reading List entry	Electronic*
Essential	Mannan, S. (2013) <i>Lees' Process Safety Essentials - Hazard Identification, Assessment and Control</i> , Oxford : Butterworth-Heinemann	☒
Further	Cherrie, J., Howie, R. and Semple, S. (2010) <i>Monitoring for Health Hazards at Work</i> , 4 th ed, New Jersey : Wiley-Blackwell	☒

Module Code	ACDB5015
Title	Advanced Physics of OME
Date	17/08/2022
Level	5
Credits	20
Pre-Requisites	Physics (OME)

AIM(S)

- To build on the concepts introduced in the level 4 Physics (OME) module. Expanding and extending ideas developed, introducing more detailed explanation of the physics principles associated with OME devices.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate a critical understanding of complex mechanics, structural aspects of physics and engineering science relevant to OME
- Critically analyse ballistics, blast and shock waves
- Model OME systems and effects

INDICATIVE CONTENT

- Euler equations, shockwaves, Rankine-Hugoniot equations
- Fluid and Material models appropriate for OME systems
- Ballistics
- Modelling of explosive and shockwave effects
- Thermal dynamics

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1 (Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Laboratory Report	5,000 words	100%

Assessment Summary

Activity type	Percentage
Written exam	0
Coursework	100%
Practical	0
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB5015	
Module Title	Advanced Physics of OME	
Classification	Reading List entry	Electronic*
Essential	Hearn, E.J. (1997) <i>Mechanics of Materials Volume1</i> , Oxford : Butterworth-Heinemann	☐
Essential	Needham, C.E. (2013) <i>Blast Waves</i> , New York : Springer	☒
Further	Rosenberg, Z. and Dekel, E. (2016) <i>Terminal Ballistics</i> , New York : Springer	☒
Further	Bacon, D.H. (1998) <i>Mechanical Technology</i> , Oxford : Butterworth-Heinemann	☒
Further	Benham, P.P., Crawford, R.J. and Armstrong, C.G. (2006) <i>Mechanics of Engineering Materials</i> , New Jersey : Prentice Hall	☐
Essential	Journals Abaqus Online Material IEEE Xplore, ACM Digital Library	☒

Module Code	ACDA5023
Title	Nuclear Safety
Date	11/07/2023
Level	5
Credits	10
Pre-Requisites	None

AIM(S)

- To provide students with an understanding of the principles and practices of nuclear safety. Students will gain an appreciation of the importance of nuclear safety, the regulatory framework governing nuclear safety, and the techniques and technologies used to maintain safe nuclear operations to support the production of safety cases.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- critically evaluate and explain the regulatory framework governing nuclear safety and safety cases;
- analyse the techniques and technologies used to maintain safe nuclear operations and understand the human, environmental and business consequences associated with nuclear safety and security;
- understand the theory of nuclear weapons systems and components concept, assessment, design for modifications and life extension including through-life requirements;
- understand the significance of safe nuclear operations and the need for well managed maintenance of interfacing equipment and supporting infrastructure.

INDICATIVE CONTENT

- Radiation physics.
- Nuclear Safety and Security Culture and Human Factors.
- Introduction to nuclear safety and its importance.
- Regulatory framework governing nuclear safety, including international conventions and national regulations.
- Nuclear safety systems and equipment.
- Nuclear Safety cases.
- Radiation protections.
- Nuclear emergency response and accident management.

- Theory of Nuclear systems and components concept, assessment, design for modifications and life extension.
- Nuclear infrastructure concept, assessment, design, modifications and life Extension through-life.
- Nuclear interfacing equipment maintenance and supporting infrastructure maintenance.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	24%
Independent learning	76	76%
Placement learning	0	0%
TOTAL	100	100%

ASSESSMENT

Assessment Component 1

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	2,500 words	100%

INDICATIVE READING LIST

Module Code	ACDA5023	
Module Title	Nuclear Safety	
Classification	Reading List entry	Electronic*
Essential	Nuclear Safety: A Human Factors Perspective by J. Harvey & E. Spencer. (2020). London: Routledge.	☐
Essential	Nuclear Weapons by Mark Wolverton (2022). MIT Press	☐
Essential	Nuclear Safety: A Guide to the International Atomic Energy Agency Regulations by M. Collins & J. Smith. (2021). London: Springer.	☐
Further	The Fukushima Daiichi Nuclear Accident: Final Report of the Independent Investigation Commission. (2020). Tokyo: The National Diet of Japan	☐
Further	Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture. (2021). Vienna: International Atomic Energy Agency	☐
Further	Nuclear Power Plant Safety and Mechanical Integrity: Design and Operability of Mechanical Systems, Equipment and Supporting Structures. (2022). Oxford: Woodhead Publishing	☐
Further	Nuclear Safety in Light Water Reactors: Severe Accident Phenomenology by B. Boyack & K. Olsen. (2021). New York: Elsevier.	☐

Further	Decommissioning of Nuclear Power Plants: Strategies and Technologies by J. Lee & C. Kim. (2022). Hoboken: John Wiley & Sons.	☐
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Module Code	ACDA5021
Title	Systems Engineering
Date	17/08/2022
Level	5
Credits	20
Pre-Requisites	None

AIM(S)

- To provide the students with a holistic and interdisciplinary approach as a means of enabling the realisation of a working system.
- To provide the students with experience of left shifting design to aid safety, test, manufacturing, breakdown and disposal.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Embed the process of system thinking, including needs analysis, developing options, assessing risk and constraints.
- Use suitable engineering design methods to design a safe system which is robust solution to a defined set of requirements.
- Apply underlying concepts and principles, to justify the process, design methods and tools used in the development of the above solution.

INDICATIVE CONTENT

- Design of robust, practical and safe solutions
- Design for test, safety, manufacturing, and disposal
- Combining instrumentation, Range operation and safety systems to design a trial
- Needs Analysis
- Integration and Evaluation.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio (Group work)	5,000-words equivalent. The portfolio includes design process and group presentation.	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA5021	
Module Title	Systems Engineering	
Classification	Reading List entry	Electronic*
Essential	Kossiakoff, A., Sweet, W., Seymour, S. and Biemer, S. (2011) <i>Systems Engineering Principles and Practice</i> , New Jersey : Wiley-Blackwell	☒
Essential	Leveson, N.G and Moses, J. (2017) <i>Engineering a safer world: Systems thinking applied to safety (Engineering systems)</i> , MIT Press	☒
Further	Blanchard, B. (2016) <i>Systems Engineering Management - 5th ed</i> , New Jersey : John Wiley	☒
Further	Kasser, J. (2013) <i>A Framework for Understanding Systems Engineering - 2nd ed</i> , CreateSpace Independent Publishing Platform	☒
Further	Jenney, J., Gangl, M., Kwolek, R., Melton, D., Ridenour, N. and Coe, M. (2011) <i>Modern Methods of Systems Engineering, with an Introduction to Pattern and Model-Based Methods</i> , CreateSpace Independent Publishing Platform	☐
Further	Kasser, J. (2013) <i>Holistic Thinking: Creating Innovative Solutions to Complex Problems</i> , CreateSpace Independent Publishing Platform	☒
Further	Hitchins, D.K. (2007) <i>System Engineering: A 21st century systems methodology</i> , Wiley. ISBN: 978-0-470-05856-5	☒
Further	Checkland, P. (1999) <i>Systems Thinking, Systems practice: Includes a 30-year retrospective</i> , Wiley.	☒
Further	Ramage, M. and Shipp, K. (2009) <i>Systems Thinkers</i> , Springer.	☒
Further	Journals <i>ACM Transactions on Information Systems</i>	☒

	<i>Journal of Data and Information Quality</i> <i>Journal of the ACM</i> <i>Journal of Systems Engineering and Electronics</i>	
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Module Code	ACDA5024
Title	Technical Authoring
Date	11/07/2023
Level	5
Credits	20
Pre-Requisites	None

AIM(S)

- To underpin the importance of technical authoring and communication and provide a comprehensive understanding of the knowledge required, including; preparing technical instructions and manuals and supporting documents, communicating complex and technical information, gathering and disseminating technical information to customers, designers, and manufacturers.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- systematically understand the requirements for visual aids, the principles of cognitive psychology, analyse source material and communicate ideas effectively;
- design and deliver instructional materials, manage complex writing and design projects and use appropriate multimedia applications.

INDICATIVE CONTENT

- Process analysis.
- Cognitive and educational psychology that relate to visual aids, such as visual perception, gestalt grouping, matching of intellectual and visual inferences.
- Professional communication for engineers and scientists.
- Editing and visual design.
- Document control and publications management.
- Specialized documents; proposal writing and document design.
- The advantages of a multimedia approach to technical authoring.
- Manipulate data using a variety of tools to provide insight and information.
- Develop ways of writing and communicating with different audiences.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Technical Report	2,500 words	50%

Assessment Component 2

☐ Written exam ☐ Coursework ☒ Practical

Mode of assessment	Volume	Weighting
Formal Presentation	20 min presentation	50%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	50%
Practical	50%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA5024	
Module Title	Technical Authoring	
Classification	Reading List entry	Electronic*
Essential	Riordan, D, Technical Report Writing Today, Wadsworth Publishing, 2013	☒
Further	R. Lachman, J. L. Lachman and E. C. Butterfield, Cognitive Psychology and Information Processing: An Introduction, Psychology Press; 22 Dec. 2015	☒
Further	Smith, S.C.H, Academic Presentations: EAP Foundation, Evident Press, 2018	☒

Module Code	ACDA5022
Title	Work-Based Group Project
Date	17/08/2022
Level	5
Credits	20
Pre-Requisites	None

AIM(S)

- As a team, apply system thinking principles and skills to the solution of a defined technical problem.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Select, specify and plan a project, as part of a team, and to present the design and development concepts and implementation stages.
- Select appropriate design methodology and development of an artefact from initial concept to final realisation.
- Critically evaluate the component features of the design and explain strategies for delivery of a reliable and robust product.
- Demonstrate specific in-depth knowledge and understanding of legal, social, ethical, environmental and sustainability issues relating to the project.

INDICATIVE CONTENT

- Systematic design procedures
- Objective design selection
- Project Planning
- Cost prediction,
- Manufacturing techniques
- Quality and reliability
- Technical report writing
- Group working and management
- Communication skills
- Legal, social, and ethical aspects of projects
- Environmental and sustainability

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	24	12%
Independent learning	176	88%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio of work	5,000 words equivalent	100%

Students will produce a portfolio of work appropriate to the nature of their project. Portfolio elements could include a selection of the following:

- Written Report
- Presentation slides
- Demonstration of work
- Ethical approval form
- Logbook

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA5022	
Module Title	Work-Based Group Project	
Classification	Reading List entry	Electronic*
Essential	The Work Based and Placement Learning Association (2013) <i>Good Practice Guide for Workbased Learning and Placement Learning in Higher Education</i> , Sheffield : ASET	☒
Essential	McCormac, C. and Davis, J. (2012) <i>Research Project Success: The Essential Guide for Science and Engineering Students</i> , Royal Society of Chemistry	☐
Essential	O'Leary, Z. (2013) <i>Doing Your Research Project, 2nd Edition</i> , SAGE Publications Ltd	☐
Essential	Gray, D. E. (2018) <i>Doing Real World Research</i> , London : SAGE	☐
Further	Kerzner, H. (2017) <i>Project Management: A Systems Approach to Planning, Scheduling, and Controlling</i> , New Jersey : John Wiley	☐
Further	Curedale, R. (2016) <i>Design Thinking Process and Methods - 3rd ed</i> , Design Community College	☐
Further	McKeown, M. (2014) <i>The Innovation Book: How to Manage Ideas and Execution for Outstanding Results (The X Book)</i> , FT Publishing International.	☒
Further	Yin, R. K, (2008) <i>Case Study Research: Design and Methods - 4th ed</i> , Sage : Beverly Hills	☐

Module Code	ACDB6008
Title	Scientific Principles of OME Design
Date	17/08/2022
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- To develop a systematic understanding of the scientific principles behind the design of OME, their mode of operation and the outcomes to be expected from their correct functioning.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Apply a systematic understanding of the scientific principles behind OME design.
- Critically analyse and select appropriate OME to produce a given effect.

INDICATIVE CONTENT

- Material properties relevant to shock
- Penetration mechanics
- Formation of EFPs and shaped charge jets.
- Ballistics design
- Designing for blast and fragmentation effects
- Arming, fusing and firing.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Exam	2 hours	50%

Assessment Component 2

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	3,000 words	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB6008	
Module Title	Scientific Principles of OME Design	
Classification	Reading List entry	Electronic*
Essential	Akhavan, J. (2011) <i>The Chemistry of Explosives</i> , Cambridge : Royal Society of Chemistry	☒
Essential	JSP 333: <i>Services textbook of explosives</i> , (2020) Ministry of Defence.	☒
Further	Agrawal, J.P. (2010) <i>High Energy Materials</i> , New Jersey : Wiley	☐
Further	Carlucci, D.E. and Jacobson, S.S. (2013) <i>Ballistics: Theory and Design of Guns and Ammunition</i> , Boca Raton, Florida : CRC Press	☐
Further	Klapötke, T.M. (2017) <i>Chemistry of High Energy Materials</i> , Berlin : de Gruyter	☐
Further	Maytas, R. and Pachman, J. (2013) <i>Primary Explosives</i> , New York : Springer	☐
Further	Zukas, J.A. and Walters, W. (2013) <i>Explosive Effects and Applications</i> , New York : Springer	☐

Module Code	ACDB6016
Title	Materials Science
Date	11/07/2023
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- To provide the student with an in-depth knowledge of the behaviour of materials in their operating environments, to gain a critical understanding of the principles and potential applications of a range of advanced engineering materials.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- demonstrate analytical knowledge of strain, fracture, fatigue and corrosion mechanisms and phenomena;
- critically evaluate the environmental degradation of both metals and non-metals and suggest methods of protection, demonstrating analytical skills in mechanical failure modes;
- systematically analyse structure-property relationships and behaviours of a range of advanced engineering materials, including potential applications.

INDICATIVE CONTENT

- Stress-strain responses for common engineering materials, plastic yield, strain hardening and flow stress.
- Alloys and structures, micro-mechanisms of fracture, fracture mechanics and fatigue mechanisms.
- Corrosion of ferrous and non-ferrous metals.
- The effects of machining OME materials -
 - Advanced traditional machining.
 - High speed machining.
 - Non-traditional machining.
 - Thermal cutting processes.
 - Abrasion processes.
 - Ultrasonics.
 - Water jetting.
- Coatings and additives.
- Environmental considerations of materials selection.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

☒ Written exam ☐ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Exam	2 Hours	50%

Assessment Component 2

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Report	2,500 words	50%

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDB6016	
Module Title	Materials Science	
Classification	Reading List entry	Electronic*
Essential	Dowling, N. E., Mechanical Behaviour of Materials: Engineering Methods for Deformation, Fracture and Fatigue (Wiley, 2012)	☒
Further	El-Hofy, H., Fundamentals of Machining Processes, Conventional and Nonconventional Processes, 2 nd Edition (CRC Taylor & Francis, 2013)	☒
Further	Roberge, P. R., Corrosion Engineering: Principles and Practice (McGraw Hill, 2008)	☒
Further	Suresh, S., Fatigue of Materials (Cambridge University Press, 1998)	☒
Further	Hosford, W. F. and Cadell, R. M., Metal Forming: Mechanics and Metallurgy (Cambridge University Press, 2014)	☒

Module Code	ACDA6020
Title	Advanced Chemistry of OME
Date	17/08/2022
Level	6
Credits	20
Pre-Requisites	Chemistry (OME)

AIM(S)

- To build on the concepts introduced in the level 4 Chemistry (OME) module. Expanding and extending ideas developed, introducing more detailed explanation of the chemical principles associated with the functioning of OME devices. Introduction of the concepts of materials chemistry and effects.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Critically analyse concepts of heat and thermodynamics, to explain the chemistry of solid phases and their interaction with other phases.
- Demonstrate a detailed understanding of reaction chemistry, ranging from complex chemical reactions to chemical compatibility of OME components.
- Analyse critically the design of chemical components for the lifetime of an OME system or device, from manufacture, through storage, use and/or disposal.

INDICATIVE CONTENT

- Advanced chemical reactions and chemical kinetics.
- Advanced System Thermodynamics and energy release.
- Materials chemistry – states of matter, phase transformations, polymers, crystals, glasses.
- Mechanical properties of the solid state.
- Chemical compatibility and testing methods.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio	6,000 words equivalent Group Presentation, Lab Report and Practical	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA6020	
Module Title	Advanced Chemistry of OME	
Classification	Reading List entry	Electronic*
Essential	Akhavan, J. (2022) <i>The Chemistry of Explosives: Edition 4</i> , Cambridge : Royal Society of Chemistry	☒
Essential	JSP 333: <i>Services textbook of explosives</i> , (2020) Ministry of Defence.	☒
Further	Atkins, P. (2010) <i>The Laws of Thermodynamics: a Very Short Introduction</i> , Cambridge : Royal Society of Chemistry	☐
Further	Atkins, P., de Paula, J. and Keeler, J. (2017) <i>Atkins' Physical Chemistry</i> , Cambridge : Royal Society of Chemistry	☐
Further	Carrington, G. (1994) <i>Basic Thermodynamics</i> , Cambridge : Royal Society of Chemistry	☐
Further	Scott, S.K. (1995) <i>Beginning Mathematics for Chemistry</i> , Cambridge : Royal Society of Chemistry	☐
Further	Pilling, M.J. and Seakins, P.W. (1995) <i>Reaction Kinetics</i> , Cambridge : Royal Society of Chemistry	☐
Further	Agrawal, J.P. (2010) <i>High Energy Materials</i> , New Jersey : John Wiley	☐
Further	Klapötke, T. M. (2017) <i>Chemistry of High Energy Materials</i> , Berlin : de Gruyter	☐
Further	Maytas, R. and Pachman, J. (2013) <i>Primary Explosives</i> , New York : Springer	☐
Further	Janssen, T.J. (2011) <i>Explosive Materials: Classification, Composition and Properties</i> , Hauppauge, NY : Nova Science Publishers	☐
Further	Wayne, R.P. (1994) <i>Chemical Instrumentation - Oxford Chemistry Primers</i> , Oxford : OUP	☐

Further	Metcalfe, I.S. (1997) <i>Chemical Reaction Engineering, a First Course</i> - Oxford Chemistry Primers, Oxford : OUP	☐
Further	Lawrence, N., Wadhawan, J. and Compton, R. (1999) <i>Foundations of Physical Chemistry: Worked Examples</i> - Oxford Chemistry Primers, Oxford : OUP	☐
Further	Ritchie, G. and Sivia, D.S. (2000) <i>Foundations of Physics for Chemists</i> - Oxford Chemistry Primers, Oxford : OUP	☐
Further	Sivia, D.S. and Rawlings, S.G. (1999) <i>Foundations of Science Mathematics</i> - Oxford Chemistry Primers, Oxford : OUP	☐
Further	Sivia, D.S., Rawlings, S.G. (1999) <i>Foundations of Science Mathematics, Worked Problems</i> - Oxford Chemistry Primers, Oxford : OUP	☐
Further	Winterton, R.H.S. (1997) <i>Heat Transfer</i> - Oxford Chemistry Primers, Oxford : OUP	☐
Further	Brouard, M. (1998) <i>Reaction Dynamics</i> - Oxford Chemistry Primers, Oxford : OUP	☐

Module Code	ACDA6021
Title	Data Capture and Evaluation
Date	17/08/2022
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- To explore and evaluate the methods of data capture used during any OME research & development and test & evaluation activity. Use the appropriate range of tools and techniques to determine product performance to specification or support gathering fundamental science and technologies.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate an in-depth knowledge in using range of tools and techniques to capture an OME event.
- Demonstrate a critical understanding and knowledge of data, capturing and analysing to determine product performance within OME field.

INDICATIVE CONTENT

- Major categories of qualitative data collection techniques
- How to evaluate and trust qualitative or quantitative data
- Standardisation, normalisation and filtering methods
- Describe recording equipment, oscilloscopes, data loggers, amplifiers, etc.
- Software for statistical analysis and data visualisation
- Evaluate monitoring techniques; blast gauges, high speed cameras, doppler radar, etc
- Time bases, sample rates / bit rates and sampling frequency (Nyquist)
- define the criteria for determining the validity of research
- 3D data scanning for inspection and test, data handling

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Essay	3,000 words	50%

Assessment Component 2

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Written Lab Report	3,000 words equivalent	50%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA6021	
Module Title	Data Capture and Evaluation	
Classification	Reading List entry	Electronic*
Essential	Kinney, G. (1985) <i>Explosive Shocks in Air</i> eISBN 978-3-642-86682-1	☐
Essential	Cooper, P. W. (2013) <i>Explosives Engineering</i> New York : Wiley VCH	☐
Essential	Mader, C. (1998) <i>Numerical Modelling of Explosives and Propellants 3rd ed</i> eISBN 978-1-4200-5239	☐
Essential	Zucas, J. A. and Walters, W. P. (1997) <i>Explosive Effects and Applications</i> New York : Springer - ISBN 978-0-387-955582	☐
Further	Needham, C. E. (2010) <i>Blast Waves</i> eISBN 978-3-642-05288-0	☐

Further	Spiegelhalter, D. (2019) <i>The Art of Statistics: Learning from Data</i> Manhattan : Penguin Random House	☒
Further	Spence, R. (2006) <i>Information Visualization: Design for Interaction</i> New Jersey : Prentice Hall	☐
Further	Loth, A. (2019) <i>Visual Analytics with Tableau</i> , New Jersey : John Wiley	☒
Further	Bourne, N. (2013) <i>Materials in Mechanical Extremes</i> Cambridge : CUP ISBN 978-1-10702375-8	☐
Further	Lillesand, L., Kiefer, R. and Chipman, J. (2015) <i>Remote Sensing and Image Interpretation</i> New Jersey : John Wiley	☐
Further	Persson, P-A., Hilmberg, and Lee, J. <i>Rock Blasting and Explosives Engineering</i> (1993) Boca Raton : CRC Press ISBN 0-8493-8978-X	☐
Further	Suceska, M. (1995) <i>Test Methods for Explosives</i> New York : Springer ISBN 978-1-4612-69045	☐

Module Code	ACDA6023
Title	End Point Assessment (EPA) for Degree Apprentices
Date	23/09/2024
Level	6
Credits	0 Credits (non-credit bearing, mandatory for completion)
Pre-Requisites	Gateway requirements of the Apprenticeship Standard (England) or Welsh Degree Apprenticeship Framework
DBS Check	May be required ☒ Not required ☐

AIM(S)

- To assess the apprentice's competence in knowledge, skills, and behaviours (KSBs), ensuring they are fully prepared for professional roles through a structured evaluation of their academic and workplace development and as outlined in the appropriate Apprenticeship Standard (England) or the Welsh Degree Apprenticeship Framework.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- demonstrate that they have met the requirements of the relevant end-point assessment criteria for their identified Apprenticeship Standard (England) or Welsh Degree Apprenticeship Framework.

INDICATIVE CONTENT

- The indicative content can be found in the End Point Assessment document relevant to the Apprenticeship Standard (England) or Welsh Degree Apprenticeship Framework.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	0	0%
Independent learning	As per EPA requirements	100%
Placement learning	0	0%
TOTAL	As per EPA requirements	100%

ASSESSMENT

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Detailed assessment criteria as outlined in the End Point Assessment plan of the relevant Apprenticeship Standard (England) or Welsh Degree Apprenticeship Framework	As outlined in the detailed assessment criteria within the specific End Point Assessment plan of the Apprenticeship Standard (England)	100%

Pass/Fail Criteria:

This is a pass/fail module. Apprentices must successfully pass all required components of the EPA to complete their apprenticeship.

Assessment Summary

Activity type	Percentage
As identified in the Apprenticeship Standard	
Coursework	100%
Practical	
TOTAL	100%

INDICATIVE READING LIST

It is essential that apprentices completing this module read and become fully conversant with the End Point Assessment criteria outlined in their Apprenticeship Standard or Framework.

Module Code	ACDA6023	
Module Title	End Point Assessment (EPA) for Degree Apprentices	
Classification	Reading List entry	Electronic*
Essential	End-point assessment guide for apprentices - GOV.UK	
Essential	Bradbury, A. and Wynne, V. (2020). <i>The Apprentice's Guide to End Point Assessment</i> . Learning Matters.	
Further	Cottrell, S. (2024). <i>The Study Skills Handbook</i> (6 th ed.). Bloomsbury Academic.	☒
Further	Boud, D., Keogh, R., & Walker, D. (2013). <i>Reflection: Turning Experience into Learning</i> . Routledge.	☐
Further	Serrat, O. (2017). <i>Knowledge Solutions: Tools, Methods, and Approaches to Drive Organizational Performance</i> . Springer.	☐

Module Code	ACCA6020
Title	Independent Project
Date	25/06/2020
Level	6
Credits	40
Pre-Requisites	None

AIM(S)

- To develop the ability of students to engage critically and innovatively with theory and/or practice relevant to their studied subject areas in order to produce a discipline specific in-depth project.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Demonstrate intellectual skills in the identification of an appropriate topic, problem or challenge for investigation pertinent to their field of study and formulate a suitable plan for further research utilising relevant investigative methods in order to produce a response.
- Evidence in-depth knowledge and critical understanding of principles necessary to underpin their education within their chosen field of study and problem solving techniques applicable to this.
- Evidence independence of thought and critical evaluation in the production of an independent piece of work, demonstrating transferable skills through exercising initiative and personal responsibility in planning own learning and self-management.
- Organise their knowledge and learning through use of a range of media, and present their work appropriately in a manner that can be understood by specialist and non-specialist audiences.

INDICATIVE CONTENT

- Research paradigms, methods, and techniques of research and enquiry.
- Conducting and writing literature reviews.
- Ethical concerns and the research process.
- Resource, project, and skills management processes and techniques.
- Presenting and illustrating data and information.
- Communication of general, specialist, technical ideas and results.
- Problem solving, creative, entrepreneurial thinking and approaches.
- Collaboration, adaptability and reflection.

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	36	9%
Independent learning	364	91%
Placement learning	0	0%
TOTAL	400	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Portfolio	Minimum of 3 elements (equivalent to 10,000 words)	100%

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

INDICATIVE READING LIST

This will be guided by the student's individual project.

Module Code	ACCA6020	
Module Title	Independent Project	
Classification	Reading List entry	Electronic*
Essential	Cottrell S, (2015) <i>Skills for Success Personal Development and Employability</i> , 3 rd edition, Palgrave. London.	☒
Essential	ASET, 2013 <i>Good Practice Guide for Workbased Learning and Placement Learning in Higher Education</i>	☒
Essential	Gray, D.E. (2018) <i>Doing Real World Research</i> , London: SAGE.	☐
Further	Gallagher K, (2016) <i>Essential Study and Employment Skills For Business and Management Students</i> , Oxford	☐
Further	Gottschall, Jonathan (2013), <i>The Storytelling Animal: How Stories Make Us Human</i> , Houghton Mifflin	☐
Further	Storr, Will (2020), <i>The Science of Storytelling</i> , William Collins	☐
Further	Cohen, L. Manion, L. and Morrison, K. (2017) <i>Research Methods in Education</i> , 8 th edition London: Routledge.	☒

Further	Flick, U. (2014) <i>An Introduction to Qualitative Research</i> , London: SAGE.	☐
Further	Aubrey, K. & Riley, A. (2017) <i>Understanding and Using Challenging Education Theories</i> , London: SAGE.	☒
Further	Brinkmann, S. and Kvale, S. (2018) <i>Doing Interviews (Qualitative Research Kit)</i> . Sage	☐
Further	Gibbs, G. (2018) <i>Analysing Qualitative Data (Qualitative Research Kit)</i> . Sage	☒
Further	Creswell, J. W. (2012). <i>Qualitative inquiry and research design: Choosing among five approaches</i> . Sage	☐
Further	Obschonka, M., Hakkarainen, K., Lonka, K. et al. Entrepreneurship as a twenty-first century skill: entrepreneurial alertness and intention in the transition to adulthood. <i>Small Bus Econ</i> 48 , 487–501 (2017). https://doi.org/10.1007/s11187-016-9798-6	☒
Further	https://ec.europa.eu/jrc/en/entrecomp	☒

Module Code	ACDA6022
Title	OME Safety Management and Legislation
Date	17/08/2022
Level	6
Credits	20
Pre-Requisites	None

AIM(S)

- To provide a comprehensive and systematic knowledge of explosives safety, legislation and regulations and its impact on OME design.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- Comprehensively interpret and communicate the legal requirements for explosives legislation.
- Critically evaluate key safety and security requirements for the design, manufacture, transport and storage of explosives.

INDICATIVE CONTENT

- Explosives authorisations and licensing
- Building construction and type
- Impact of legislation on OME design
- Separation Distances and structural Justifications
- Safety requirements
- Security provisions
- Storage and transport

Study Time Allocation

The study time for the module is divided as follows:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0
TOTAL	200	100%

ASSESSMENT

Assessment Component 1

(Tick one)

☐ Written exam ☒ Coursework ☐ Practical

Mode of assessment	Volume	Weighting
Case Study/Incident Investigation Report	6,000 words	100%

Assessment Summary

Activity type	Percentage
Written exam	0
Coursework	100%
Practical	0
TOTAL	100%

INDICATIVE READING LIST

Module Code	ACDA6022	
Module Title	OME Safety Management and Legislation	
Classification	Reading List entry	Electronic*
Essential	Explosives Regulations 2014 (amendment) Regulations 2016 (ER 2014)	☒
Essential	ER2014 Guidance on Regulations - Safety Requirements L150	☒
Essential	ER2014 Guidance on Regulations - Safety Provisions L150	☒
Further	JSP 333: <i>Services textbook of explosives</i> , Ministry of Defence, 2020	☒
Further	DSA02 – DNSR Defence Nuclear Safety Regulations of the Defence Nuclear Enterprise (May 2021), Ver 1.0	☒
Further	DSA03 – DNSR Defence Nuclear Safety Regulations of the Defence Nuclear Enterprise - Guidance (May 2021), Ver 1.0	☒