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

RESIT EXAMINATION PAPER: JULY 2017

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. They are often self supporting, however they may lose their self supporting properties when we. These are;
   (a) Silts and clays
   (b) Clays and gravel
   (c) Gravel and silts
   (d) Sands and clays
2. 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
3. According to recent case studies on hand washing, it is possible that when schools implement hand washing with soap, trips to the doctor can be decreased by;
   (a) Less than half
   (b) Half
   (c) More than half
   (d) Two-thirds
4. Subsequent to adoption of hand washing with soap in schools, pupil's understanding of correct water treatment procedure can increase;
   (a) From 21% to 65%
   (b) From 21% to 75%
   (c) From 21% to 85%
   (d) From 21% to 95%
5. Hazards of wastes do not include;
   (a) Physical hazards
   (b) Microbiological hazards
   (c) Psychological hazards
   (d) Biological hazards
6. The control of community water supplies, excrete and wastewater disposal, refuse disposal, vectors of disease, housing conditions, food supplies and handling, atmospheric conditions, and the safety of the working environment is;
   (a) Sanitation
   (b) Environmental sanitation
   (c) Sanitary waste management
   (d) Environmental sanitation handling

7. Nutrients from human and animal wastes can be recycled to soil in a process often referred to as;
   (a) Sustainable ecological on-site sanitation
   (b) Sustainable ecological waste management
   (c) Ecological recycling
   (d) Ecological sanitation
8. Access to sanitation services is;
   (a) The same in urban and rural areas
   (b) Higher in urban areas than in rural areas
   (c) Higher in rural areas than urban areas
   (d) Not possible to measure between urban and rural areas
9. Problems related to access to sanitation services are;
   (a) Severe in urban areas
   (b) Severe in peri-urban areas and slums
   (c) Severe in rural areas
   (d) Not possible to measure between rural, peri- and urban areas
10. The amount of faecal matter and urine excreted daily by individuals varies considerably depending on factors that do not include;
   (a) Water consumption
   (b) Air quality
   (c) Climate
   (d) Area of residence
11. One of the factors determining the amount of urine excreted daily is;
   (a) Humidity
   (b) Area of residence
   (c) Quality of water that the person drinks
   (d) Size of the bladder
12. The amount of urine excreted daily is estimated to be about;
   (a) 0.6 – 1.1 Lt
   (b) 0.5 – 1 Lt
   (c) 0.6 – 1.2 Lt
   (d) 1.2 – 1.5 Lt
13. Excreta decomposition gases include;
   (a) CO
   (b) CH_4
   (c) N_2O
   (d) NO_2

14. The decomposition of faecal matter is mainly carried out by;
    (a) Bacteria
    (b) Fungi
    (c) Viruses
    (d) Worms
15. During composting of a mixture of faecal matter and vegetable waste under fully aerobic conditions, the temperature may rise to;
    (a) 50°C
    (b) 60°C
    (c) 70°C
    (d) 80°C
16. Decomposition of faecal matter under water produces a much greater reduction in volume than decomposition in air.
    (a) True
    (b) False
    (c) True but not always
    (d) It is not possible to compare decomposition rates
17. Many soils may appear to be self-supporting when first excavated; however, these self supporting properties may be lost over time owing to changes in the moisture content. An example of such soils is;
    (a) Laterites
    (b) Gravel
    (c) Hard rock
    (d) Bonded rock
18. 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
19. 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
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. 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
25. When they are operated as recommended, they can be considered as permanent installations. These are;
    (a) Double-pit VIP latrines
    (b) Very dip simple latrines
    (c) VIP latrines
    (d) Very dip simple latrines lined with hard rock

QUESTION TWO [25 MARKS]

1. The amount of faecal matter produced by human beings on a daily basis is linked with a number of factors. Study **Fig. 1** carefully and answer the questions that follow.

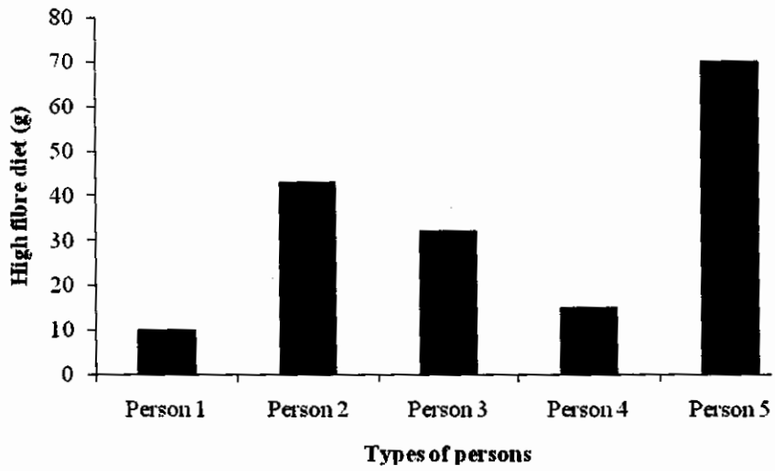

Fig. 1: Type of persons (1-5) and their intake of high fibre diet (g)

1.1 In increasing order, arrange the types of persons according to the amount of faecal matter they produce per day [**2**].

1.2 In descending order, arrange the persons according to the level of difficulty of the occupations they are involved in [**2**].

1.3 In ascending order, arrange the person according to the level of development of the area they live in [**2**].

1.4 After a day of shopping at Pick n' Pay, shopper **A** emerges with trolley containing vegetables, fruit, wholegrain foods, legumes, nuts and seeds, while shopper **B**'s trolley contains mostly white bread without nuts and seeds, white rice, plain white pasta, refined hot cereals, pancakes or waffles made from white refined flour. Using **Fig. 1**, state the most relevant types of persons for shopper **A** and **B** [**4**].

2. State any three factors that affect the rate of infiltration of liquids from pits and drainage trenches [**3**].

3. The use of local material in building latrines is important. However, the use of timber, bamboo or hard woods is generally not recommended. Why? [**4**]

4. Constant fouling on the inside of the toilet seat is a problem that might lead to increased odour and fly breeding. Describe any three strategies that might be adopted to minimize these problems [**3**].

5. The most effective way of checking the strength of a slab is to test load it seven days after manufacturing (casting) it. Describe briefly how this is done [**3**].
6. Why is it necessary for concrete to be cured before transferring the slab to the pit latrine? [**2**]

QUESTION 3 [25 MARKS]

1. There are five categories of ground conditions that affect selection and design of sanitation facilities, which must always be considered. These include; bearing capacity of the soil, self-supporting properties of the pits against collapse, depth of excavation possible, infiltration rate, and groundwater pollution risk. For each of the following statements, state the most relevant factor [**12**].

1.1 In general, it is safe to assume that if the ground is suitable for building a house it will also be strong enough to support the weight of a latrine superstructure made of similar materials, providing the pit is appropriately lined.

1.2 Soils containing organic materials also tend to retain water but the roots of plants and trees break up the soil, producing holes through which liquids can drain quickly.

1.3 Growth of microorganisms and their wastes, swelling of clay minerals, and precipitation of insoluble salts are some of the things that are a problem in this factor

1.4 Because of their comparatively large size, protozoa and helminths are rapidly removed by the straining action of the soil, but bacteria and viruses are more persistent

1.5 Of the chemical substances generally present in domestic wastes, only nitrates present serious health dangers. Young babies bottle-fed with milk made from water with a high nitrate concentration may develop methaemoglobinaemia, which can be fatal if untreated.

1.6 In the unsaturated zone, the flow of liquid is induced by gravity, and cohesive and adhesive forces set up in the soil. Seasonal variation may produce a change in the amount of air and water in the soil pores and this will affect the flow rate.

2. When building reinforced concrete slabs, what precautions need to be taken to ensure that the steel used remains in good condition for many years? [**3**]
3. Describe some of the chief problems associated with using wood or bamboo in pit latrine linings and slabs [**4**].
4. Describe any two purposes of a vent pipe [**2**].
5. Describe any two strategies that can be adopted to ensure that fly screens are kept in good condition [**2**].
6. Describe one advantage of a vent pipe positioned outside the latrine over the one positioned on the inside of the latrine [**2**].

QUESTION 4 [25 MARKS]

1. State one problem that might result in inhibition of sludge digestion processes in a septic tank [**2**].
2. State any four problems associated with simple latrines [**4**].
3. Well-constructed and maintained VIP latrines can combat most of the problems associated with simple pit latrines, except one problem. State and describe the problem [**3**].
4. What is the difference between a pour-flush latrine and an off-set pour-flush latrine? [**2**]
5. Describe any two situations or conditions that might favour the use of pour-flush latrines in a particular place [**2**].
6. Describe any two reasons why offset pour-flush latrines are favoured by many people [**4**].
7. Describe one problem associated with pour-flush latrines [**3**].
8. What is an aqua-privy? [**2**]
9. Between pour-flush and off-set pour-flush latrines, which one require larger volumes of flushing water and why? [**3**]

QUESTION 5 [25 MARKS]

1. The inadequate and insanitary disposal of infected faecal matter leads to the contamination of the ground and of sources of water. Often it provides the sites and the opportunity for certain disease vectors to lay their eggs, to breed, or to feed on the exposed material and to carry infection. Based on this understanding, describe the following terms, with one disease example in each case [**12**]
   1.1 Water-borne
   1.2 Water-washed
   1.3 Water-based aquatic intermediate host.
   1.4 Water-related insect vectors
2. How can problems such as foul gases, flies and mosquitos be controlled in an aqua-privy? [**2**]
3. In aqua-privy latrines, leaks and the influence of evaporation can affect the seal at the bottom of the drop-pipe. How can these problems be prevented? [**3**]
4. State any five pathogens that may be found in excreta [**5**].
5. Why do you think children under the age of five years are the ones considered most at risk of sanitation-related diseases? [**3**]