Maritime & Coastguard Agency

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

June 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 6th March to the 3rd April 2023 regarding the Cadet Training Syllabus Review. The consultation was published on 06th March 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 fourth consultation was carried out between 6th March and 3rd April 2023 and can be found at: www.gov.uk

1.2.3 A total of 15 responses were received across the seven 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.

1.2.4 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 32 outcomes over eight templates were posed in the fourth 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:

Marine Engineering - Electro-Technology			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Explain fundamental electrical concepts and quantify their electrical units	**Keep**	**100%**	**None**
1.1 Electrical charge, current, voltage, energy, power	Keep	100%	None
1.2 Potential difference, emf, resistance, inductance, and capacitance	Modernise	100%	None
1.3 Temperature coefficient of resistance	Modernise	100%	None
Outcome 2: Solve problems on DC circuits with resistances in parallel and series	**Keep**	**100%**	**None**
2.1 Series resistive DC circuits	Keep	100%	None
2.2 Parallel resistive DC circuits	Keep	100%	None
2.3 Combination Series and Parallel resistive DC circuits	Keep	100%	None
2.4 Wheatstone bridge	Modernise	100%	None
Outcome 3: Solve problems on series single phase AC circuits comprising resistance, capacitance and inductance	**Keep**	**100%**	**None**

3.1 Basic use of polar and rectangular forms of complex number	Remove	67%	None
3.2 RLC series AC circuits	Keep	100%	None
3.3 Power factor, apparent power, true power, and reactive power	Keep	100%	None
3.4 Phasor diagrams	Amend	100%	None
Outcome 4: Explain high voltage at operational level in marine electrical practice	**Keep**	**100%**	**None**
4.1 High voltage marine generators and systems	Keep	100%	None
4.2 High voltage protection devices and circuit protection	Keep	100%	None
4.3 Insulated and earthed neutral distribution systems and earthing requirements	Keep	100%	None
4.4 Safety requirements necessary for HV installations	Keep	100%	None
4.5 Safe working practice and permit to work	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:			
Objective	**Reason Why**	**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	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	No Feedback Received

	future seagoing technologies and practices.	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 - Electrical Distribution system			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Solve Problems on three phase balanced and unbalanced AC circuits	**Modernise**	**100%**	**None**
1.1 Balanced star and/or delta connected three phase AC loads	Modernise	100%	None
1.2 Phasor diagrams	Modernise	100%	None
1.3 Unbalanced three phase AC loads	Modernise	100%	None
Outcome 2: Solve problems on three phase AC motors	**Modernise**	**100%**	**None**
2.1 Induction motors	Modernise	100%	None
2.2 Synchronous motors	Modernise	100%	None
Outcome 3: Solve problems on Distribution systems and load sharing.	**Modernise**	**100%**	**None**
3.1 Distribution system load sharing	Modernise	100%	None
3.2 Power factor including its correction	Modernise	100%	None
Outcome 4: Explain and solve problems on AC transformers	**Modernise**	**100%**	**None**
4.1 Principle of operation and construction	Modernise	100%	None
4.2 EMF equation, transformer ratio and VA ratings.	Modernise	100%	None
4.3 Phasor diagrams	Modernise	100%	None
4.4 Transformer losses and efficiency	Modernise	100%	None
4.5 Principle of operation of an autotransformer including applications and circuit diagrams	Modernise	100%	None

4.6 Solve problems on autotransformers, involving voltages, turns ratio, and tapping points	Modernise	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:			
Objective	**Reason Why**	**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.	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	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	100%

	focus on these skills needs to be taught where relevant.	every template has Data Science recommendations but please do add any you feel may have been missed.	

Marine Engineering - Electrical Machines			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Explain the layout and component parts of typical marine electrical distribution systems	**Keep**	**100%**	**None**
1.2 Insulated and earthed neutrals systems	Keep	100%	None
1.3 Distribution circuit breakers	Modernise	100%	None
1.4 Power and instrument transformers	Modernise	100%	None
1.5 Circuit protection	Keep	100%	None
Outcome 2: Explain the construction and operation of AC generators	**Keep**	**100%**	**None**
2.1 AC generator construction and cooling	Keep	100%	None
2.2 AC generator operation	Keep	100%	None
2.3 Excitation methods	Keep	100%	None
2.4 Automatic Voltage Regulation	Keep	100%	None
2.5 Generators in parallel	Keep	100%	None
2.6 Emergency generators	Keep	100%	None
Outcome 3: Explain the construction and operation of AC motors	**Keep**	**100%**	**None**
3.1 Three phase induction and synchronous motors	Modernise	100%	None
3.2 Construction of three phase induction and synchronous motors	Modernise	100%	None
3.3 Characteristics of three phase induction and synchronous motors	Modernise	100%	None

3.4 Starting of three phase induction motors	Keep	100%	None
3.5 Speed control of three phase induction and synchronous motors	Keep	100%	None
Outcome 4: Explain the operation of electronic devices in power circuits	**Keep**	**100%**	**None**
4.1 Operation and characteristics of a thyristor	Keep	100%	None
4.2 Phase shift control of a thyristor circuit	Keep	100%	None
4.3 Operation and characteristics of Zener diode	Keep	100%	None
4.4 DC stabilizer circuits	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:

Objective	Reason Why	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.	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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Marine Engineering - Electrical Power (Management Level)			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Solve problems on Resistive DC circuits connected in series and parallel	**Modernise**	**100%**	**None**
1.1 DC radial feeders circuits involving no more than three unknowns	Modernise	100%	None
1.2 DC ring mains circuits involving no more than three unknowns	Modernise	100%	None
1.3 DC double-fed systems involving no more than three unknowns	Modernise	100%	None
Outcome 2: Solve problems on Non-linear DC transient circuits, Resistive/Capacitive and Resistive Inductive circuits	**Modernise**	**100%**	**None**
2.1 RC connected DC circuit transients during charge/discharge	Modernise	100%	None
2.2 RL connected DC circuit transients during switch on and/or switch	Modernise	100%	None
Outcome 3: Evaluate parallel single phase AC circuits comprising resistance, capacitance and inductance	**Keep**	**100%**	**None**
3.1 Single phase parallel RLC AC circuits	Keep	100%	None
3.2 Phasor diagrams, impedance, resistance, capacitance	Keep	100%	None
3.3 Inductance, power factor	Keep	100%	None
3.4 Apparent power, true power, reactive power	Keep	100%	None

3.5 Power factor correction	Keep	100%	None
Outcome 4: Evaluate Electronics in marine applications	**Keep**	**100%**	**None**
4.1 Operations of p and n type diode	Keep	100%	None
4.2 Rectification of an ac single phase supply	Keep	100%	None
4.3 Rectifier circuits using one or two diodes; centre tapped transformer; bridge rectifier	Keep	100%	None
4.4 Rectifier voltage calculations	Keep	100%	None
4.5 Formation of a pnp and npn junction transistor	Keep	100%	None
4.6 Bipolar transistors as switches in marine applications	Keep	100%	None
4.7 Operation of small signal bipolar transistor amplifiers in marine applications	Keep	100%	None
4.8 Photo-electric effect	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:			
Objective	**Reason Why**	**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.	100%

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Marine Engineering - Propulsion			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Explain the layout, Construction and operation marine propulsion plant and ancillary systems as found on Modern Merchant Ships	**Modernise**	**100%**	**None**
1.1Types of marine propulsion plant	Modernise	100%	None
1.2 Layout of marine propulsion plant	Keep	100%	None
1.3 Operating principles of marine propulsion plant	Modernise	100%	None
1.4 Operating principles of marine propulsion plant	Keep	83%	None
1.5 Construction of marine propulsion plant	Keep	83%	None
1.6 Systems that marine propulsion plant require in order to operate	Keep	67%	Included “emission control technology and future fuel handling systems at a schematic level.”
Outcome 2: Explain the operational procedures, operational problems, and maintenance of marine propulsion plant.as found on Modern Merchant Ships	**Keep**	**83%**	**None**
2.1 Types of marine propulsion plant	Keep	100%	None
2.2 Starting plant	Modernise	100%	None
2.3 Stopping plant	Modernise	100%	None
2.4 Fault recognition	Keep	100%	None
2.5 Maintenance procedures	Modernise	83%	Included “information on planned maintenance systems, classification notations (PMS), use of new technology such as in build vibration monitoring

			etc.” and “the impact of maintenance procedures on NOx production.”
Outcomes for this competency, above and beyond STCW which would be needed due to use of modern technology and impact of future fuels onboard:			
Objective	**Reason Why**	**Action required**	**Consultation Support %**
Include Emission Control Technologies	Exhaust Gas Scrubbers (Open and closed loop) and other technologies are used for engines and boilers and are an important equipment related to propulsion machinery. This must include their impact on NOx/ Sox/ other harmful emissions.	Include Emission Control Technologies in this module.	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%
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ETO - Principles of Power Electronics			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome 1: Principles and characteristics of power electronic devices	**Keep**	**No Feedback Received**	**None**
1.1 Diode	Keep	No Feedback Received	None
1.2 Diac	Keep	No Feedback Received	None
1.3 Thyirstor	Keep	No Feedback Received	None
1.4 Gate Turn-Off Thyristor 4	Keep	No Feedback Received	None
1.5 Triac	Keep	No Feedback Received	None
1.6 Power MOSFET	Keep	No Feedback Received	None
1.7 Insulated Gate Bipolar Transistor	Keep	No Feedback Received	None
1.8 Smart Power Devices	Keep	No Feedback Received	None
Outcome 2: Outline arrangements for the protection of and the dissipation of heat from power electronic devices	**Keep**	**No Feedback Received**	**None**
2.1 Overcurrent protection (eg fuses, crowbar circuit)	Keep	No Feedback Received	None
2.2 Overvoltage protection	Keep	No Feedback Received	None
2.3 Heat transfer paths	Keep	No Feedback Received	None
2.4 Thermal characteristics of heat transfer process	Modernise	No Feedback Received	None
2.5 Use of heatsinks	Keep	No Feedback Received	None
Outcome 3: Analyse the operation and applications of single phase and three phase converters	**Keep**	**No Feedback Received**	**None**
3.1 Difference between half-wave and full-wave rectifier circuits	Keep	No Feedback Received	None
3.2 Difference between no control, half control and full control converters	Keep	No Feedback Received	None

3.3 One to Four Quadrant Operation	Keep	No Feedback Received	None
3.4 Full-wave, half-controlled bridge circuit with resistive load	Keep	No Feedback Received	None
3.5 Full-wave, half-controlled bridge circuit with inductive load and flywheel diode	Keep	No Feedback Received	None
3.6 Full-wave, fully controlled bridge circuit with inductive load	Keep	No Feedback Received	None
3.7 Typical applications of single phase converters	Keep	No Feedback Received	None
3.8 Laboratory exercise involving a single phase converter	Keep	No Feedback Received	None
Outcome 4: Construction features and operation of dc to dc choppers	**Keep**	**No Feedback Received**	**None**
4.1 Step-down chopper with resistive load	Keep	No Feedback Received	None
4.2 Step-down chopper with inductive load	Keep	No Feedback Received	None
4.3 Typical applications of step-down chopper circuits	Keep	No Feedback Received	None
4.4 Step-up chopper 1	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:			
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	with reference to current and future seagoing technologies and practices.	contextualisation recommendations but please do add any you feel may have been missed.	
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ETO - Applications of Power Electronics			
Outcome	**Sub-Group 1.2 Recommended Action**	**Consultation Support %**	**Changes made as a result of industry feedback**
Outcome1: Explain the operation of single-phase converters and D.C. choppers	**Keep**	**No Feedback Received**	**None**
1.1Single phase converters (half-wave controlled and full wave-controlled rectifier circuits)	Keep	No Feedback Received	None
1.2 Application of single-phase converters in the speed control of D.C. motors	Keep	No Feedback Received	None
1.3 D.C. chopper circuits	Keep	No Feedback Received	None
1.4 Application of D.C. chopper circuits in the speed control of D.C. motors	Keep	No Feedback Received	None
Outcome 2: Explain the operation of three-phase converters, A.C. to A.C. regulators and inverters	**Keep**	**No Feedback Received**	**None**
2.1 Three-phase convertors (three-phase diode bridge, half controlled three-phase bridge converter, full controlled three-phase bridge converter)	Keep	No Feedback Received	None
2.2 A.C. to A.C. regulators (phase control, burst firing)	Keep	No Feedback Received	None
2.3 Application of A.C. to A.C. converters in the speed control of a universal motor	Keep	No Feedback Received	None
2.4 Inverters (voltage source, current source, PWM, D.C. link)	Keep	No Feedback Received	None
Outcome 3: Investigate and analyse the operation and	**Keep**	**No Feedback Received**	**None**

performance of an electronically controlled motor speed control system			
3.1 Block diagram of the system	Keep	No Feedback Received	None
3.2 Description of system operation	Modernise	No Feedback Received	None
3.3 Waveforms	Modernise	No Feedback Received	None
3.4 Key performance characteristics	Modernise	No Feedback Received	None
3.5 Starting and braking	Keep	No Feedback Received	None
3.6 Protection	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:			
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