

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 is required so as to create upward lift through desired drag, while creating a shape of aircraft producing least parasitic drag. Fluid dynamics may be utilised in understanding how aerobots produce lift, Bernoulli's theory states that sum of pressures in a stream of air is equal, this contributes to how lift is created.

Engineering materials are vital in producing a strong air frame, that is light weight, materials like carbon fibre have a great strength to weight ratio, hence less thrust is required to promote flight. Such legal implications are that of patents, Aeronautical engineers must abide by the law, recognise that designs belong to the company, follow the steps in order to use such a design.

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

Through the development of pre and post tensioned concrete, bridges have been enabled to increase in greater spans. These arch bridges require less supports, can withstand more load, without the threat of reduced cracking than tension. Pre tensioned concrete is when steel cables are tensioned before being covered with concrete, after curing, tension is released, as steel returns to unstressed state, it instills compressive forces in concrete, these compressive forces must first be

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

With an ability to cover greater distances per span, cities have been allowed to breach environmental barriers causing urban sprawling. Now that these bridges can withstand more loads, the supply of industrial resources, such as metals, fuels can take place to once isolated communities. Less supports results in less significant destructions and alterations to environmental waterways. Not affecting aquatic life so severely.

overcome before tensile failure.

End of Question 11