MARINE DEPARTMENT.—NEW ZEALAND

EXAMINATION OF ENGINEERS IN THE MERCANTILE MARINE

Specimen Set of Examination Papers for a Second-class Coastal Motor Certificate

Exn. 1F

These Examination Papers relate to Examinations held under the Regulations published in 1939 (Exn. 1A (1939))

2

Memoranda to be used in working the problems will be found on the first page of the answer-book.

PRACTICAL MATHEMATICS

MORNING PAPER

(Time allowed: Three hours)

1. A double-bottom tank is 64 ft. long. The width at one end is 38·7 ft., at the middle length it is 38·9 ft., and 38·5 ft. at the other end. The mean depth is 2·8 ft. It is filled with oil of specific gravity 0·82. Find the tons of oil the tank will hold.

2. A crank-pin bearing is 12 in. diameter and 13 in. long. The bottom brass is lined with white metal to cover 40 per cent. of the bearing surface. Of this surface 9 per cent. is then cut out for oil ways. Find the contact bearing surface.

3. A bar 3 ft. long has weights of 75 lb. and 65 lb. hung at the ends. Find the position of the fulcrum to produce equilibrium, neglecting the weight of the bar.

4. A piece of metal weighs 4·7 lb. when weighed in air and 4·05 lb. when weighed in fresh water. Find the specific gravity of the metal.

5. The working pressure in a boiler is 10 kilogrammes per square centimetre. Express this pressure in pounds per square inch.

6. A propeller has a pitch of 19 ft. and makes 75 revolutions per minute. Find the percentage slip when the vessel's speed is 12·5 knots.

PRACTICAL MATHEMATICS

AFTERNOON PAPER

(Time allowed: Three hours)

7. An inclined plane rises 1 in 10. What force acting parallel to the plane is necessary to move a body weighing 25 lb. up the plane, neglecting friction; and calculate the work done in drawing the body a distance of 8 ft. in this direction?

8. The output of a pumping-engine is 25 horse-power. How long will it take to pump 2,500 cubic feet of sea-water to an average height of 22 ft., neglecting losses in the pump itself?

9. The quantity of circulating water passing through the condenser per hour is 500 cubic feet. The temperature of the inlet is 62° F. and that of the discharge is 104° F. How many thermal units are put overboard in that time, and what is the equivalent horse-power?

10. Define Ohm's Law. The E.M.F. in a circuit is 110 volts and the current flowing is 28 amperes. What is the resistance?

11. A ballast pump can pump out a tank in ten hours, and a general service pump can empty the same tank in eighteen hours. How long will it take to empty the tank if both pumps are working together?

12. A solid-drawn pipe, 7 in. inside diameter and $\frac{1}{4}$ in. thick, is subjected to a pressure of 200 lb. per square inch. The tensile strength of the material is 24 tons per square inch. What is the factor of safety?

ENGINEERING KNOWLEDGE

Morning Paper

(Time allowed: Three hours)

1. The following terms are used when referring to the quality of an oil: "flash-point," "firing-point," "calorific value," "specific gravity," "viscosity." Give a brief description of each term, and state the benefit derived by an engineer having knowledge of these terms.

2. Make a rough sketch of a cylinder for a heavy-oil internal-combustion engine, showing clearly how cooling is effected. What may cause the cover to crack, and what precautions should be taken to prevent such a failure?

3. How is the bunker fuel oil carried in motor-ships? What precautions are necessary should overflow occur when filling? How are the air-pipes arranged, and how is the quantity of oil in a fuel-tank ascertained?

4. What particular attention is required by an air-compressor to ensure it functioning in a safe and efficient manner?

5. Many failures have occurred in the crankshafts of heavy-oil internal-combustion engines. To what do you attribute these failures, and what measures, in your opinion, would prevent such an occurrence?

6. How can the indicated horse-power of an internal-combustion engine be ascertained? Should no indicator be available, how could you, as engineer, satisfy yourself that each cylinder was doing its share of the work?

ENGINEERING KNOWLEDGE

Afternoon Paper

(Time allowed: Three hours)

7. Sketch the arrangement of stern tube and propeller shaft as found on motor coasters. What kind of bearing is incorporated in the tube, and what would you consider to be the maximum permissible wear of this bearing?

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8. Relief-valves are fitted to the cylinder covers of heavy-oil internal-combustion engines. Why are such fittings necessary? Under what conditions would the valves function, and what attention do they require?

9. You are ordered to prepare the engine of a motor coaster for sea. Describe in detail how you would proceed.

10. What precautions should be taken to minimize the danger of fire in the engine-room of a motor-vessel? Describe the principle of a fire-extinguisher and what routine you would adopt to ensure the extinguisher being in good condition?

11. A governor of some description is usually fitted to a marine motor. Explain the necessity of such a fitting, and describe any type of governor with which you may be familiar.

12. Assuming you are fitting a spare pair of crank-pin brasses, explain in detail how you proceed. Your explanation should cover the entire job from taking down the old brasses to the time when the engine is ready for running again.

WORKING DRAWING

(Time allowed: Three hours)

General Instructions

1. Draw the object clearly in pencil, but insert the dimension arrow-heads in ink.

2. Do not draw any more parts than are specified below.

3. Working drawings to scale are required, and not pictorial representations.

4. Any diagrams to which the question may refer will be provided by the Examiner.

5. Insert all dimensions necessary for the construction of the object in the workshops, including those given in the questions and those purposely omitted.

6. Dimensions may be given in feet and inches or in metrical units.

7. Credit will be given for correct projection.

8. The material of which different parts are to be made should be indicated on the drawing.

The candidate will be expected to show that he is capable of making a dimensioned drawing of a part of the machinery so that the article made therefrom can be fitted into place without alteration.

Question.—Draw the following views of a set of crank-pin brasses suitable for a 6-in.-diameter crankshaft :—

(*a*) Side elevation half in section.
(*b*) Plan.

NOTE.—The shells are made of steel lined with white metal. The provision for lubrication should be illustrated.