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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

COURSE NAME : MATERIALS AND HARDWARE
COURSE CODE : BDS 10103
PROGRAMME : BDM
DATE : JULY/AUGUST 2023
DURATION : 3 HOUR
INSTRUCTION : 1. ANSWER **ALL** QUESTIONS IN SECTION A AND ANY **FOUR** QUESTIONS FROM SECTION B
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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SECTION A: ANSWER ALL QUESTIONS

1. Define the pitch of a screw thread.
 - A. Distance between the crest and the root of the thread.
 - B. Distance from the centre of one crest to the next.
 - C. Difference between major diameter and minor diameter.
 - D. Difference between crest to axis.

2. Identify which thread type has the better vibration resistance?
 - A. A fine thread.
 - B. A course thread.
 - C. UNJ.
 - D. UNS.

3. The initials UNC when related to aircraft bolts stands for
 - A. United National Countersunk.
 - B. Unified National Coarse.
 - C. Unified National Centred.
 - D. United Nominal Centre.

4. Which statement is true for multi-start threads.
 - A. Increase the lead and decrease the pitch.
 - B. Increase the lead without increasing the pitch.
 - C. Increase the lead and the pitch.
 - D. Decrease the lead and pitch

5. There would be a _____ load on a clevis bolt in a control cable fork end.
 - A. tension
 - B. compression
 - C. shear
 - D. bending

6. A bolt part number AN25C15 when compared to a bolt part number AN25-15 has
 - A. a higher pitch thread.
 - B. a higher resistance to corrosion.
 - C. a higher compression strength.
 - D. a lower alloying element.

7. When internal thread in soft materials like magnesium, zinc and aluminum alloys or brass and bronze become damaged the problem is overcome by installing a stainless steel wire threaded insert into the hole. The most common thread insert form is
 - A. Spring dowel.
 - B. Helicoil.
 - C. Lock bolts.
 - D. Ezy-out.

8. A thread insert may be removed by
 - A. a blade removal tool.
 - B. a hammer and punch.
 - C. a pre-wind insertion tool.
 - D. Heated at predetermined temperature.

9. A spring type washer when used on an aluminium component must be used
 - A. with a plain washer.
 - B. with shake-proof washer.
 - C. with split pins.
 - D. with sealant to minimize galvanic corrosion.

10. A tab washer _____ if it has been removed from a non-essential system after being installed for a brief period of time.
 - A. can be re-used
 - B. can be re-used provided it has been refurbished
 - C. should be inspected for physical condition
 - D. must be discarded

11. Taper pins are subject to _____ loads.
 - A. shear
 - B. compression
 - C. tension
 - D. All of the above

12. This nut has an unthreaded plastic insert in the counter-bored end with the internal diameter slightly smaller than the nut thread, so that, as the nut is screwed on the bolt, the plastic insert is displaced and a high degree of friction is created. This statement is true for
 - A. Castle nut.
 - B. Nyloc nut.
 - C. Aerotight nut.
 - D. Oddie nut.

13. Wire locking approach angles should not be less than
 - A. 10°.
 - B. 15°.
 - C. 45°.
 - D. 90°.

14. Thin wire copper is used as to hold switches and levers
 - A. to ensure the crew are aware that maintenance is in progress.
 - B. to prevent the accidental operation of switches and levers.
 - C. to facilitate and guide the pilot in case of emergency during the flight.
 - D. to assist maintenance crew securing the switches and levers.

15. Dzus fasteners are used to securing
- A. fairings.
 - B. inspection access panel.
 - C. cowlings.
 - D. All of the above.
16. This fastener consists of a spring-loaded stud assembly and a receptacle. The stud assembly is fastened to the removable panel whilst the receptacle is fastened to the airframe. This fastener is referring to
- A. Dzus fastener.
 - B. Camlock fastener.
 - C. Oddie fastener.
 - D. Airlock fastener.
17. If D or DD rivets are not formed in time, or removed from the freezer in time, they
- A. must be discarded.
 - B. must be re-heat treated before use.
 - C. can be re-heat treated once then discarded.
 - D. Can be driven as usual.
18. Which statement is true for 'field' rivet.
- A. The rivet needs to be heat-treated before use.
 - B. The rivet can be identified by cross marking on the head.
 - C. The rivet made from high strength heat-treatable aluminium alloys.
 - D. The rivet is ready to be used as received.
19. A plate of 10 inches by 5 inches is to be riveted with 3 rows of rivets, with the normal 4D rivet spacing and 2 D edge distance. The rivets are AN460AD4-6. How many rivets are required?
- A. 20.
 - B. 35.
 - C. 42.
 - D. 60.
20. These fasteners were produced to attach rubber de-icing boots to aircraft wing and tail leading edges. This statement is refers to
- A. Jo-bolts.
 - B. Hi-Loks.
 - C. Rivnuts.
 - D. Cherry rivets.

SECTION B: ANSWER ANY FOUR (04) QUESTIONS

- Q1** (a) There are various fluid system pipes in an aircraft, and to avoid any incidents, there are markers made up of colour codes, words, and geometric symbols. Sketch the symbol for:
- (i) Hydraulic lines
 - (ii) Fuel lines
 - (iii) Breathing oxygen lines
 - (iv) De-icing lines
- (8 marks)
- (b) Describe the advantages of self-sealing couplings.
- (6 marks)
- (c) Quick-release couplings can be found in fuel, oil, hydraulic and pneumatic systems. Explain the purpose of quick-release couplings.
- (6 marks)
- Q2** (a) There are several basic forces, which may be exerted on, and applied by, springs where these forces may act singly or in combinations of any. Explain the forces.
- (6 marks)
- (b) Sketch a spring and label its pitch, coil angle, mean diameter, and free length.
- (8 marks)
- (c) Identify three applications involving the use of springs in aircraft engineering.
- (6 marks)
- Q3** (a) Bearings serve many functions, one of which is to support moving parts in a machine.
- (i) List three bearing applications in an aircraft.
- (3 marks)
- (ii) Sketch the loads acting on a bearing.
- (5 marks)
- (b) Bearing 6210, single row deep groove ball bearing (50mm bore x 90mm outside diameter x 20mm wide) has basic dynamic rating, $C = 35100$ N. The bearing operates at 3,600 rpm with 70°C bearing temperature and loaded with 4000 N radial load. Exponent of the life equation for ball bearing is 3. Calculate its basic life rating in hours.
- (9 marks)

- Q4** (a) Transmission is a group of interconnected elements (or mechanisms) that allow one portion to be powered by another, causing the latter to move and perform the necessary task.
- (i) List three functions of transmission. (3 marks)
- (ii) Explain the importance of backlash in gears. (5 marks)
- (c) The driver and driven gears have 50 and 25 teeth, respectively. The driver gear is rotating with 250 rpm and 15Nm torque. Calculate the speed and torque of the output shaft. (12 marks)
- Q5** (a) The number of strands and the number of wires in each strand are used to determine the kind of cable. The 7x7 and 7x19 cables are the most often used as aircraft cables. Differentiate between these two cables. (6 marks)
- (b) From the neutral position, control surfaces should move a specific distance in each direction. These actions must be coordinated with the controls on the flight deck. To meet these needs, the flight control system must be modified (rigged). Explain the basic steps in aircraft rigging. (6 marks)
- (c) The controls will be difficult to operate if the cable runs are too tight, and the controls will be sloppy and unresponsive if the cable lines are too loose. In order to ensure the recommended tension is achieved, manufacturers use a turnbuckle. Describe how a turnbuckle can be used to make a tension adjustment. (8 marks)
- Q6** (a) For aircraft applications, the conductor selection used for electrical cables is crucial as it directly affects the reliability and safety of the electrical systems.
- (i) Explain the importance factors in conductor selection. (6 marks)
- (ii) List two types of material commonly used for aircraft application. (2 marks)
- (iii) Based on your answer for Q6(a)ii, list two of their advantages and disadvantages. (8 marks)

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- (b) A 4m wire with a cross-sectional area of 0.05m^2 has a 20Ω resistance. Calculate the wire resistivity.

(4 marks)

- END OF QUESTIONS -