2003 HIGHER SCHOOL CERTIFICATE EXAMINATION

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 easily applied to wing design. The wing must act in such a way to lift the aircraft. By using Bernulli's law a wing can be made to so an area of high pressure is form below the wing forcing the plane up into areas of lower pressure above the wing.
- Fluid mechanics is used in the design of the Pitot tube which is used to measure a planes airspeed. It does this through calibrations in regard to ~~the~~ static difference in static and dynamic pressure.
- Materials are very important. Planes requiring light weight but very strong materials in their shell and frame. Alclad is an material used which Duralumin is sandwiched between thin aluminium for high tensile strength and corrosion resistance.
- Legally aeronautical engineers can protect their own ideas using patients. These restrict other using designs or ideas without organised approval.

Question 11 continues on page 10

Marks

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**

- Length of spans has been able to increase due to the introduction of high tensile strength steel cables as well as reinforced concrete. This combined with innovative design allows for longer, lighter weight bridges with increased strength.
- Structures are also increasing in height. Using a solid, stiff stabilising core made from steel and reinforced concrete structures can be built, with little more than toughened glass, outer walls. This means less weight on each level and buildings able to be built higher.

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

- The increased span of bridges has allowed for fast transportation over rivers and harbours which previously would require days to get around or boat travel. This has significantly decreased travel times and allowed for urban expansion across water because of ease of transport.
- The increased height of structures has many effects, cities no longer move out but up. This allows large companies to have all workers on one site within reach. It allows more efficient utilisation of space, saving money as property prices increase dramatically, and allows provides a dramatic skyline in which many tourists visit every year eg. centre point (AMP) tower.

End of Question 11