

CERTIFICATES OF COMPETENCY FOR ENGINEERS (YACHT)

**EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF
MARITIME AND COASTGUARD AGENCY**

SMALL VESSEL CHIEF ENGINEER UNLIMITED

058-01 - APPLIED MARINE ENGINEERING

FRIDAY, 05 March 2021

1400-1600 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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| <ol style="list-style-type: none">1. Candidates should note that 100 marks are allocated to this paper. To pass candidates must achieve 50 marks.2. Non-programmable calculators may be used3. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer. |
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Materials to be supplied by examination centres:

Candidate's examination workbook

APPLIED MARINE ENGINEERING

Attempt ALL questions

Marks for each part question are shown in brackets

1. With reference to the manufacture of carbon fibre components:
 - (a) describe EACH of the following processes and its advantages:
 - (i) vacuum bagging; (2)
 - (ii) autoclave curing; (2)
 - (iii) resin transfer moulding; (3)
 - (b) list the type of component that EACH process described in part (a) is best suited to. (3)

2. With reference to the heat treatment of steel:
 - (a) explain which steels this process is best suited to; (2)
 - (b) explain EACH of the following processes, making reference to mechanical properties and internal structure:
 - (i) hardening; (4)
 - (ii) tempering. (4)

3. With reference to stresses within engineering materials:
 - (a) explain EACH of the following terms
 - (i) tensile stress; (1)
 - (ii) shear stress; (1)
 - (iii) compressive stress; (1)
 - (b) list TWO components within a diesel engine that are subject to the effects of EACH of the three stresses listed in part (a); (6)
 - (c) state the component in a 4 stroke diesel engine that has a maximum recommended service life due to constant cyclic stress. (1)

4. Explain EACH of the following engineering terms, stating ONE material that exhibits EACH property:
- (a) brittleness; (2)
 - (b) ductility; (2)
 - (c) hardness; (2)
 - (d) malleability; (2)
 - (e) toughness. (2)
5. With reference to gas metal arc welding (MIG) of mild steel:
- (a) describe the process; (3)
 - (b) explain, with reasons, the surface preparation required; (3)
 - (c) list THREE advantages and ONE limitation. (4)
6. Explain EACH of the following terms:
- (a) galvanic corrosion; (2)
 - (b) cavitation damage; (2)
 - (c) erosion damage; (2)
 - (d) stress corrosion; (2)
 - (e) atmospheric corrosion. (2)
7. List FIVE different methods of remotely monitoring the content level of a fuel oil service tank, explaining their operating principle. (10)
8. (a) Explain, with the aid of a sketch, how the fluid level in a tank can be measured using ultrasound energy. (6)
- (b) State TWO advantages of using ultrasound. (2)
 - (c) State TWO limitations of this type of measuring device. (2)
9. Explain, with the aid of a diagram, the principle of a cascade control method for regulating the freshwater coolant temperature of a diesel engine. (10)

10. With reference to hydraulic governors fitted to alternators designed to run in parallel:
- (a) explain why these governors have adjustable integral action; (5)
 - (b) explain, with the aid of a load/frequency diagram, how two generators operating in parallel are able to achieve a stable load share with a 50/50 ratio. (5)