UNIVERSITY OF SWAZILAND
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE

FINAL EXAMINATION PAPER: DECEMBER 2016

TITLE OF PAPER	ON-SITE SANITATION
COURSE CODE	EHS 205
DURATION	2 HOURS
TOTAL NUMBER OF MARKS	100
INSTRUCTIONS	1. DO NOT OPEN THIS PAPER UNTIL YOU ARE INSTRUCTED TO DO SO BY THE INVIGILATOR. 2. QUESTION ONE IS COMPULSORY. CHOOSE TRHEE OTHER QUESTIONS IN ADDITION TO QUESTION ONE. 3. BEGIN YOUR ANSWERS TO EACH QUESTION ON A FRESH PAGE OF THE ANSWER BOOKLET. ALL PAGES MUST BE NUMBERED CORRECTLY. 4. UNCLEAR HANDWRITING AND CARELESSNESS IN ENGLISH LANGUAGE GRAMMAR SHALL RESULT IN LOSS OF MARKS. 5. MISCONDUCT DURING THE COURSE OF THE EXAMINATION IS PUNISHABLE IN LINE WITH REGULATIONS 012.45-012.48.

QUESTION ONE [25 MARKS]

1. The greatest number of episodes of illness (morbidity) and deaths (mortality) worldwide is caused by;
   (a) Water-related insect vectors
   (b) Water-borne and water-related insect vectors
   (c) Water-washed and water-borne diseases
   (d) Water-based aquatic intermediate host and water-washed diseases
2. Apart from pathogens found in excreta, other components of wastewater that might lead to health problems include;
   (a) NO_3^- content
   (b) CO_2 content
   (c) CO content
   (d) SO_2 content
3. Methaemoglobinaemia in infants is associated with elevated levels of;
   (a) CO_2 content
   (b) CO content
   (c) NO_3^- content
   (d) SO_2 content
4. The main reservoirs of most diseases that affect humans are;
   (a) Houseflies
   (b) Snails
   (c) Humans
   (d) Mosquitos
5. Optimum control of foul odours and infestation of flies and mosquitos are better controlled in;
   (a) Borehole, aqua-privy, and VIP latrines
   (b) Septic tank, pour-flush and aqua-privy systems
   (c) Aqua-privy, off-set pour-flush and double pit VIP latrines
   (d) Hardly any of the above
6. The most expensive on-site sanitation systems are;
   (a) VIP latrines
   (b) Septic tanks
   (c) Pour-flush latrines
   (d) Ecological latrines
7. In a septic tank, the maximum rate of digestion can be achieved at about;
   (a) 25 °C
   (b) 35 °C
   (c) 40 °C
   (d) 45 °C

8. In an emergency situation, the type of latrine that might bring relief within a short space of time is;
   (a) A raised pit latrine
   (b) Simple pit latrine
   (c) Borehole latrine
   (d) Pour-flush latrine
9. The diameter of the hole in a borehole latrine is about;
   (a) 100-300 mm
   (b) 200-500 mm
   (c) 300-600 mm
   (d) 300-500 mm
10. Double-pit pour-flush latrines and double-pi VIP latrines are most useful in areas;
   (a) Where there is a problem of mosquito infestations
   (b) Where it is not possible to dig a deep pit
   (c) Where pit lining is not required
   (d) Where a concrete superstructure is not required
11. This statement "the superstructure design is irrelevant to the operation of the latrine but crucial to the acceptability of the latrine to the user" is applicable to;
   (a) VIP latrines
   (b) Ecological latrines
   (c) Simple latrines
   (d) Composting latrines
12. When they are operated as recommended, they can be considered as permanent installations. These are;
   (a) Very dip simple latrines
   (b) VIP latrines
   (c) Very dip simple latrines lined with hard rock
   (d) Double-pit VIP latrines
13. Unfortunately the superstructure frequently becomes infested with flies and mosquitos and full of pungent odours because users do not replace the squat hole cover after use. Self-closing hole covers have been tried but are often disliked because the cover rests against the user's back. This describes a/an;
   (a) Pour-flush latrine
   (b) Simple latrine
   (c) Offset simple latrines
   (d) Unlined VIP latrines

14. In a flat-roofed latrine, to achieve satisfactory air movement, the top of the vent should be at least;
    (a) 450 mm above the highest part of the roof
    (b) 500 mm above the highest part of the roof
    (c) 550 mm above the highest part of the roof
    (d) 600 mm above the highest part of the roof
15. They are often self supporting, however they may lose their self supporting properties when we. These are;
    (a) Clays and gravel
    (b) Gravel and silts
    (c) Silts and clays
    (d) Sands and clays
16. When casting concrete slabs, curing is an important aspect that determines the strength of the slab. If the concrete is not cured, it will have only;
    (a) 40% of its ultimate design strength
    (b) 50% of its ultimate design strength
    (c) 60% of its ultimate design strength
    (d) 70% of its ultimate design strength
17. If the concrete is cured for three days, it will attain;
    (a) 60% of its ultimate design strength
    (b) 80% of its ultimate design strength
    (c) 90% of its ultimate design strength
    (d) 70% of its ultimate design strength
18. If the concrete is cured for no less than seven days will reach almost
    (a) 100% of its ultimate design strength
    (b) 80% of its ultimate design strength
    (c) 90% of its ultimate design strength
    (d) 70% of its ultimate design strength
19. In many parts of the world, people prefer to sit when using the toilet. Advisably, the seat level should be at a position that is comfortable for the majority of the users, which is normally about;
    (a) 150 mm above the top of the slab
    (b) 350 mm above the top of the slab
    (c) 250 mm above the top of the slab
    (d) 450 mm above the top of the slab
20. Keeping excreta in a dark place does not prevent the breeding of;
    (a) Houseflies
    (b) Dragon flies
    (c) Anopheles mosquitos
    (d) Blowflies

21. For finding food, sight and smell are important in
    (a) Anopheles mosquitos
    (b) Flies
    (c) Viruses
    (d) Pathogens
22. Keeping the pit of a latrine fully sealed or covering the surface of the liquid with a film, such as oil, is important in minimizing the breeding of;
    (a) Culex mosquitos
    (b) Dragon flies
    (c) Blowflies
    (d) Cockroaches
23. When building latrines, the shape of the pit may be circular, square or rectangular in plan. However, the most stable type of a pit is the one that is;
    (a) Square
    (b) Circular
    (c) Rectangular
    (d) Square (especially in granular soils)
24. Many insects are attracted to excreta because it provides rich organic material and water, both of which are essential for the insects' development. The most important groups of insects, from a health point of view, do not include;
    (a) Culex mosquitos
    (b) Dragon flies
    (c) Anopheles mosquitos
    (d) Blowflies
25. Soil porosity also affects the rate of infiltration liquids from pits and drainage trenches. Soils known to drain easily include;
    (a) Gravel
    (b) Silt
    (c) Clay
    (d) Soils containing organic matter

QUESTION TWO [25 MARKS]

1. Unless excreta is isolated from potential contact with humans, animals and insects, pathogens may be carried on unwashed hands, in contaminated water or food, via flies, or contaminated ground to further human hosts. In sanitation studies, the first and second barrier concepts are considered as the simplest strategies to stop or reduce transmission. Using only a labeled sketch of the F-Diagram, show how proper excreta disposal and hand washing with soap can stop or prevent transmission of faecal pathogens [**15**].
2. State other two constraints that hinder access to sanitation services [**2**].
3. What is sanitation? [**2**]
4. As faecal matter is decomposed, it is reduced in volume and mass. State any four factors that contribute to reduction [**4**].
5. What is concrete? [**1**]
6. When building concrete slabs for pit latrines, reinforcement is normally required. Why is reinforcement necessary? [**1**]

QUESTION 3 [25 MARKS]

1. In most countries, concrete or cement-based slabs provide the most durable and economic method of covering latrine pits. However, not everybody can afford concrete-based slabs, and thus, wood is also utilized in building slabs. Describe your understanding of;
   (a) Timber and earth slabs [**4**].
   (b) Sawn timber slabs [**4**].
2. **Figure 1** represents an item that can be used in construction of certain types of latrines. Study the diagram carefully and answer the questions that follow.

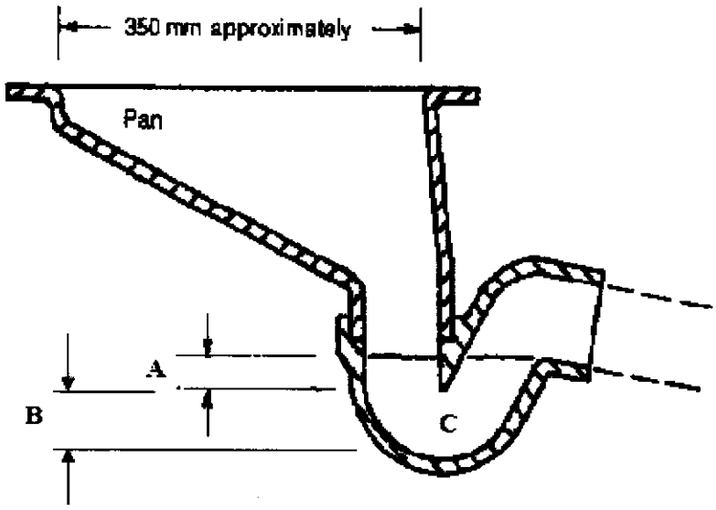

Figure 1: An item used in construction of some types of latrines

2.1 State the name of the item shown in **Fig. 1** [**1**].
2.2 State one latrine type that requires the installation of the **Fig. 1** [**1**].
2.3 State and define the features represented by A, B and C [**6**].
2.4 State the recommended dimensions for A and B [**2**].
3. Describe the key challenges associated with borehole latrines [**5**].
4. What is the purpose of seeding a new septic tank with sludge from a septic tank that has been operating for some time? [**2**]

QUESTION 4 [25 MARKS]

1. Some of the key constraints that hinder access to sanitation services in peri-urban areas and slums are low prioritization by governments and lack of financial resources. In not more than three points for each, describe some of the problems associated with these constraints [**9**].
2. The technical objective of sanitary excreta disposal is to isolate faecal matter so that the infectious agents in them cannot reach a new host. However, the method or type of facility chosen for any particular area or region might depend on many factors, including socio-cultural beliefs. In your understanding, how can this affect access to sanitation facilities? [**6**]
3. State any three types of durable material that may be used for pit latrine lining [**3**].
4. State any two factors that determine the amount of urine excreted by an individual on a daily basis [**2**].
5. State any four factors affecting the amount of excreta and urine excreted by an individual on a daily basis [**4**].
6. What is a vent pipe? [**1**]

QUESTION 5 [25 MARKS]

1. **Figure 1** shows some of the requirements for concrete slabs in construction of latrines. Study the diagram carefully and answer the questions that follow.

1.1 What is the purpose of a slab in a latrine? [**3**]
1.2 State (in mm) the extent of slab overlap at x and y sides of the pit [**2**].
1.3 What is the purpose of slab overlap? [**2**]
1.4 According to (i) and (ii), the upper surface of the slab is higher than the surrounding ground level. What is the purpose of this detail? [**2**]
1.5 What is the recommended height of ground between (i) and (ii)? [**1**]
1.6 According to (iii), there is a slight fall in the level of the slab. What is the purpose of this detail? [**2**]
1.7 State the recommended fall in slab level as shown in (iii) [**1**]