Proposal to modernise the Methodology of Teaching, Assessment/ Examination

Engineering STCW III/1 CoC	**Name of respondent, role and organisation:**		
Competency/ Module: Marine Engineering Thermodynamics	***Operate main and auxiliary machinery and associated control system***		
Knowledge, understanding and proficiency	**Recommendation of working group regarding the outcome and objective.**	**Rationale**	**Action required**
Outcome 1: Calculate and explain the effect of applying heat energy to solids and liquids	Keep	Relevant	See sub-outcomes.
1.1 Heat energy, sensible heat, latent heat.	Keep	It is useful to gain appreciation of the science behind the process of machinery operation	Include “modern heat exchangers” and “the controlling and monitoring measures of heat transfer efficiency”. Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
1.2 Resultant temperature when a solid is placed in a liquid at a different temperature.	Keep	It is useful to gain appreciation of the science behind the process of machinery operation	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.

1.3 Resultant temperature when up to three liquids at different temperatures are mixed.	Keep	It is useful to gain appreciation of the science behind the process of machinery operation	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
1.4 Coefficient of linear expansion and coefficient of cubical expansion	Keep	It is useful to gain appreciation of the science behind the process of machinery operation	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
1.5 Heat transfer by conduction, convection, radiation.	Keep	It is useful to gain appreciation of the science behind the process of machinery operation	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
1.6 Heat transfer through a composite wall of no more than three flat layers in contact.	Keep	It is useful to gain appreciation of the science behind the process of machinery operation	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
Outcome 2: Apply the Gas Laws for thermodynamic systems and evaluate the work done.	Modernise	Future fuels storage systems should be recovered.	Modernise refrigeration theory to include wider range e.g. cryogenic fuel storage systems

2.1 Ideal gas laws	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
2.2 Isothermal, adiabatic and polytropic processes process diagrams	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
2.3 Specific heat capacities of a gas at constant pressure and at constant volume.	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
2.4 Change in internal energy	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
2.5 Steady flow processes	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
2.6 Non-flow processes	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.

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Outcome 3: Explain and analyse combustion cycles associated with Marine Engines.	Keep	Relevant	See sub-outcomes.
3.1 Ideal Cycles associated with Marine Heat Engines	Modernise	Greater understanding of modern fuels required.	Include the combustion of modern fuels (Ultra low sulphur, or LNG) just to show students how it has changed the exhaust products. Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
3.2 Practical cycles associated with Marine Heat Engines	Modernise	Greater understanding of modern fuels required.	Include usage of new fuels, and Green House Gas reduction methods. Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
3.3 Indicated and brake powers	Modernise	Greater understanding of modern fuels required.	Include usage of new fuels, and Green House Gas reduction methods. Include more use of simulators and/or computer software to demonstrate performance measurement of an engine, considering energy efficiency regulations.
3.4 Thermal and mechanical efficiency	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.

3.5 calorific values — Exhaust gas products — stoichiometric air conditions — Exhaust gas products — excess air conditions	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
Outcome 4: Apply the data from Property Tables to solve thermodynamic process problems.	Keep	Relevant	See sub-outcomes.
4.1 Refrigerant and insulation material	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
4.2 Principle components of a vapour compression vapor system	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.

4.3 P-H diagram to describe the quality of a refrigerant or steam	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
4.4 Property tables to determine the specific enthalpy and specific volume of wet, dry and superheated working fluids	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
4.5 Coefficient of performance and capacity	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
4.6 Change of phase diagram for ice, water and steam	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.
4.7 Final condition of a vapour after throttling	Keep	It is useful to gain appreciation of the science behind the process of machinery operation.	Include more practical elements, ensuring engine room systems simulation mirrors the theory taught.

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Proposal submitted by:	**Any other 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**
Cadet Training & Modernisation Working Group	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.
Cadet Training & Modernisation Working Group	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	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.

		skills needs to be taught where relevant.	
Cadet Training & Modernisation Working Group	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.