UNIVERSITY OF BRISTOL
FACULTY OF ENGINEERING

First Year Examination for the Degree of
Batchelor of Engineering and Master of Engineering

MAY/JUNE 2012 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*

IMPORTANT:

Write your answers **sequentially** using **one line per answer** of the answer booklet.

Use **block capitals** to indicate which one of the four choices you believe to be correct.

Q1 When did the first successful, manned, rotary-winged aircraft fly?

A) 1903
B) 1907
C) 1923
D) 1936

Q2 Who developed the single-main rotor with single-tail rotor helicopter configuration?

A) Wright Brothers
B) Igor Sikorsky
C) Juan de la Cierva
D) Igor Bensen

Q3 Early developments of the Autogiro (by Juan de la Cierva) had a tendency to roll-over as the aircraft left the ground. Cierva eliminated this problem by the introduction of:

A) powerful fixed wing aileron controls
B) feathering hinges to reduce the pitch of the "advancing" blade
C) blade flapping hinges
D) blade lead-lag hinges

Q4 The main advantage that the co-axial, contra-rotating rotor system helicopter has compared to the conventional single-main rotor with single-tail rotor helicopter is:

A) a compact design with no power wasted to provide torque reaction
B) lower drag (due to absence of a tail boom) so greater speed available
C) a powerful yaw control for manoeuvrability
D) a simple main rotor control system and no tail rotor to require control inputs

Q5 Which is the most common method of launching a glider in this country?

A) aerotow (glider pulled into the air by a powered aircraft)
B) wire launch by winch (cable drum method)
C) wire launch by reverse pulley (car or truck method)
D) catapult launch (also referred to as "bungee" launch)

Q6 The major contribution to improved glider performance in the past 50 years has been:

A) more sophisticated cockpit instrumentation
B) increased wing spans
C) use of Glass Reinforced Plastic (GRP) for wings and fuselage
D) reductions in aircraft weight resulting from use of high technology materials

Q7 The first flight of Turbojet Powered Aircraft in the UK was in the year:

A) 1941
B) 1930
C) 1935
D) 1944

Q8 The first by-pass engine to enter airline service was the:

A) PW JT9D
B) RR Conway
C) GE TF39
D) RB 211

Q9 The major source of noise of the early civil turbojet engines like the RR Avon was the:

A) compressor
B) combustion chamber
C) turbine
D) jet efflux

Q10 Modern turbine blades are made from what metal?

A) titanium
B) aluminium
C) nickel based alloy
D) magnesium

Q11 In an engine with a-pass ratio of 9, what percentage of the total flow is heated in the combustion chamber:

A) 90%
B) 60%
C) 30%
D) 10%

Q12 The de Havilland Comet was the first jet airliner to enter service. The engines were mounted:

A) under the wings
B) in the wing root
C) on the rear fuselage
D) on top of the wings

Q13 The first manned aircraft to fly faster that the speed of sound in controlled level flight was:

A) Bell X-1
B) Me262
C) North American F100 Super Sabre
D) Miles M52

Q14 An aircraft empennage is a term used for the:

A) vertical tailplane
B) horizontal tailplane
C) vertical and horizontal tailplane
D) wings

Q15 Which of the following is not a primary control surface?

A) aileron
B) rudder
C) elevator
D) flap

Q16 An aileron is used to control the aircraft in:

A) roll
B) pitch
C) yaw
d) roll, pitch and yaw

Q17 When an aircraft's flaps are extended:

A) the stalling speed of the aircraft is reduced
B) the drag of the aircraft decreases
C) the aircraft is about to climb
D) the aircraft is in cruise

Q18 For conventional fixed wing aircraft, there are how many main categories of wing position?

A) 2
B) 3
C) 4
D) 5

Q19 A landing gear blister is most likely to be required for an aircraft with:

A) fuselage mounted engines
B) a low-wing configuration
C) a high-wing configuration
D) highly swept wings

Q20 A double-lobe or double-bubble fuselage is sometimes used in preference to a circular fuselage to:

A) provide greater ease of manufacture
B) provide greater structural efficiency
C) minimise frontal area for a given cargo capacity
D) improve the field of vision for the pilot

Q21 The wing loading is a parametric quantity defined as:

A) the maximum take-off weight divided by the reference wing area
B) the empty weight of the aircraft divided by the reference wing area.
C) the reference wing area divided by the maximum lift coefficient
D) the maximum lift coefficient divided by the reference wing area

Q22 The main types of wing plan-form are:

A) cranked, swept and straight taper
B) cranked and straight taper
C) straight taper and curved taper
D) cranked and swept

Q23 For a turbofan engined aircraft, the power loading is defined by:

A) the total net thrust output divided by the maximum take-off weight
B) the maximum take-off weight divided by the total net thrust
C) the total net thrust output divided by the reference wing area
D) the reference wing area divided by the total net thrust

Q24 When architecting aircraft systems, which approach can mitigate for random errors?

A) introducing redundancy
B) using dissimilar hardware
C) using real-time processing
D) making a system deterministic

Q25 Which of these statements best defines 'integrity' in an aerospace context?

A) the probability that a system or an item is in a functioning state at a given point in time
B) the attribute of a system or an item indicating that it can be relied upon to work correctly on demand
C) the inability of an item to perform its intended function
D) freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment

Q26 The main error mechanisms affecting inertial navigation systems cause:

A) a cumulative error increasing with time
B) a summative error which reduces with time
C) an error periodic with rotation of the earth
D) a constant error related to accuracy of calibartion

Q27 Air data can be used to derive:

A) ground speed and altitude
B) height and wind speed
C) climb and Mach number
D) glide slope and air speed

Q28 High frequency radio signals have a wavelength approximately:

A) 0.02 m
B) 0.2 m
C) 2 m
D) 20 m

Q29 Which of these acronyms is not associated with aircraft Communications?

A) IMMARSAT
B) ARINC
C) GPWS
D) VHF

Q30 Radio navigation systems complement inertial systems because :

A) low frequencies reach across oceanic areas,
B) errors are random around the true position
C) they require minimum ground infrastructure
D) they require extensive airborne infrastructure

Q31 GPS has been slow to be adopted in aircraft because:

A) more accurate alternatives are available
B) it is particularly susceptible to interference from solar flares
C) its origin and development led to concerns about availability
D) large royalties must be paid to the inventors

Q32 Batteries on a civil airliner provide power for:

A) starting the engines
B) emergency back-up
C) electronics that need a 28V DC supply
D) the galley

Q33 Approximately how much electrical is a typical civil airliner will be capable of generating?

A) 2 kW
B) 20 kW
C) 200 kW
D) 2000 kW

Q34 What is the function of the hydraulic CVG in between the engine power take-off and the electrical generator?

A) it ensures correct phase and frequency output of each generator
B) it maintains a set output voltage
C) it matches the load on each generator
D) it measures the power to the electrical system

Q35 Which of these statement is most true?

A) the MEA imitative is driven mainly by climate change pressures
B) the MEA imitative is driven mainly by maintenance issues
C) the MEA imitative is driven mainly by airport operators
D) the MEA imitative is driven mainly by bureaucrats in Brussels.

Q36 The pressure in a typical aircraft hydraulic system:

A) is around 200 times atmospheric pressure at sea level
B) can be increased to boost power at critical times
C) is augmented using the low outside air pressure
D) causes the normally solid hydraulic fluid to melt

Q37 The pneumatic system provide which functions:

A) engine start, anti-ice and air conditioning
B) anti-ice and tyre pressurisation
C) air conditioning, brake servo, and anti-ice
D) none of the above statements are correct

Q38 The RAF standardised cockpits in the 1930's by defining a set of displays known as the:

A) 'basic 6'
B) 'normal 9'
C) 'standard 8'
D) 'unlucky 13'

Q39 Which of these statements is true?

A) night vision systems amplify low level background light
B) night vision systems broadcast IR light and convert to electrons
C) night vision systems amplify electrons with multi-channel saucers
D) night vision systems amplify light by reducing the field of view

Q40 A real-time computer:

A) uses Greenwich Mean Time
B) is the most up-to-date technology
C) performs calculations within a defined period
D) clocks one calculation each second