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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : INSTRUMENTS
COURSE CODE : BDT 40602
PROGRAMME CODE : BDC
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 2 HOURS
INSTRUCTION : ANSWERS **FOUR (4)** QUESTIONS **ONLY**

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THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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- Q1** (a) Air Data Computer (ADC) commonly used in high performance aircraft. ADC will ease the workload in cockpit as the system convert sensed air pressures into digital values makes them more easily manipulated by the computer to output accurate information. List four (4) advantages of ADC. (4 marks)
- (b) Temperature plays a significant part in flight planning, aerodynamics and aircraft performance. In aviation, temperature can be classified into three classes. State and explain three (3) classes of temperature. Pick one that is being used frequently in aviation. (7 marks)
- (c) Gyroscope or better known for gyro is a rotating mass which has freedom to move in one or more planes perpendicular to the plane of rotation. The freedom is provided by mounting the spinning mass in a system of gimbals which are pivoted at right angles to each other. Explain two (2) gyro properties and the factors affecting them. (8 marks)
- (d) Discuss the effect of turning on bank angle and pitch of an Attitude Indicator (AI) when turning through:
(i) 90°
(ii) 270°
(iii) 360° (6 marks)
- Q2** (a) Earth is a huge permanent magnet itself and if we were to put a magnet on Earth, the South of a magnet will point almost to the North of Earth. This is also known as terrestrial magnetism. Define each of given terminology
(iv) Isogonals
(v) Isoclinals
(vi) Aclinic lines
(vii) Agonic Lines (4 marks)
- (b) Provided that A and B are isogonals with 10° W variation, an aircraft is tracking from A to B on a magnetic heading of 234° M and direct reading compass gives a reading of 240° C, what will be the True North and the aircraft deviation? Provide relevant sketch for the calculations. (4 marks)
- (c) Aircraft magnetism can be considered made up of hard iron and soft iron. As for analytical purposes, only components of horizontal hard iron (HHI) and vertical soft iron (VSI) will be focused for any discussion. Explain the magnetism components in determining hard iron and soft iron and briefly describe the relationship of both with latitude. (6 marks)

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- (d) Calculate aircraft compass, datum compass and deviation for each heading as well as coefficient A, B and C for the readings in **Table Q2 (d)**.
(11 marks)

Q3 (a) A Flight Management System (FMS) is a fundamental component of a modern airliner's avionics. An FMS is a specialized computer system that automates a wide variety of in-flight tasks, reducing the workload on the flight crew to the point that modern civilian aircraft no longer carry flight engineers or navigators. List four (4) FMS capabilities.
(4 marks)

- (b) An FMS comprises four main components and every FMS contains two databases, which are navigation database and performance database. Explain and classify the information contained in each types of FMS database.
(6 marks)

- (c) Not all passenger aircraft flying today have an autopilot system. Older and smaller general aviation aircraft especially are still hand-flown, and even small airliners with fewer than twenty seats may also be without an autopilot as they are used on short-duration flights with two pilots. The installation of autopilots in aircraft with more than twenty seats is generally made mandatory by international aviation regulations. Explain three (3) types of autopilot mode in small aircraft.
(6 marks)

- (d) Modern aircraft are increasingly reliant on automation for safe and efficient operation. However, automation also has the potential to cause significant incidents when misunderstood or mishandled. Discuss nine (9) problems the flight crew – automation interaction can possibly cause.
(9 marks)

Q4 (a) Aviation communication is a crucial component pertaining to the successful functionality of aircraft movement both on the ground and in the air. Incident and accident rate will increase if communication failure occur either in the air or on the ground. List four (4) types of communication breakdown.
(4 marks)

- (b) In direct emergency communication, a new communication capability is provided to allow direct communication between the flight crew and air rescue and firefighting (ARFF). The controller remains in the communication loop but in a passive position. Explain six (6) advantages of direct communications have over standard communication loop.
(6 marks)

- (c) An aircraft Stall Warning System (SWS) is a system which provides the pilot with advance warning of an impending stall. Discuss the requirement for a stall warning system for aircraft other than Transport Category.
(7 marks)

- (d) The requirement for a Stall Warning System will be found within the aviation regulations for the State of Manufacture and the State of the Operator for any given aircraft. Name and briefly explain working principle for four (4) types of warning systems.

(8 marks)

- Q5** (a) It is a crucial task for all pilot to recover the aircraft back into normal attitude after any unusual aircraft state. List step-by-step the required recovery actions.

(5 marks)

- (b) It is crucial to investigate the data from the recording system of any aircraft such as Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR) after accidents or even incidents. The main reason is basically to avoid any similar events in the future and make any appropriate adjustments to the aircraft systems. Identify the location for CVR and FDR in an aircraft and explain the types of data collected by each recording system.

(4 marks)

- (c) The development of deployable flight recording systems (DFRS) for commercial aircraft has started as it is important to retrieve Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR) as soon as possible. List step-by-step working principle of Automatic Deployable Flight Recorder.

(6 marks)

- (d) Maintenance programmes and schedules will give a list of tasks, with intervals quoted in units of flight hours, flight cycles or calendar time. The operator will use maintenance schedule to suit its own operations, based on either a Block (Pyramid) system or Equalised (Progressive) system. Explain both Block and Equalised maintenance programmes that often used to ensure that the aircraft is reliable and airworthy.

(10 marks)

-END OF QUESTIONS -

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Aircraft Compass	Datum Compass	Deviation
360° C	007° M	+7
089° C	086° M	
184° C	183° M	-1
	269° M	+5

Table Q2 (d)**TERBUKA**