

**B.TECH. (AEROSPACE ENGINEERING)  
(BTAE)**

**Term-End Examination 00780**

**December, 2012**

**BAS-018 : AIRCRAFT SAFETY AND  
MAINTENANCE ENGINEERING**

*Time : 3 hours*

*Maximum Marks : 70*

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**Note :** (1) Question No. 1 is **compulsory**.

(2) Answer **any four** questions from the questions 2-8.

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1. Choose the correct answer for the following objective type questions.
- (a) Which of the following is **not** true for the maintainability ? 2
- (i) Ease of maintenance
  - (ii) Minimum down time
  - (iii) Provide redundancy
  - (iv) Interchangeability
- (b) Safety engineering is concerned with : 2
- (i) Part identification
  - (ii) Item nomenclature
  - (iii) Failure detection
  - (iv) Severity classification
- (c) Inspect and repair type maintenance is known as : 2
- (i) Overhaul
  - (ii) Salvage
  - (iii) Servicing
  - (iv) Rebuild

- (d) MTTF is \_\_\_\_\_ proportional to hazard rate. 2
- (i) Directly
  - (ii) Inversely
  - (iii) Exponentially
  - (iv) Logarithmically
- (e) Which of the following will improve the reliability ? 2
- (i) Series components
  - (ii) Parallel components
  - (iii) None of the (i) and (ii)
  - (iv) Both of the (i) and (ii)
- (f) The relation between Safety Factor (SF) and Safety Margin (SM) is given by : 2
- (i)  $SM = SF - 1$
  - (ii)  $SM = SF + 1$
  - (iii)  $SM = SF + K\sigma$
  - (iv)  $SM = SF - K\sigma$
- (g) Hard Time (Hard Life) maintenance of an aircraft is \_\_\_\_\_. 2
- (i) Routine maintenance
  - (ii) Non-routine maintenance
  - (iii) Refurbishment
  - (iv) Modification

2. Discuss the significance of following factors on maintainability of equipment. 14
- (a) Standardization
  - (b) Modularization
  - (c) Interchangeability
  - (d) Accessibility
3. (a) A technician is performing maintenance task at continuous time. Derive an expression to check his reliability if the rate of errors made by him is assumed to be constant. 7
- (b) A technician is performing maintenance task at continuous time at 0.008 errors per hour. Calculate his reliability during a 7 hour mission. 7
4. (a) Define safety margin and bring out an expression to calculate safety margin for material strength following Normal Distribution. 7
- (b) Calculate the 3-sigma and 6-sigma safety margins for a component subjected to following values. 7
- |                                |           |
|--------------------------------|-----------|
| Average strength               | = 450 mPa |
| Average stress                 | = 200 mPa |
| Standard deviation of strength | = 18 ma   |
| Standard deviation of stress   | = 4 mPa   |

5. An aircraft has Built-In-Test (BIT) set up fitted to a five Line Replaceable Unit (LRU) system. The system performance characteristics are mentioned below :  $4+4+4+2=14$

- (a) Mean Time Between Failures of the system is 50 flying hours.
- (b) Total mission duration = 5000 Flying hours
- (c) Percentage of fault detection = 90%
- (d) Percentage of fault isolation = 90% (To LRU Level)
- (e) Mean Time to Repair (MTTR)

MTTR with BIT = 2 hours (Fault detected and isolated)

MTTR with NO BIT = 05 hours (Fault detected and NOT isolated)

Making use of the above information determine the following :

- (i) Expected number of failures during 5000 flying hours.
- (ii) Expected number of failures detected by the BIT.
- (iii) Expected number of failures isolated to an LRU.
- (iv) Automatic fault isolation capability (AFIC).

6. (a) Derive an expression for Mean Time Between Failures (MTBF) for an exponential reliability function at constant failure rate. 7
- (b) An aircraft engine consists of three modules having constant failure rates  $\lambda_1 = 0.002$  ;  $\lambda_2 = 0.0015$  and  $\lambda_3 = 0.0025$  failures per operating hour. Calculate the probability that the engine will not fail in 24 hours period. 7
7. Write in brief about the following check procedures in aircraft maintenance. **3+3+3+3+2=14**
- (a) Transit check
- (b) Ramp check
- (c) Service check
- (d) Inter check
- (e) Major service
8. (a) What is the Life - cycle costing concept and what are its benefits ? 7
- (b) Give examples of recurring cost and nonrecurring cost with brief explanations. 7
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