Maritime & Coastguard Agency

Consultation Report: Cadet Training & Modernisation Programme Syllabus Review – Eighth Group of Consultation Templates

August 2023

Contents

Foreword

The Maritime and Coastguard Agency (MCA), an executive Agency of the Department for Transport (DfT), carried out a public consultation on behalf of the Cadet Training and Modernisation (CT&M) Programme from 1st May to the 29th May 2023 regarding the Cadet Training Syllabus Review. The consultation was published on 1st May 2023 and notification of the consultation was sent to all participants of the CT&M Programme for wider dissemination through the maritime industry. This was also promoted on social media platforms and maritime news outlets.

The proposed amendments to the Cadet training syllabus were published in multiple formats and feedback on these amendments was gathered through surveys hosted on Smart Survey.

1 Key Findings

1.1 Introduction

1.1.1 Through the process of the consultation, it has been found that the majority of survey respondents agreed with the changes suggested by CT&M Sub-Group 1.2.

1.2 Consultation

1.2.1 The eighth consultation was carried out between 1st May and 29th May 2023 and can be found at: www.gov.uk

1.2.2 A total of 7 responses were received across the eight templates. With all respondents answering every question posed on their survey. A summary of consultee responses and the action taken by CT&M Sub-Group 1.2 as a result can be found in **Annex A**. A more detailed summary can be found in the accompanying 'Detail of feedback received' section of the consultation page. The answers given have been fully and carefully considered.

1.2.3 This consultation has been completed in order to ensure best practice has been followed and provide the opportunity for feedback from the entire maritime industry. There was no legal requirement to undertake this consultation.

Consultation Outcome

2 Summary of responses

2.1 Introduction

2.1.1 A total of 71 outcomes over eight templates were posed in the eighth consultation.

2.1.2 These outcomes, together with the consultees comments and the Cadet Training & Modernisation Sub-Group 1.2's response, are shown in detail in the accompanying 'Detail of feedback received' section of the consultation page. However, the main points are summarised below at Annex A.

2.1.3 Finalised versions of each module can also be found in the 'Detail of outcome' section of the consultation page.

3 Our response

3.1 What happens next?

3.1.1 The MCA will make the appropriate amendments to the syllabus templates. These will then be used to create academic modules that will form the new Cadet training syllabus with a view to complete this process by the end of 2023.

3.1.2 Once these academic modules have been created, it will take approximately 12 to 18 months to implement the new syllabus.

3.1.3 Cadet Assessment and the Training Record Book will also be amended to reflect these changes.

ANNEX A

SUMMARY OF THE CONSULTATION OUTCOMES, CONSULTEE FEEDBACK AND SUB-GROUP 1.2 RESPONSES TO THE FEEDBACK

Each module had its own survey which included the recommendations of Sub-Group 1.2:

ETO - Switchgear and Protection of High Voltage Systems			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1: Explain the need for protection devices in high voltage systems	**Keep**	**100%**	**None**
1.1 Requirements of protection	State the requirements of this outcome	100%	None
1.2 Overcurrent and earth fault	State the requirements of this outcome	100%	None
1.3 Protection Current transformers, Voltage transformers and Summation transformers	Keep	100%	None
1.4 Surge protection	Keep	100%	None
1.5 Arc Flash Protection	State the requirements of this outcome	100%	None
Outcome 2: Explain distribution substation feeder protection schemes	**Keep**	**100%**	**None**
2.1 Operation and application of an IDMT overcurrent and earth fault protection scheme	Contextualise	100%	None
2.2 Operation and application a unit protection scheme	Keep	100%	None

2.3 IDMT calculations for a series circuit	Keep	100%	None
2.4 Application of digital communications within a distribution substation	Keep	100%	None
Outcome 3: Explain construction, operation and application of switchgear	**Keep**	**100%**	**None**
3.1 Fuses	Keep	100%	None
3.2 Circuit breakers	Keep	100%	None
3.3 Switches	Keep	100%	None
3.4 Isolators	Keep	100%	None
3.5 High Rupturing Capacity (HRC) Fuse	Add	100%	None
3.6 Lightening Arresters	Add	100%	None
3.7 Manufacturer's Instructions on troubleshooting and fault finding on specific equipment	Add	N/A	Suggested addition from industry
Outcome 4: Explain operation and application of protection schemes	**Keep**	**100%**	**None**
4.1 Spur protection	Keep	100%	None
4.2 Distance protection	Keep	100%	None
4.3 Transformer protection	Keep	100%	None
4.4 Embedded generation protection	Keep	100%	None
4.5 Bus bar Fault	Add	100%	None
4.6 Types of protection	Add	100%	None
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
How would you deliver this outcome/ objective?	**How would you assess this outcome/ objective?**	**Action required**	**Consultation Support %**
Analyse power system faults	An academic module to be included within the ETO syllabus, which is currently only in the Marine Engineering syllabus.	Add the Engineering Module, "7b. Electrical Distribution Systems" to the ETO syllabus.	100%

Ensure all outcomes are contextualised to help Cadets understand what they are learning in relation to what they will experience at sea.	While some outcomes are intrinsically linked to work carried out at sea, some need to be contextualised to show how they apply to work on board. Where this is the case, it is important to make sure Cadets clearly understand how the outcome relates to work at sea and it is essential to make sure that this context is given with reference to current and future seagoing technologies and practices.	Where outcomes do not specifically cover a topic which relates to work carried out at sea, more must be done to contextualise the outcome and make it relevant to the maritime industry, giving specific shipping examples of how the outcome may be applied in a modern shipping context. Not every template has contextualisation recommendations but please do add any you feel may have been missed.	100%
Include Human Element Factors throughout the syllabus	To provide seafarers with a contextualised understanding of the Human Element in the maritime industry, showing how they can put theory into practice in the work they carry out at sea.	Raise awareness throughout the Cadet's training of the areas in which human element factors will have an impact. Recommendations on where this can be included have been noted throughout the entire syllabus. Not every template has Human Element Factor recommendations but please do add any you feel may have been missed.	100%
Include Data Science skills throughout the syllabus	Data Science Skills (Comprehension, Analysis, Presentation, etc...) are already required within much of the syllabus. A further, specific focus on these skills needs to be taught where relevant.	A specific topic will need to be introduced to improve Cadets' Data Science skills. Practical application of data science skills should be highlighted throughout the syllabus. Not every template has Data Science recommendations but please do add any you feel may have been missed.	100%

Marine Engineering: Strength of Materials (Management Level)			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1: Explain terminology as used in strength of materials and solve related problems.	**Modernise**	**No Feedback Received**	**None**
1.1 Direct stress and strain, shear stress and strain, modulus of elasticity “E”, factor of safety and proof stress	Contextualise	No Feedback Received	None
1.2 Stresses in simple and stepped bars subjected to linear thermal strain	Keep	No Feedback Received	None
1.3 Temperature change on composite members	Keep	No Feedback Received	None
1.4 Differential thermal expansion and contraction	Keep	No Feedback Received	None
1.5 Compound bars subjected to both direct loading and temperature change	Keep	No Feedback Received	None
Outcome 2: Explain and solve problems relating to shear forces and bending moments on simply supported and cantilever beams	**Contextualise**	**No Feedback Received**	**None**
2.1 Support reactions for beams subjected to point or uniformly distributed loads	Keep	No Feedback Received	None
2.2 Shear force and bending moment diagrams for simply supported and cantilever beams	Keep	No Feedback Received	None
2.3 Point of contraflexure	Keep	No Feedback Received	None
2.4 Uniformly varying distributed loading	Keep	No Feedback Received	None

2.5 Bending Equation	Keep	No Feedback Received	None
2.6 Section modulus “Z”	Keep	No Feedback Received	None
Outcome 3: Explain and solve problems on the theory of torsion involving circular sections and close coiled helical springs	**Contextualise**	**No Feedback Received**	**None**
3.1 Assumptions for deriving the torsion theory	Keep	No Feedback Received	None
3.2 Torsion equation	Keep	No Feedback Received	None
3.3 Power transmitted by a rotating shaft	Keep	No Feedback Received	None
3.4 Torsional stiffness	Keep	No Feedback Received	None
3.5 Relationship between torque transmitted by a shaft and shear force induced in the coupling bolts	Keep	No Feedback Received	None
3.6 Formula for stress and deflection of a helical spring subjected to an axial load	Keep	No Feedback Received	None
3.7 Design of helical springs	Keep	No Feedback Received	None
Outcome 4: Explain and solve problems on elastic strain energy and stresses on oblique planes of stressed material	**Contextualise**	**No Feedback Received**	**None**
4.1 Strain energy and resilience	Keep	No Feedback Received	None
4.2 Expression for elastic strain energy	Keep	No Feedback Received	None
4.3 Impact Loading	Keep	No Feedback Received	None
4.4 Conversion of PE and KE into strain energy to determine maximum instantaneous stress deformation	Keep	No Feedback Received	None
4.5 Expression for strain energy of a helical spring	Keep	No Feedback Received	None
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			

How would you deliver this outcome/ objective?	How would you assess this outcome/ objective?	Action required	Consultation Support %
Ensure all outcomes are contextualised to help Cadets understand what they are learning in relation to what they will experience at sea.	While some outcomes are intrinsically linked to work carried out at sea, some need to be contextualised to show how they apply to work on board. Where this is the case, it is important to make sure Cadets clearly understand how the outcome relates to work at sea and it is essential to make sure that this context is given with reference to current and future seagoing technologies and practices.	Where outcomes do not specifically cover a topic which relates to work carried out at sea, more must be done to contextualise the outcome and make it relevant to the maritime industry, giving specific shipping examples of how the outcome may be applied in a modern shipping context. Not every template has contextualisation recommendations but please do add any you feel may have been missed.	No Feedback Received
Include Human Element Factors throughout the syllabus	To provide seafarers with a contextualised understanding of the Human Element in the maritime industry, showing how they can put theory into practice in the work they carry out at sea.	Raise awareness throughout the Cadet's training of the areas in which human element factors will have an impact. Recommendations on where this can be included have been noted throughout the entire syllabus. Not every template has Human Element Factor recommendations but please do add any you feel may have been missed.	No Feedback Received
Include Data Science skills throughout the syllabus	Data Science Skills (Comprehension, Analysis, Presentation, etc...) are already required within much of the syllabus. A further, specific focus on these skills needs to be taught where relevant.	A specific topic will need to be introduced to improve Cadets' Data Science skills. Practical application of data science skills should be highlighted throughout the syllabus. Not every template has Data Science recommendations but please	No Feedback Received

		do add any you feel may have been missed.	

ETO - Marine Navigation Systems			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1: Analyse marine radar and automatic radar plotting systems	**Keep**	**100%**	**None**
1.1 Calculate and explain the factors affecting minimum range, range discrimination, bearing discrimination, scanner speed	Contextualise	100%	None
1.2 Calculate and explain the correlation between scanner speed, Pulse Repetition Frequency (PRF), Horizontal Bandwidth (HBW).	Contextualise	50%	None
1.3 Modes of presentation	Keep	100%	None
1.4 Radar/ARPA systems	Keep	100%	None
1.5 Target acquisition and tracking	Keep	100%	None
1.6 System Interfacing requirements	Keep	100%	None
Outcome 2: Analyse terrestrial and satellite position fixing and transponder systems	**Keep**	**100%**	**None**
2.1 Principles of a Global Position System (GPS)	Keep	100%	None
2.2 Operation of GPS	Keep	100%	None
2.3 Operation of GPS receivers	Keep	100%	None
2.4 Principles of operation of the eLoran system	Remove	100%	None
2.5 Operation of the eLoran system	Remove	100%	None

2.6 Principles of operation of Automatic Identification Systems (AIS)	Keep	100%	None
2.7 AIS data transmission	Keep	100%	None
2.8 Interfacing of AIS and GPS	Keep	100%	None
Outcome 3: Explain ship speed and distance measuring systems and echo sounding systems	**Keep**	**100%**	**None**
3.1 Factors affecting the speed of sound in seawater	Keep	100%	None
3.2 Losses affecting sound propagation through sea water	Keep	100%	None
3.3 Absolute and relative speed	Keep	100%	None
3.4 Construction and use of electrostrictive transducers for speed and distance measurement	Keep	100%	None
3.5 Doppler shift measurement compensation for trim and pitch	Keep	100%	None
3.6 Compensation methods for change in salinity and temperature of sea water	Keep	100%	None
3.7 Ship speed measurement system, electromagnetic log	Keep	100%	None
3.8 Marine echo sounding system	Keep	100%	None
3.9 The principles of echo sounding	Keep	100%	None
Outcome 4: Assess automatic steering systems	**Keep**	**100%**	**None**
4.1 Regulations governing automatic steering systems	Keep	100%	None
4.2 Non follow up (NFU) and follow up (FU) control of	Keep	100%	None

electro-hydraulic steering gear			
4.3 The components of a marine autopilot system	Keep	100%	None
4.4 Application of three term control and the effect of control settings on autopilot	Keep	100%	None
4.5 Integration of autopilot with other navigation systems	Keep	100%	None
Outcome 5: Explain marine compass and repeater systems	**Keep**	**100%**	**None**
5.1 Principles of operation of a magnetic compass	Keep	100%	None
5.2 Construction and location of a marine magnetic compass	Keep	100%	None
5.3 Principle of a free gyroscope	Keep	100%	None
5.4 Construction of a marine gyro compass	Keep	100%	None
5.5 Operation of a marine gyro compass	Keep	100%	None
5.6 Compass repeater systems	Keep	100%	None
5.7 Principles of other compasses used in the maritime industry (e.g. Fibreoptic)	Add	100%	None
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
How would you deliver this outcome/ objective?	**How would you assess this outcome/ objective?**	**Action required**	**Consultation Support %**

Basic overview of Dynamic Positioning systems	Dynamic Positioning systems are now more common at sea and should be covered in this module.	Add an outcome including: Examples of different types Principles of DP systems. Understanding of standard signals working within a DP system	100%
Awareness of future navigational automation technologies	Navigational automation technology is becoming more common at sea and should be covered in this module.	Add an outcome including: Overview of upcoming technologies and potential impact on ETOs. Automation	100%
Working with Integrated Bridge Systems.	Integrated Bridge systems are now more common at sea and should be covered in this module.	Add an outcome including: Fault finding challenges interacting with Integrated Bridge Systems Working with shoreside technicians. Understanding of the elements of an Integrated Bridge System	100%
Ensure all outcomes are contextualised to help Cadets understand what they are learning in relation to what they will experience at sea.	While some outcomes are intrinsically linked to work carried out at sea, some need to be contextualised to show how they apply to work on board. Where this is the case, it is important to make sure Cadets clearly understand how the outcome relates to work at sea and it is essential to make sure that this context is given with reference to current and	Where outcomes do not specifically cover a topic which relates to work carried out at sea, more must be done to contextualise the outcome and make it relevant to the maritime industry, giving specific shipping examples of how the outcome may be applied in a modern shipping context. Not every template has contextualisation	100%

	future seagoing technologies and practices.	recommendations but please do add any you feel may have been missed.	
Include Human Element Factors throughout the syllabus	To provide seafarers with a contextualised understanding of the Human Element in the maritime industry, showing how they can put theory into practice in the work they carry out at sea.	Raise awareness throughout the Cadet's training of the areas in which human element factors will have an impact. Recommendations on where this can be included have been noted throughout the entire syllabus. Not every template has Human Element Factor recommendations but please do add any you feel may have been missed.	100%
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Marine Engineering - Applied Mechanics (Management Level)			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1: Solve equilibrium problems related to bodies subjected to coplanar and non-coplanar force systems	**Keep**	**100%**	**Added industry suggestion to: "Include the application of these concepts in the operation of onboard machinery." And "Use Case Studies and Industry Guidelines."**
1.1 Cranks and connecting rods	Keep	100%	None
1.2 Non coplanar force system	Keep	100%	None
1.3 Bodies on an inclined plane	Keep	100%	None
1.4 Rapsons slide	Keep	100%	None
Outcome 2: Solve problems involving combinations of linear, angular and relative motion	**Keep**	**100%**	**Added industry suggestion to: "Include the application of these concepts in the operation of onboard machinery." And "Use Case Studies and Industry Guidelines."**
2.1 Single and double projectiles	Keep	100%	None
2.2 Velocity vector diagrams of simple mechanisms	Keep	100%	None
2.3 Stepped rope and flywheel systems	Keep	100%	None
2.4 Angular momentum and impulse	Keep	100%	None
2.5 Moment of Inertia and Radius of Gyration	Keep	100%	None
Outcome 3: Solve problems involving simple harmonic motion	**Keep**	**100%**	**Added industry suggestion to: "Include the application of these concepts in the operation of onboard**

			machinery." And "Use Case Studies and Industry Guidelines."
3.1 Spring and mass systems	Keep	100%	None
3.2 Pendulums	Keep	100%	None
3.3 Crank and connecting rods	Keep	100%	None
3.4 Cams and followers	Keep	100%	None
Outcome 4: Solve problems involving the dynamics of motion	**Keep**	**100%**	**Added industry suggestion to: "Include the application of these concepts in the operation of onboard machinery." And "Use Case Studies and Industry Guidelines."**
4.1 Newton's 3 laws of motion	Keep	100%	None
4.2 Tractive effort and tractive resistance	Keep	100%	None
4.3 Bodies hauled or lowered on an inclined plane	Keep	100%	None
4.4 Power, force and velocity	Keep	100%	None
4.5 Potential and kinetic energy	Keep	100%	None
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
How would you deliver this outcome/ objective?	**How would you assess this outcome/ objective?**	**Action required**	**Consultation Support %**
Ensure all outcomes are contextualised to help Cadets understand what they are learning in relation to what they will experience at sea.	While some outcomes are intrinsically linked to work carried out at sea, some need to be contextualised to show how they apply to work on board. Where this is the case, it is important to make sure Cadets clearly understand how the outcome relates to work at sea and it is essential to make sure that this context is given with	Where outcomes do not specifically cover a topic which relates to work carried out at sea, more must be done to contextualise the outcome and make it relevant to the maritime industry, giving specific shipping examples of how the outcome may be applied in a modern shipping context. Not every template has	100%

	reference to current and future seagoing technologies and practices.	contextualisation recommendations but please do add any you feel may have been missed.	
Include Human Element Factors throughout the syllabus	To provide seafarers with a contextualised understanding of the Human Element in the maritime industry, showing how they can put theory into practice in the work they carry out at sea.	Raise awareness throughout the Cadet's training of the areas in which human element factors will have an impact. Recommendations on where this can be included have been noted throughout the entire syllabus. Not every template has Human Element Factor recommendations but please do add any you feel may have been missed.	100%
Include Data Science skills throughout the syllabus	Data Science Skills (Comprehension, Analysis, Presentation, etc...) are already required within much of the syllabus. A further, specific focus on these skills needs to be taught where relevant.	A specific topic will need to be introduced to improve Cadets' Data Science skills. Practical application of data science skills should be highlighted throughout the syllabus. Not every template has Data Science recommendations but please do add any you feel may have been missed.	100%

ETO - Radio Communications			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1: Analyse amplitude and angle modulation	**Keep**	**No Feedback Received**	**None**
1.1Waveform and modulation index for an amplitude modulated (AM) waveform	Keep	No Feedback Received	None
1.2 Signal spectrum of an AM waveform	Keep	No Feedback Received	None
1.3 Power in each frequency component of a radiated AM waveform	Keep	No Feedback Received	None
1.4 Operation of an AM envelope detector	Keep	No Feedback Received	None
1.5 Signal spectrum of a single sideband (SSB) transmitter at key points	Keep	No Feedback Received	None
1.6 Modulation index and frequency deviation of a frequency modulated (FM) waveform	Keep	No Feedback Received	None
1.7 Signal spectrum of an FM waveform	Keep	No Feedback Received	None
1.8 Frequency deviation and the use of pre-emphasis and de-emphasis in a FM context	Keep	No Feedback Received	None
1.9 The applications of FM and AM	Keep	No Feedback Received	None
Outcome 2: Explain the principles of radiation and propagation of transverse electromagnetic waves in the bands very low frequency (VLF) to extra high frequency (EHF)	**Keep**	**No Feedback Received**	**None**

2.1 Fundamentals of electromagnetic waves	Keep	No Feedback Received	None
2.2 Radiation and reception of electromagnetic waves	Keep	No Feedback Received	None
2.3 Properties of aerials for electromagnetic waves	Keep	No Feedback Received	None
2.4 The electromagnetic spectrum.	Keep	No Feedback Received	None
2.5 Bandwidth, classification, application of radio bands	Keep	No Feedback Received	None
2.6 Modes of propagation of radio waves of different frequencies	Keep	No Feedback Received	None
2.7 Errors and losses within the propagation of radio waves	Keep	No Feedback Received	None
2.8 Radio horizon	Keep	No Feedback Received	None
2.9 Anomalous propagation	Keep	No Feedback Received	None
Outcome 3: Investigate and evaluate the principles and operation of radio transmitters	**Contextualise**	**No Feedback Received**	**None**
3.1 The legal requirements for transmitter operation	Keep	No Feedback Received	None
3.2 The operating principles of an amplitude-modulated (AM) transmitter	Keep	No Feedback Received	None
3.3 The function of the stages of an AM transmitter	Keep	No Feedback Received	None
3.4 The operating principles of a frequency-modulated (FM) transmitter	Keep	No Feedback Received	None
3.5 The function of the stages of an FM transmitter	Keep	No Feedback Received	None
3.6 Carrier frequency generation	Keep	No Feedback Received	None
3.7 Digital modulation techniques and transmission	Add	No Feedback Received	None

Outcome 4: Investigate and evaluate the principles and operation of radio receivers	**Contextualise**	**No Feedback Received**	**None**
4.1 The operation of an AM tuned-radio frequency (TRF) receiver	Keep	No Feedback Received	None
4.2 The disadvantages of TRF	Keep	No Feedback Received	None
4.3 The operating principles of the superheterodyne receiver	Keep	No Feedback Received	None
4.4 The operation of a superheterodyne receiver	Keep	No Feedback Received	None
4.5 The operation of a superheterodyne receiver	Remove	No Feedback Received	None
4.6 Signal processing techniques	Add	No Feedback Received	None
Outcome 5: Outline Satellite communication principles	**Keep**	**No Feedback Received**	**None**
5.1 Principles of operation of satellite communication systems and antennas	Keep	No Feedback Received	None
5.2 Maritime satellite communication systems	Keep	No Feedback Received	None
5.3 Satellite communication system antennas.	Keep	No Feedback Received	None
5.4 Modulation techniques	Keep	No Feedback Received	None
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
How would you deliver this outcome/ objective?	**How would you assess this outcome/ objective?**	**Action required**	**Consultation Support %**
Ensure all outcomes are contextualised to help Cadets understand what they are learning in relation to what they will experience at sea.	While some outcomes are intrinsically linked to work carried out at sea, some need to be contextualised to show how they apply to work on board. Where this is the case, it is important to make sure Cadets clearly	Where outcomes do not specifically cover a topic which relates to work carried out at sea, more must be done to contextualise the outcome and make it relevant to the maritime industry, giving specific shipping	No Feedback Received

	understand how the outcome relates to work at sea and it is essential to make sure that this context is given with reference to current and future seagoing technologies and practices.	examples of how the outcome may be applied in a modern shipping context. Not every template has contextualisation recommendations but please do add any you feel may have been missed.	
Include Human Element Factors throughout the syllabus	To provide seafarers with a contextualised understanding of the Human Element in the maritime industry, showing how they can put theory into practice in the work they carry out at sea.	Raise awareness throughout the Cadet's training of the areas in which human element factors will have an impact. Recommendations on where this can be included have been noted throughout the entire syllabus. Not every template has Human Element Factor recommendations but please do add any you feel may have been missed.	No Feedback Received
Include Data Science skills throughout the syllabus	Data Science Skills (Comprehension, Analysis, Presentation, etc...) are already required within much of the syllabus. A further, specific focus on these skills needs to be taught where relevant.	A specific topic will need to be introduced to improve Cadets' Data Science skills. Practical application of data science skills should be highlighted throughout the syllabus. Not every template has Data Science recommendations but please do add any you feel may have been missed.	No Feedback Received

Marine Engineering - Mechanics (Management Level)			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1 Explain and solve problems relating to centripetal and centrifugal forces involving clutches and governors	**Keep**	**100%**	**None**
1.1 Centripetal and centrifugal force	Keep	100%	None
1.2 Clutches	Keep	100%	None
1.3 Balancing of rotating masses	Keep	100%	None
1.4 Governors	Keep	100%	None
Outcome 2: Explain and solve problems relating to moments of area and mass	**Keep**	**100%**	**None**
2.1 Moments of mass	Keep	100%	None
2.2 Moments of area	Keep	100%	None
2.3 Centroid of laminas made up of basic shapes	Keep	100%	None
Outcome 3: Explain and solve problems relating to forces in engineering frameworks	**Keep**	**100%**	**None**
3.1 Stable, unstable, and neutral equilibrium	Keep	100%	None
3.2 Struts and ties	Keep	100%	None
3.3 Pin Joints	Keep	100%	None
3.4 Reaction forces	Keep	100%	None
3.5 Bows Notation	Keep	100%	None
Outcome 4: Explain and solve problems relating to the stability of axially loaded columns and stresses found within thin cylinders	**Keep**	**100%**	**None**

4.1 Hoop and longitudinal stress in thin cylinders	Keep	100%	None
4.2 Direct and shear stress on oblique seams of thin cylinder	Keep	100%	None
4.3 Axially loaded columns	Keep	100%	None
4.4 Buckling and slenderness ratio	Keep	100%	None
4.5 Euler formula	Keep	100%	None
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
How would you deliver this outcome/ objective?	**How would you assess this outcome/ objective?**	**Action required**	**Consultation Support %**
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		do add any you feel may have been missed.	
Include Data Science skills throughout the syllabus	Data Science Skills (Comprehension, Analysis, Presentation, etc...) are already required within much of the syllabus. A further, specific focus on these skills needs to be taught where relevant.	A specific topic will need to be introduced to improve Cadets' Data Science skills. Practical application of data science skills should be highlighted throughout the syllabus. Not every template has Data Science recommendations but please do add any you feel may have been missed.	100%

Marine Engineering - Workshop Skills			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Safe and efficient use of equipment using COSWP and permit to work systems.	**Keep**	**100%**	**None**
1.1 Inspection of equipment, care, selection, and suitability of equipment.	Include Human Element Factors in this outcome.	100%	None
1.2 Use and care of hand tools: File, Hacksaw, Chisel, Screwdriver, Hammers, Spanners, Sockets, Torque, wrench, Scraper, Taps and dies, Hand reamers, Power Tools	Remove Hand Reamers Add Power Tools	100%	None
1.3 Inspection of tools for their fitness for use	Keep	100%	None
1.4 Sharpening and dressing of hand tools.	Keep	100%	None
1.5 Use of abrasive wheels, certificates and regulations pertaining.	Keep	100%	None
Outcome 2: Measuring equipment	**Modernise**	**100%**	**None**
2.1 Callipers and rules	Modernise	100%	None
2.2 Internal and external micrometer	Modernise	100%	None
2.3 Vernier calliper	Modernise	100%	None
2.4 Feelers	Modernise	100%	None
2.5 DTIS	Modernise	100%	None
2.6 Marking out	Modernise	100%	None
Outcome 3: Effective use of communicating technical information.	**Keep**	**100%**	**None**
3.1. Technical Drawings	Keep	100%	None

Outcome 4: Safe use of machinery.	**Keep**	**100%**	**None**
4.1 Drilling machine	Keep	100%	None
4.2 Centre lathe	Keep	100%	None
4.3 Vertical milling machine	Remove	0%	None
4.4 Off-hand grinding machine	Remove	100%	None
4.5 Metal joining and gas cutting	Keep	100%	None
4.6 Mechanical joints including pipe work	Keep	100%	None
Outcome 5: Specification for training in maintenance, assembly skills, Electrical and electronic skills:	**Keep**	**100%**	**None**
5.1 Safe and efficient use of suitable equipment in conjunction with COSWP	Keep	100%	None
5.2 Inspection and care of equipment	Keep	100%	None
5.3 Selection and suitability of equipment	Keep	100%	None
Outcome 6: Maintenance Skills	**Keep**	**100%**	**None**
6.1 Work planning	State the requirements of this outcome	100%	None
6.2 Safety precautions	Keep	100%	None
6.3 Permits to work	Keep	100%	None
6.4 Spare parts requirement	Keep	100%	None
6.5 Use of drawings	Keep	100%	None
6.6 Interpretation of electrical circuit diagrams and symbols	Keep	100%	None
6.7 Completing the job safely	Keep	100%	None
6.8 Testing and commissioning	Keep	100%	None
6.9 Restoring work area	Keep	100%	None
6.10 Completion of records	Keep	100%	None
Outcome 7: Assembly skills	**Keep**	**100%**	**None**
7.1 Lifting and slinging	Contextualise	100%	None

7.2 Fault diagnosis	Include Data Science skills throughout the syllabus	100%	None
7.3 Tool selection and usage	Keep	100%	None
7.4 Use of drawings and manuals	Keep	100%	None
7.5 Dis-assembly and assembly using methods of sealing techniques	Keep	100%	None
7.6 Appropriate use of force	Keep	100%	None
7.7 Use of pulling tools.	Keep	100%	None
7.8 Component management and care using marking, damage protection, cleanliness and care during maintenance.	State the requirements of this outcome	100%	None
7.9 Assessment of condition by way of checking clearances, wear, alignment.	Keep	100%	None
7.10 Torque and tightening sequences.	Keep	100%	None
7.11 Adjustments and settings.	Keep	100%	None
7.12 Limits and fits.	Keep	100%	None
7.13 Bearing fitting.	Keep	100%	None
Outcome 8: Electrical/electronic practice	**Keep**	**100%**	**None**
8.1 Safety aspects.	Keep	100%	None
8.2 Use and care of tools.	Keep	100%	None
8.3 Minor wiring installation and repair.	Keep	100%	None
8.4 Basic diagnostic skills.	Keep	100%	None
8.5 Recognizing common components, symbols and configuration	Keep	100%	None
8.6 Electrical power circuits, rectification and amplification circuits-- Build and test full wave and half wave rectifiers.	Keep	100%	None

8.7 Ripple frequency, smoothing, build and test a single stage amplifier and determine stage gain and use of test equipment.	Keep	100%	None
8.8 Maintenance testing and fault finding of machines and controllers both AC and DC—strip down and re-build.	Keep	100%	None
8.9 Insulation testing on machines, single phasing, Identification in a range of starters, DOL, Star, Delta, Auto transformer.	Keep	100%	None
8.10 Maintenance procedures.	Keep	100%	None
8.11 Fault finding.	Include Data Science skills throughout the syllabus	100%	None
8.12 Generator maintenance and control.	Keep	100%	None
8.13 HV and LV distribution.	Keep	100%	None
8.14 Hazardous area installation, equipment and maintenance.	Contextualisation	100%	None
8.15 Use of drawings and international circuit diagrams.	Keep	100%	None
8.16 Electrochemical as applied to batteries, electro-chlorination, cathodic protection and water sterilization methods.	Contextualisation	100%	None
Outcome 9: Refrigeration and air conditioning technologies	**Add**	**100%**	**None**
Outcome 10: Awareness of 3-D Printing	**Add**	**100%**	**None**
Outcome 11: Human Machine Interface similar to ETO workshop skills	**Add**	**100%**	**None**

Outcome 12: Use of diagnostic software and remote assistance for fault finding	**Add**	**100%**	**None**
Outcome 13: Hydraulics and pneumatics	**Add**	**100%**	**None**
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
How would you deliver this outcome/ objective?	**How would you assess this outcome/ objective?**	**Action required**	**Consultation Support %**
Consider crossover between workshop skills for Engineers and ETOs.	If there is crossover between the two workshop skills modules, they could be taught in conjunction to save time and resources for colleges, cadets and shipping companies alike.	When creating the finalised academic modules CT&M Sub-Group 1.2 will highlight any crossover between the two modules.	100%
Ensure all outcomes are contextualised to help Cadets understand what they are learning in relation to what they will experience at sea.	While some outcomes are intrinsically linked to work carried out at sea, some need to be contextualised to show how they apply to work on board. Where this is the case, it is important to make sure Cadets clearly understand how the outcome relates to work at sea and it is essential to make sure that this context is given with reference to current and future seagoing technologies and practices.	Where outcomes do not specifically cover a topic which relates to work carried out at sea, more must be done to contextualise the outcome and make it relevant to the maritime industry, giving specific shipping examples of how the outcome may be applied in a modern shipping context. Not every template has contextualisation recommendations but please do add any you feel may have been missed.	100%

Include Human Element Factors throughout the syllabus	To provide seafarers with a contextualised understanding of the Human Element in the maritime industry, showing how they can put theory into practice in the work they carry out at sea.	Raise awareness throughout the Cadet's training of the areas in which human element factors will have an impact. Recommendations on where this can be included have been noted throughout the entire syllabus. Not every template has Human Element Factor recommendations but please do add any you feel may have been missed.	100%
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ETO - Workshop Skills			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Procedures	**Include Human Element Factors**	**100%**	**None**
1.1 Code of safe working practices	Keep	100%	None
1.2 Hazards	Amend – move to a different outcome	100%	None
1.2 Provision use of equipment	Add & modernise	100%	None
1.3 Use of tools and equipment	Add	100%	None
1.4 Portable power operated tools and equipment	Add	100%	None
1.5 Workshop and bench machines (fixed installations)	Add	100%	None
1.6 Manual handling	Add	100%	None
Outcome 2: Risk Assessment (RA)	**Keep**	**100%**	**None**
2.1 Assessment	Keep	100%	None
2.2 Principles	Include Human Element Factors	100%	None
2.3 Hazard identification	Contextualise	100%	None
2.4 Risk control measures	Contextualise	100%	None
2.5 Hazards	Add	100%	None
Outcome 3: Permit to work systems	**Keep**	**100%**	**None**
3.1 Permit to work checklist	Keep	100%	None
3.2 Provision use of equipment	Amend – move to a different outcome	100%	None

3.2 Definition and purpose of a Permit to Work	Add this sub-outcome	100%	None
3.3 Use of tools and equipment	Amend – move to a different outcome	100%	None
3.3 Information included on a Permit to Work	Add this sub-outcome	100%	None
3.4 Portable power operated tools and equipment	Amend – move to a different outcome	100%	None
3.4 Types of Permit to Work	Add this sub-outcome	100%	None
3.5 Electrical shock	Keep	100%	None
3.6 Electrical wiring	Keep	100%	None
3.7 Workshop and bench machines (fixed installations)	Amend – move to a different outcome	100%	None
3.8 Manual handling	Amend – move to a different outcome	100%	None
Outcome 4: Lock out procedures	**Contextualise**	**100%**	**None**
Outcome 5: Electricity at work regulations (1989)	**Contextualise**	**100%**	**None**
5.1 Safe isolation procedures	As per outcome 5	100%	None
5.2 Safe isolation practice	As per outcome 5	100%	None
5.3 Isolation of individual circuits	As per outcome 5	100%	None
5.4 Isolation of individual circuits protected by circuit breakers	As per outcome 5	100%	None
5.5 Isolation of individual circuits protected by fuses	As per outcome 5	100%	None
5.6 Neutral conductor	As per outcome 5	100%	None

5.7 Proving dead	As per outcome 5	100%	None
5.8 Unused or unidentified cables	As per outcome 5	100%	None
5.9 New installations	As per outcome 5	100%	None
Outcome 6: Use of a residual current device (RCD)	**Keep**	**100%**	**None**
Outcome 7: Portable appliance test (PAT)	**Keep**	**100%**	**None**
7.1 Examples of PAT class 1 and class 2 appliances and power cords	Keep	100%	None
Outcome 8: Electronics	**Keep**	**100%**	**None**
8.1 Resistor colour code	Contextualise	100%	None
8.2 Electron components; identification, testing and preparation for soldering	Keep	100%	None
8.3 Diodes and testing of various diodes	Keep	100%	None
8.4 Transistors and testing	Keep	100%	None
8.5 Capacitors and testing	Keep	100%	None
8.6 Design and build electronic circuits using discrete components on circuit board	Add	100%	None
8.7 Take measurements on electronic circuits using a range of instruments	Add	100%	None
Outcome 9: Motors-3 Phase inc construction	**Keep**	**100%**	**None**
9.1 Testing a motor, motor-starter control equipment – Build, test, and commission	Contextualise	100%	None
9.2 Polarisation index, an alternative way to IR test	Contextualise with High Voltage (HV) systems	100%	None

9.3 PI – Best practice and IEEE Regs	Keep	100%	None
9.4 Relay circuits theory & practice using motor-starter control equipment	Keep	100%	None
Outcome 10: STAR (Y)/ DELTA (∆) Theory / practise	**Keep**	**100%**	**None**
10.1 DOL Starters	Add	100%	None
10.2 STAR (Y)/ DELTA (∆)	Add	100%	None
10.3 Soft Starter	Add	100%	None
10.4 Variable frequency drive	Add	100%	None
Outcome 11: 3 Phase transformer connections and advantages	**Keep**	**100%**	**None**
Outcome 12: Batteries	**Keep**	**100%**	**None**
12.1 Valve regulated lead acid (VRLA) batteries	Modernise	100%	None
12.2 Other types of VRLA batteries	Contextualise	100%	None
12.3 Reasons why batteries fail	Keep	100%	None
12.4 Battery general care procedures	Keep	100%	None
12.5 Maintenance	Keep	100%	None
12.6 Determining when a battery is fully charged	Keep	100%	None
12.7 Testing the batteries	Keep	100%	None
12.8 Hydrometer use	Keep	100%	None
12.9 Load test battery – Motor starting	Keep	100%	None
12.10 Cold cranking amps	Keep	100%	None
12.11 Cranking amps	Keep	100%	None
12.12 Reserve capacity	Keep	100%	None
12.13 Latest technological developments in battery	Include impact on propulsion systems	100%	None
Outcome 13: UPS – GMDSS – Navigation SIM room – Circuit diagram	**Modernise**	**100%**	**None**

Outcome 14: Motor generator set v-belt replacement and tensioning	**Contextualise**	**100%**	**None**
Outlook 15: Programmable logic controllers (PLC's)	**Contextualise**	**100%**	**None**
15.1 ladder logic	Keep	100%	None
15.2 Programming rules	Keep	100%	None
15.3 Addressing	Keep	100%	None
15.4 Safety	Keep	100%	None
15.5 Modification	Keep	100%	None
15.6 Zero logic smart relay programming	Keep	100%	None
Outcome 16: Hazardous area electrical equipment report	**Keep**	**100%**	**None**
Outcome 17: Hazardous area electrical equipment – Cables and glands	**Include an appreciation of the hazards caused by and safety measures required modern and future fuels.**	**100%**	**None**
Outcome 18: Navigation lights system	**Keep**	**100%**	**None**
Outcome 19: Fire alarm system	**Contextualise**	**100%**	**None**
Outcome 20: Generator switching simulator MODEQ-100	**Contextualise**	**100%**	**None**
Outcome 21: Variable speed drive	**Keep**	**100%**	**None**
Outcome 22: Measuring physical quantities	**Contextualise**	**100%**	**None**
Outcome 23: Instrumentation –	**Keep**	**100%**	**None**

Designing measurement circuits			
Outcome 24: The application of human factors principles to the design of devices and systems	**Add this outcome**	**100%**	**None**
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
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