

Section A (compulsory)

- a) ii
- b) iv
- c) iii
- d) iv
- e) i
- f) iv
- g) iii
- h) i
- i) ii
- j) ii

Section B

3a.

The five main principles of the code of ethics are:

1. Engineers shall hold paramount the safety, health and welfare of the public.

This means that all the work done by the engineer has to place safety, health and welfare above all. If the engineer's judgement is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate. They should approve only those engineering documents that are in conformity with applicable standards.

2. Engineers shall perform services only in the areas of their competence.

This means that engineers shall only undertake projects that they have the qualified education and experience with, i.e. civil engineering degree. He or she must not sign or affix their signatures to documents that they lack competence and knowledge in. If needed, they have to call in experts to obtain services required.

3. Engineers shall issue public statements only in an objective and truthful manner.

The engineers must be truthful and objective in their documents, professional reports or testimony. They shall include all relevant and pertinent information in such documents bearing the date it was produced. They are allowed to express technical opinions publicly only if these opinions are based on facts and knowledge of the subject.

4. Engineers shall act for each employer or client as faithful agents or trustees.

The engineers must disclose all known or potential conflict of interest that could influence or appear to influence their judgement. They shall not accept any other remuneration or compensation from any other parties except his client or employer for the same project unless it is fully disclosed and agreed upon. The trust bestowed on the engineers an honour and privileges but at the same time also imposes legal and professional responsibilities.

5. Engineers shall avoid deceptive acts.

This means the engineers cannot provide false qualifications and permits. They are also not allowed to offer, solicit or receive, either directly or indirectly, any contributions to influence the award of a contract by public authority. Any form of conflict of interest will also tarnish the engineers' loyalties as their original obligations may be compromised because of self-interest or other obligations.

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3b.

The Nicoll Highway accident is one of the major engineering disasters that occurred in Singapore. At about 3.30 pm on 20<sup>th</sup> April 2004, a collapse occurred at part of the excavation site known as "Type M3", which was directly adjacent to the Nicoll Highway.

The collapse was due to two critical design errors:

- i. Under-design of the diaphragm wall using Method A.
- ii. Under-design of the waler connection in the strutting system (about 10% underestimation of strut loads at level 9, 50% underestimation of wall bending moment, 50% underestimation of wall deflections)

The lessons learnt from this disaster are:

- i. There must be a strong safety culture in all construction projects.
- ii. Project safety committees should be formed for every major project under the leadership of the project directors.
- iii. Structural safety of temporary works is as important as that of permanent work.
- iv. Monitoring and instrumentation during the construction must be meticulously undertaken with an eye to safety.
- v. Safety Enforcement by LTA should be done.
- vi. A need for the LTA to review its current practice of dual appointments and identify potential areas of conflict of interest and to take measures to avoid or reduce the conflict.

3c.

The Workplace Safety and Health Act cover all workplaces to ensure the safety and health of all workers since 2010. There are three principles governing the Act are:

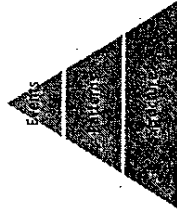
- i. Reduce risk at source by requiring all stakeholders to minimise or eliminate risks which they create.  
Occupiers, employer, supplier, manufacturers, designers and persons at work will have responsibility to identify and prevent or mitigate risks at source
- ii. Industry will be required to take greater ownership of safety outcomes.  
From Prescription to Goal Setting for safety standards and practices, employers must develop actionable plans to achieve the OSH desired outcome.
- iii. Prevent accidents through higher penalties for poor safety management.  
Greater financial incentive, disincentives and penalties.

An action is considered to be practicable when it is capable of being done. Whether it is also reasonable usually takes into account:

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- The severity of any injury or harm to health that may occur;
- The degree of risk (or likelihood) of that injury or harm occurring;
- How much is known about the hazard and the ways of eliminating, reducing or controlling it; and
- The availability, suitability and cost of the safeguards.

3d.



An event is an occurrence at some moment in time. Solutions that address events are short-lives because they do not address the fundamental structure that caused the event. For instance, a company notices that its sale of products is dropping this month. This is an event. Instead of find out why the sales of their product is decreasing, the sales director only focused on getting the numbers up and make the announcement that rewards will be given to those who meet the sales target the next month.

Patterns are changes in events over time and allow us to understand the systemic structure that drives that pattern. In a pattern we begin to see how a series of events are inter-related and begin thinking about what caused them. Using the above example again, the sales manager detects a sales pattern that when sales figure goes up only when the logistic team is meeting their expectations. He then turns his attention to making sure the sales and logistic team cooperates effectively in order to achieve better result. To anticipate events and ultimately change a pattern we need to move to the level of structure.

A structure is the way system components are inter-related. A system's structure gives rise to events and patterns. Although systems are built on structure, they are invisible. The structure holds the key to lasting change because actions taken at the structural level are creative and influence the future. So using back the same example, the sales manager realised that the sales are still affected and this is because of the way the product was being assembled and designed, causing logistic to be inefficient and hence affecting sales. This will require the entire team to work together to find a better solutions to their product in order to enhance the efficiency of every stage from production to delivery. It is hence important to know when to address a problem at the event, pattern or structural level or even a combination of the three.

4a.

Some of the internal factors affecting ASEAN are:

- Not sticking to the true spirit of the Charter
- Protectionism still sporadic in some member states against economic integration
- Haze problem from Indonesia causing disenchantment from neighbouring states (as recent as March 2014)
- Recent disagreement among some members in their disputes over territorial claim in the South China Sea with China (failing to reach a declaration on its 2012 Summit in Cambodia)

The external factors affecting ASEAN are:

- Souring of US-China relations due to trade imbalance, protectionism in US, China's domestic considerations and priorities to maintain internal stability and growth and regarding Taiwan.
- Upheaval in the Middle East relating to Israel-Palestine conflict stirring up strong passions in Muslims communities worldwide.
- Disputes over South China Sea could cause potential disruptions to Sea Lines of Communications for trade-dependent countries like Singapore.
- Disputes over East China Sea by China and Japan, Korea and Japan, weighing down the booming Asian economy which is powered by Japan, China and Korea.

4b.

There are many way in which engineers can contribute to the society.

Civil Engineering:

- Provide infrastructures such as housing, roads, highways and underground tunnels.
- Provide expertise in urban development of the limited land in Singapore.
- Provide expertise in improving transport systems ( buses, mrt, roads) in Singapore.

Environmental Engineering:

- Provide clean and potable water sources.
- Provide solutions to solid waste management.
- Provide solutions to air and water pollution.
- Ensure that all projects that are undertaken fulfil safety and environmental requirements.

Engineers are not just limited to these contributions because as engineers, we are keen and quick to finding solutions to problems, whether or not it is in a specific discipline.

4c.

The reason Singapore has to use the best technology for our military defence is to serve as a strong deterrent against potential aggressor/predator. It is also important for us to achieve military superiority on first-strike, avoiding protracted engagements. Since 1982, Singapore's SAF has been using the Swiss Model for total defence and is combat ready with 6-hour mobilisation.

Our army is capable of rapid deployment and territorial defence and our navy best equipped in the region, is to ensure the sea lane is open, to conduct search and rescue and peace keeping. Our air force is the strongest in the region to maintain air superiority. The defence and related industries generate 10% of GDP, exporter of small fire arms and ammunitions, SAR 21 assault rifle, 50MG machine gun, 40 AGI automatic grenade launcher, Bionic IFVs and etc.

DSTA now employs more than 2800 engineers and scientist in R&D, mainly with PhDs and were awarded with scholarships, to develop home-grown technologies for military and commercial applications, collaborations with NUT/NIUS, and spur technopreneurship in Singapore.

4d.

The advantages of globalisation to Singapore are as follows:

- Increased free trade between nations between Singapore and other nations.
- Increased capital flow through foreign direct investment.
- Greater ease and speed of transportation for goods and people.
- Greater interdependence of nation-states.
- Reduction of likelihood of war between Singapore and other developed nations thanks to diplomacy.

The disadvantages are:

- Increased flow of foreign workers into Singapore causing cultural shock (Little India Riot).
- Increased likelihood of economic disruptions in one country to affect Singapore's economy.
- Greater chance of reactions for globalisation being violent in an attempt to protect local industry and employment.
- International organizations like WTO infringe on national and individual sovereignty.