

**UNIVERSITY OF BRISTOL
FACULTY OF ENGINEERING**

**First Year Examination for the Degree of
Bachelor of Engineering and Master of Engineering**

MAY/JUNE 2011 2 Hours

Aerospace Vehicle Design and System Integration
AENG10001

This paper contains *40* questions

Questions carry *1 mark* each.
The maximum for this paper is *40 marks*

- Q1 When did the first successful, manned, rotary-winged aircraft fly?**
- a) 1903
 - b) 1907
 - c) 1923
 - d) 1936
- Q2 Who invented the first successful, manned, rotary-winged aircraft?**
- a) Wright Brothers
 - b) Igor Sikorsky
 - c) Juan de la Cierva
 - d) Igor Bensen
- Q3 The very low power-to-weight ratio of engines fitted to the first successful helicopters (such as the Fa-61 and the Breguet-Dorand Gyroplane Laboratoire) was the primary reason why:**
- a) they were slower than their fixed-wing counter parts
 - b) they had small diameter rotors
 - c) they didn't have a tail rotor
 - d) the rotor speed was limited
- Q4 Compound helicopters can fly faster than conventional helicopters because they:**
- a) have greater installed power
 - b) have additional (fixed) wing surfaces
 - c) have a dedicated propulsion system
 - d) they can partially off-load the duties of the main rotor
- Q5 The main operational difference between the most highly developed autogyro and the helicopter is that it:**
- a) cannot take-off or land vertically
 - b) has a lower maximum flight speed
 - c) cannot hover for sustained periods
 - d) is able to land safely in the event of total power loss
- Q6 The helicopter rotor configuration most conducive to carrying a variety of different payloads is:**
- a) Conventional main rotor with tail rotor
 - b) Tandem rotor
 - c) Synchropter (inclined side-by-side)
 - d) Coaxial, contra-rotating
- Q7 Who was the first person to design and develop a successful gas turbine for aircraft propulsion in the UK?**
- a) Stanley Hooker
 - b) Frank Whittle
 - c) Barnes Wallis
 - d) Reginald Mitchell.
- Q8 What approximate temperature do the exhaust gases leave the combustion chamber of a modern gas turbine?**
- a) 900K
 - b) 1300K
 - c) 1900K.
 - d) 2500K

- Q9 From what part of the engine does the air needed to cool the high pressure turbine come from?**
- a) Inlet to the compression system
 - b) The by-pass stream
 - c) Combustion exhaust
 - d) Exit to the compression system
- Q10 What engine powered the Concorde supersonic Airliner?**
- a) Adour
 - b) Olympus
 - c) Spey
 - d) Pegasus
- Q11 For what aircraft was the first high by-pass ratio engine designed?**
- a) Lockheed Tristar
 - b) Boeing 747 Jumbo
 - c) Lockheed C5A
 - d) Douglas DC10
- Q12 Modern fan blades are made from what metal?**
- a) Titanium
 - b) Aluminium
 - c) Nickel based alloy
 - d) Magnesium
- Q13 Which one of these statements does not describe safety?**
- a) The state in which risk is lower than some pre-defined upper level.
 - b) Freedom from conditions that can cause death or injury.
 - c) The attribute of a system to perform correctly on demand.
 - d) Freedom from conditions that can cause damage to equipment or the environment.
- Q14 A systematic failure is one where;**
- a) Several interconnected parts have failed.
 - b) We can predict when the failure will occur.
 - c) We can use probability to quantify risk of failure.
 - d) Several systems are affected by failure.
- Q15 Which of the following best describes a random failure?**
- a) A 'bug' in navigation software.
 - b) An aircraft display overheating when parked in sunshine.
 - c) The filament blowing in the 'call attendant' cabin light.
 - d) An aircraft skidding off the runway in icy conditions.
- Q16 Introducing redundancy into a system involves;**
- a) Building it from obsolete components.
 - b) Building it with more parts than are needed to operate.
 - c) Switching between parts to reduce wear and tear
 - d) Reducing the workforce making the system components.
- Q17 Why do large aircraft have batteries in their electrical system?**
- a) To start the engines
 - b) To provide back-up power
 - c) To supply low voltage lamps

- d) To keep the security alarm powered when on stand
- Q18 What are the standard distribution voltages on current civil airliners?**
- a) 28VDC and 115VAC 3 phase 400Hz.
 - b) 28VAC and 115VDC 3 phase 50Hz.
 - c) 24VDC and 220VAC 1 phase 50Hz.
 - d) 24VAC and 220VDC 1 phase 400Hz.
- Q19 The installed electrical generation capacity of the A380 is approximately**
- a) 50,000 W
 - b) 500,000 W
 - c) 5,000,000 W
 - d) 50,000,000 W
- Q20 The 'More Electric Aircraft' initiative is about;**
- a) Reducing aircraft noise
 - b) Increasing the power of the main engines
 - c) Reducing the weight of aircraft components
 - d) Making aircraft easier to maintain.
- Q21 'CVG' stands for**
- a) Constant Velocity Gearbox
 - b) Controlled Voltage Generator
 - c) Certified Valve Group
 - d) Concentric Variable Gear.
- Q22 Which one of the following systems uses the largest amount of power?**
- a) Flight control actuation
 - b) Environmental control
 - c) Galley heating
 - d) Wing de-icing
- Q23 Which statement is least accurate?**
- a) Hydraulic actuation systems can be made to fail safe.
 - b) Hydraulic actuation systems are easy to maintain.
 - c) Hydraulic actuation systems have a high power/weight ratio.
 - d) Hydraulic actuation systems are an established technology
- Q24 Which of the following acronyms does not refer to a navigation or communication system?**
- a) TCAS
 - b) CFIT
 - c) GPS
 - d) IFF
- Q25 Radar systems are not used for**
- a) locating other aircraft
 - b) detecting rain and snow
 - c) determining aircraft height
 - d) measuring altitude
- Q26 A federated architecture is one which;**
- a) is being introduced on the latest aircraft
 - b) uses differing hardware for individual functions.
 - c) combines functions onto a single processor

- d) is designed by several different individuals for safety.
- Q27 On a modern airliner fuel is not used for;**
- a) powering the engines.
 - b) de-icing.
 - c) cooling electronics
 - d) trim.
- Q28 An aircraft with a glass cockpit has;**
- a) large windows for improved visibility
 - b) large area multi function displays
 - c) dedicated displays for each instrument
 - d) has optical fibres in place of cables.
- Q29 Under air worthiness regulations an event that significantly increases crew workload and causes some injury is classed as;**
- a) minor
 - b) major
 - c) hazardous
 - d) catastrophic
- Q30 A gyroscope measures**
- a) acceleration
 - b) velocity
 - c) angular velocity
 - d) angular acceleration
- Q31 The position error of an inertial navigation system will**
- a) increase with flight time as the error is cumulative
 - b) reduce with flight time as more measurements average out the error
 - c) stay the same as error is based only on initial calibration
 - d) periodically increase and decrease due to tiny variations in gravity
- Q32 Which of the following describes an effect of increasing RF frequency?**
- a) range increases
 - b) antenna size increases
 - c) data rate increases
 - d) all of the above.
- Q33 'Fly by wire' means**
- a) flight control surfaces actuated by wire cable and pulleys, as opposed to a push rod.
 - b) having no mechanical link between the pilot and control surface
 - c) The use of electrical autopilot to fly the plane
 - d) power for flight surface actuation provided electrical cables.
- Q34 Identify which of the following is not a real aircraft control surface**
- a) elevon
 - b) slateron
 - c) ruddervator
 - d) taileron
- Q35 The attitude indicator is;**
- a) part of the primary flight display showing pitch and roll
 - b) part of the navigation display showing heading
 - c) part of the ECAM display showing operational information

d) part of the airline customer service questionnaire.

Q36 VOR beacons offer improvements compared to the older ADF navigation system because;

- a) The VOR system operates via satellite link
- b) The VOR system requires no moving parts
- c) The VOR system works on oceanic routes
- d) The VOR infrastructure is much cheaper

Q37 GPS has limitations for aircraft navigation use because;

- a) It only covers certain parts of the globe
- b) GPS receivers do not work well at altitude
- c) It is not as robust as other systems
- d) The US charges royalties on airlines using the system

Q38 To calculate vertical velocity we need to measure;

- a) static air pressure only
- b) dynamic air pressure only
- c) both static and dynamic air pressure
- d) height and static and dynamic air pressure

Q39 What is the function of the 'localiser'?

- a) to keep the aircraft aligned with the runway on landing
- b) to keep the aircraft on the correct decent when landing
- c) to re-tune the aircraft's radio to traffic control at different airports
- d) to locate the aircraft if it has been lost.

Q40 Which statement is most correct

- a) Aircraft technology generally leads other sectors
- b) Aircraft technology often lags behind other sectors
- c) Aircraft technology is unique and not used in other sectors
- d) Aircraft technology is cheap compared to other sectors because there are lots of aircraft