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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015**

COURSE NAME : AIRCRAFT SYSTEM (THEORY)
COURSE CODE : BDU 20402
PROGRAMME : 2 BDC/2 BDM
EXAMINATION DATE : DECEMBER 2014/JANUARY 2015
DURATION : 2 HOURS
INSTRUCTION : 1. ANSWER ALL QUESTIONS IN SECTION A
2. ANSWER ONE (1) QUESTION IN SECTION B

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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SECTION A

- Q1** (a) Figure **Q1** shows a simple hydraulic system. State three ways that can be used in order to increase the output work without changing the geometry of the device. (3 marks)
- (b) Explain the working principle of a complete hydraulic system. Discuss the function of each component in the system. Provide necessary sketch to support your explanation. (14 marks)
- (c) Discuss the differences between hydraulic and pneumatic systems. Give three examples of each system found in aircraft. (6 marks)
- Q2** (a) Describe the properties of hydraulic fluid. Briefly discuss three types of hydraulic fluid. (11 marks)
- (b) Discuss the sources of compressed air for aircraft pneumatic system. When the aircraft is on the ground with engines off, state the source from which the compressed air is obtained to support the operation of all pneumatic systems. (7 marks)
- (c) Air enters a compressor with a stagnation pressure of 100 kPa and a stagnation temperature of 27°C. It is compressed to a stagnation pressure of 900 kPa. Assuming the air as an ideal gas, and the compression process to be isentropic, sketch a schematic diagram based on these information, and determine the power input (in kW) to the compressor for a mass flow rate of 0.02 kg/s. Given the specific heat at constant pressure, $c_p = 1.005$ kJ/kg.K. (7 marks)
- Q3** (a) Draw the landing gear configurations used in modern airline aircraft. Explain the factors considered in the selection of the landing gear configuration. (11 marks)
- (b) Explain the function of shock absorber in landing gear assembly. Briefly discuss the difference between landing gear system used in commercial aircraft and light aircraft. (5 marks)

- (c) The criteria for a landing gear retraction is as follows:
 Force Requirements = 5000 lb
 Distance moved = 2 ft
 Time required = 10 s
- (i) Determine the mechanical power required in watt. (3 marks)
- (ii) If the pressure p in the system is 2100 psi, obtain the flow rate requirement Q in gpm. (3 marks)
- (iii) Find the hydraulic HP if the system has an efficiency of 0.5. (3 marks)

SECTION B

- Q4** (a) Define wet and dry sump oil systems. Briefly discuss the differences between each other. (6 marks)
- (b) By sketching an appropriate schematic diagram, explain the working principle of a dry sump oil system. State the function of each component in the system. (12 marks)
- (c) A 150-hp compressor shown in Figure **Q4** draws in air from the outside through an 8 m long, 20 cm diameter duct. The compressor takes in air at a rate of $0.47 \text{ m}^3/\text{s}$ at certain outdoor conditions. The density and molecular viscosity of air are given as follows:
 $\rho = 1.149 \text{ kg/m}^3$
 $\mu = 1.802 \times 10^{-5} \text{ kg/m}\cdot\text{s}$
 Determine the average velocity and the Reynolds number of the flow in the duct. (7 marks)
- Q5** (a) Give the most important characteristic of lubricant oil. Discuss your answer. Briefly explain how temperature affects the oil viscosity. (10 marks)
- (b) Define 'air distribution' in aircraft environmental systems. Explain three types of air distribution system. (8 marks)

- (c) Sketch a schematic diagram of a typical supplemental oxygen system used in a commercial aircraft. Label all the components. (7 marks)

- END OF QUESTION -

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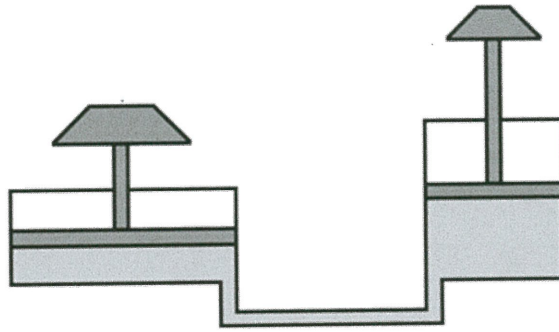


FIGURE Q1

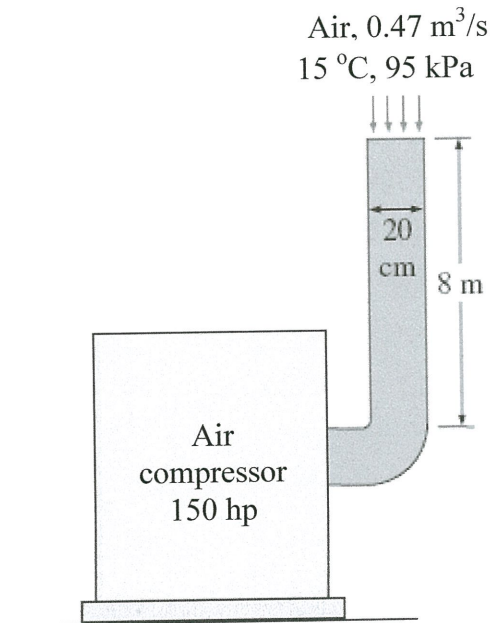


FIGURE Q4