

Engineering Studies

Section II

70 marks

Attempt Questions 11–16

Allow about 2 hours for this section

Answer the questions in the spaces provided.

Marks

Question 11 — Historical and Societal Influences, and the Scope of the Profession (10 marks)

(a) The range of knowledge in which an aeronautical engineer is trained includes: **4**

- aerodynamics
- fluid mechanics
- engineering materials
- legal and ethical implications.

Demonstrate how each of these four knowledge areas may be appropriately applied to the design or construction of an aircraft or its components.

- Aerodynamics - with an understanding of aerodynamics, the design of a plane could be more accurately modelled to produce a plane with the most possible lift.
- Fluid mechanics - an understanding of this would allow the engineer to design a wing that has minimal drag through air, which ~~is~~ behaves like air.
- Engineering materials - a knowledge of materials would allow planes to be designed to be lighter and stronger, also this knowledge could be carried through to streamline construction.
- Legal and Ethical - this would allow the engineer to build aircraft that complies with legal specifications, and within community expectations, ie quieter aircraft.

Question 11 continues on page 10

Question 11 (continued)

(b) Improvements to materials over the past 200 years have changed the significant design features of civil structures. These features include:

- the height of the structures
- the length of unsupported spans
- the load carried by structures
- the stiffness of structures
- the expected lifespan of structures.

(i) Outline how the improvements to materials have affected any TWO of these features. 3

• Load carried - with improved material knowledge over the years, engineers have learnt how to create alloys of metals, getting desirable properties from each, which in turn allowed for lighter, and more importantly, stronger materials.

• Lifespan - improved material knowledge has allowed the development of materials that are corrosion resistant (aluminium), or that use another layer to stop the corrosion, for example anodising or painting, allowed for longer structure life.

(ii) Discuss how society has been affected by the changes to any TWO of these features. 3

• Height - made for high rise buildings, increased population density, which in turn increased pollution. However, allowed for a more convenient lifestyle, with shops and services closer together.

• Length - allowed for bridges to span to islands that were unreachable before, or even ^{other} countries, some of these bridges became city icons (golden gate). However, ~~the~~ car ferry services that used to transport cars were made redundant.

End of Question 11