

## **Sample questions for exam: WM0324LR**

### **Ethics and Engineering for Aerospace Engineering**

Instructions:

- this is a closed book exam; you are not allowed to use any books, readers or personal notes during the exam session;
- the exam consists of short essay questions. This document contains eight sample questions;
- in the real exam, the maximum number of points per question is mentioned in brackets immediately after the question. If relevant, the expected number of words is also mentioned;
- for some questions, you are asked to underline two to four keywords. If you fail to underline any words, you will get a subtraction of at most 10% on the total number of points;

## Case: FANX

James is an engineer working for the company AERO that produces aero-engines. The company is developing a new type of aero-engine called the FANX. James is responsible for the testing of the FANX. He is in the middle of conducting a range of crucial tests for the reliability of the new aero-engine. Yesterday, Bill – who is James' boss - has asked James to finish his test reports within a week because an important potential customer will visit AERO next week and wants to have a look at the first test reports. James first reaction is to refuse Bill's request: he is not able to finish the test report within a week; he first needs to do more tests. James considers these additional tests crucial for gaining good insight in the reliability of the FANX. Bill tells James to abandon the planned other tests and to start writing his report immediately. Later, there will be more time to do the other tests. Bill also tells James that if James refuses he will ask Eric to write the report. James says that he really needs more time. Moreover, he objects, Eric is not knowledgeable of the tests and will not be able to write a sound report. After the meeting, James contacts Eric who says that he agrees with Bill and that he will write the report if Bill asks him to do so.

[1] Suppose that James the next day decides to follow Bill's order and to finish the report immediately abandoning the other tests. Can this choice of James be justified in utilitarian terms? Explain why or why not [75-150 words].

*YES:*

- *Criterion is greatest good for greatest number*
- *Better consequences because more sound report than in case Eric accepts assignment*
- *Therefore all parties are better off: customer (has report and report is more sound than as Eric does it), Bill (according to his request), Eric (does not have to write report for which he is not qualified), James (better report, better for his position in company), public (less chance of accident due to incomplete or unsound report)*
- *James can indicate in report that it is preliminary and that more tests have to be done*

*BUT:*

- *Are consequences indeed better?*

- *Are there other options than either writing report or letting Eric do it? (e.g. whistle blowing)?*

[2] What should James do if he would try to apply Kant's categorical imperative to this situation? Underline three keywords [50-100 words].

- *Refuse: Action cannot be universalized. Maxim: write incomplete test report if your boss asks you to do so. If every test engineer would give in in situations like this; tests reports will not be trusted anymore and testing would become superfluous. You cannot want this because it denies the maxim that underlies your action because tests reports become useless.*
- *Also: lying/misinforming the potential customer; cannot be made universal according to Kant.*
- *Other answers are possible (also other keywords).*

[3] What virtues are relevant for an engineer doing test (like James)? (Mention four virtues)

- *Precision, exactness, carefulness*
- *Professionalism/expertise*
- *Objectivity*
- *Integrity*
- *Firmness, courage*
- *(loyalty?)*

*Other virtues might be mentioned, but the virtues should be clearly relevant for a testing engineer.*

[4] What action is supported by these virtues? [25-50 words].

*Not giving in; also not accepting hat Eric takes over assignment. Note: an action should be indicated and it should be argued how it fits with the virtues (compared to other actions).*

[5] Which moral framework (theory) is in your mind best able to deal with this moral problem. Argue why? [50-75 words]

*Score depends on arguments. You should argue not only within a framework but also from the view of choosing between the frameworks. E.g. not only that there are good consequences but also why consequentialism is a better approach than deontology.*

### **Legal versus moral responsibility**

The reader discusses moral responsibility and legal responsibility (liability).

[6] Explain the difference between moral and legal responsibility (mention two points of difference). Illustrate your explanation of a example where the two differ. Underline the two points of difference [50-75 words]

- *The conditions on the basis of which someone is held morally responsible are often different.*
- *Legal responsibility is established in an official and well-regulated procedure in court. It requires a verdict by a judge or a jury and the liability conditions must be proven to apply in a formal juridical sense.*
- *Legal responsibility usually implies the obligation to pay a fine or repay damages, while this is not usually the implication of moral responsibility.*
- *Legal responsibility applies always after the fact, while moral responsibility is relevant both after the fact (backward-looking) as well as before something undesirable has occurred (forward-looking).*

*In the example of Gilbane Gold, it is questionable whether it was morally permissible for the company Z-Corp to continue discharging polluted water, even though the firm acted within the law (different conditions). A pro-active attitude to repair or at least mention the flaws in the required test methods might have been morally desirable (forward-looking).*

### **Technological risks**

In the reader four strategies are mentioned for safe design.

[7] Mention two of these strategies and choose example from aerospace engineering (or engineering in general) to explain how they work. Underline the two strategies [50-100 words]

- Inherently safe design: avoid dangers instead of coping with them for example by replacing substance, mechanisms and reactions that are dangerous by less hazardous ones.
- Safety factors. Constructions are usually made stronger than the load they probably have to bear. Adding a safety factor to the expected load or maximum load is an explicit way of doing this (this probably holds for all strength computations, also for aerospace structures).
- Negative feedback. In case that a device fails or an operator loses control, negative feedback mechanisms can be built in that the cause self-shuts down. An example is the dead man's handle that stops the train when the driver falls asleep or loses consciousness.
- Multiple independent safety barriers. A chain of safety barriers can be designed that operate independently so that if the first fails the others still help to prevent or minimize the effects (example, flying with a co-pilot).

### **Professional codes**

Professional codes or codes of conduct are formulated for several reasons, like increasing moral awareness, the explication of moral norms and values of a profession or a company, the stimulation of ethical discussion, as a way to increase the accountability to the outside world and, finally, to improve the image of a profession or company.

[8] Discuss two limitations of or objections against the use of codes and use one of the ethical theories either to support or to refute these objections. Underline two keywords per argument [50-100 words]

- *ethical behaviour cannot be codified: depends on type of code. Disciplinary codes are binding but advisory codes leave room for autonomy.*
- *codes merely serve as window-dressing (consequentialist argumentation: but if it does lead to better consequences the outcome is still better)*
- *codes are contradictory (a criticism raised against Kantianism as well. But then, moral demands are often contradictory. If these codes can help make it explicit it is a first step. Virtue ethics may give insight in how to find a balance between, for example, confidentiality and making certain things open to the public)*
- *Other limitations/objections are possible as well (see also Section 2.3.3. in reader).*