UNIVERSITY OF KWAZULU-NATAL

FACULTY OF ENGINEERING

SCHOOL OF ELECTRICAL, ELECTRONIC & COMPUTER ENGINEERING

Environmental Engineering

2nd SEMESTER EXAMINATION – December 2016

MODULE CODE : **ENEL2ENH2**

EXAMINER : Troy Govender (Internal)

MODERATOR : Novashni Moodley (External)

MARKS: 100 **DURATION: 2 hours**

FULL NAME: _____

STUDENT NO.: _____

SIGNATURE : _____

INSTRUCTIONS: (Please Read Instructions Carefully)

1. Answer a total of FIVE (5) **QUESTIONS** (Q1 from Section A, Q2 from Section B and any 3 questions ONLY from Section C).
2. Before choosing the **THREE (3) QUESTIONS** only from **SECTION C**, read all the questions first to determine which three you can answer best.
3. Answers for Section A must be entered on the Mark Reading Card (provided) with a dark (HB) **PENCIL** only.
4. Answers for Section B and C must be completed on this question paper with a **PEN**.
5. Check that you have a total of 15 pages including this cover sheet, before you attempt this paper.

SECTION A

QUESTION 1: Multiple Choice Questions to be answered on MCQ Mark Reading Cards. Make sure you enter your name and student number on the MCQ mark card correctly. Shade in fully (in HB pencil) your name, student number and choice for the correct answer in the boxes of the MCQ mark card. Crosses (x) or dashes (-) on the mark reading card will be INCORRECT.

1.1 Which of the following statements about <u>population</u> and <u>poverty</u> are TRUE?

(a) The current world population is approx. 7 billion

(b) Approx. 4 billion people live in poverty in the world

(c) In Africa about 60% of the population live in poverty

(d) South Africa's population is approx. 52 million of which about 30.2 million live in poverty

A. (a), (b) B. (a), (b), (d)

C. (c), (d) D. (a), (b), (c), (d)

E. (a), (d)

1.2 The equation, *Risk* = *Hazards* + *Outrage* can be used to understand and manage environmental issues in business.

Which of the following statements about this equation are TRUE?

(a) <u>Risk</u> refers to financial, legal, environmental and publicity risks

(b) <u>Hazards</u> refer to environmental damage (hazardous substance spills, illegal cutting of indigenous/protected trees, air, land and water pollution, etc.)

(c) <u>Outrage</u> refers to media, community, government or NGO response, anger or dissatisfaction

(d) A company's risk is indirectly proportional to the sum of its hazards and outrage

A. (a), (c), (d) B. (a), (b), (c)

C. (a), (b) D. (a), (b), (c), (d)

E. (b), (c)

1.3 The main or number one reason that forces most businesses to respond to the environmental challenges is…

A. ethical considerations

B. reduction of risk

C. new business opportunities

D. new standards and legislation

E. public pressure

1.4 The components of sustainability are:

(a) Environmental sustainability
(b) Social sustainability
(c) Political sustainability
(d) Economic sustainability

A. (a), (c), (d)
B. (a), (b), (c), (d)
C. (a), (b), (d)
D. (b), (c), (d)
E. (b), (c)

1.5 Which of the following statements about trees and deforestation are TRUE?

(a) Trees are the natural "lungs" of the world, as they absorb CO_2 and give off O_2
(b) Each minute an area of tropical rain forest equal to the size of 20 football fields is destroyed
(c) Deforestation contributes directly to global warming
(d) If deforestation continues at the present rate, in the next decade 5% of all plant and animal species known to man will be extinct

A. (a), (b), (c)
B. (a), (b)
C. (b), (c)
D. (a), (c)
E. (a), (b), (c), (d)

1.6 The potential water crisis in South Africa is caused by:

(a) the contamination of water resources
(b) the wanton (careless) waste of water by many in the country
(c) the irrigation systems used by the poor for food production
(d) pollution of large volumes of our fresh water by chemicals, oils, etc.

A. (a), (b), (c)
B. (a), (c), (d)
C. (c), (d)
D. (a), (b), (d)
E. (a), (c)

1.7 Some suggested solutions to address overpopulation include…

(a) Better Education
(b) Relocation of families to less populated areas
(c) Tax Benefits or Concessions
(d) Sex Education

A. (a), (b), (c), (d)
B. (c), (d)
C. (a), (c), (d)
D. (b), (d)
E. (a), (b), (c)

1.8 Which of the following statements about Global Warming and Climate Change is CORRECT?

(a) Global Warming is often referred to as "The Butterfly Effect"

(b) Human activities now emit more than 135 times more CO_2 than volcanoes each year

(c) Atmospheric CO_2 concentrations have increased by almost 80% since pre-industrial times

(d) China is now estimated to be the largest emitter of GHGs in the world

A. (a), (b), (c), (d) B. (c), (d)

C. (a), (c), (d) D. (b), (d)

E. (a), (b)

1.9 Green House Gases (GHGs)…

(a) are from anthropogenic (human-made) and natural sources (e.g. wetlands)

(b) CO_2 is able to trap more heat than methane (CH_4)

(c) released from human activities is currently over 30 billion tons of CO_2

(d) are many, but the main ones are carbon dioxide, methane, nitrous oxide, fluorinated gases and water vapour

A. (a), (b), (c),(d) B. (c), (d)

C. (a), (c), (d) D. (b), (d)

E. (a), (c)

1.10 Climate change will affect human health in the following ways…

(a) an increase in the risk of heat-related illnesses and death

(b) human safety and health at risk due to an increase in the frequency and strength of extreme events (such as floods, droughts, and storms)

(c) more temperature-related illness and death from increased smog and heat waves

(d) the spread of infectious diseases such as malaria, dengue and yellow fever across countries as insects carrying these diseases migrate with the warming climate

A. (a), (c), (d) B. (a), (b), (c), (d)

C. (a), (b), (d) D. (d), (c)

E. (a), (b), (c)

1.11 Some examples of <u>adaptation</u> to climate change include:

(a) planting millions of trees to absorb all the CO_2 in the atmosphere

(b) building seawalls to protect coastal areas from sea swells or rising sea levels

(c) relocating buildings to higher ground to protect communities against increased flooding due to storms

(d) farmers planting stress-resistant crops to cope with wetter conditions

A. (c), (d) B. (a), (b), (c), (d)

C. (a), (b), (d) D. (a), (c), (d)

E. (b), (c), (d)

1.12 A young engineer paid R11 925-00 carbon tax on a new car she bought. Which of following cars did she purchase?

A. BMW M3, CO_2 emission = 204g/km

B. Audi RS5 Coupe quattro, CO_2 emission = 246g/km

C. VW Golf R, CO_2 emission = 165g/km

D. Toyota 86 2.0 High, CO_2 emission = 181g/km

E. Mercedes AMG SL65, CO_2 emission = 279g/km

1.13 A factory in Durban emits 150 tons of CO_2 annually. What is the carbon tax this company will be subjected to, under the new proposed carbon tax in South Africa?

A. R11 250-00

B. R18 000-00

C. R3 600-00

D. R20 250-00

E. R15 000-00

1.14 Some of the responses required from business/industry to the climate change crisis include…

(a) Ensuring energy and water efficiency at their offices/sites

(b) Capturing and storing their carbon emissions

(c) Measuring and managing their carbon emissions

(d) Minimising the generation of waste and re-using or recycling waste wherever possible

A. (a), (b), (c) B. (a), (c), (d)

C. (a), (b), (c), (d) D. (a), (b), (d)

E. (a), (c)

1.15 The environmental rights (Section 24 of the S.A. Constitution) of all in South Africa, are made effective/enforceable by which law?

A. *The Environment Conservation Act (Act 73 of 1989)*
B. *National Heritage Resources Act (Act 25 of 1999)*
C. *National Environmental Management Act (Act 107 of 1998) (NEMA)*
D. *Public Finance Management Act (Act 1 of 1999)*
E. *The Enforcement of Rights Act (Act 3 of 1997)*

1.16 In terms of NEMA, Section 30 (5) all significant environmental incidents must be reported to the authorities within/once

A. 30 days
B. 24 hours
C. the internal investigations are completed
D. 14 days
E. the agreed timeframes between the organisation and the authority

1.17 Protected trees such as *Marula (Umganu)*, *White milkwood (makhwelafingqane)*, etc. are given special protection in S.A. under the

A. *National Environmental Management Act (Act 107 of 1998)*
B. *Protected Tree Act (Act 33 of 1997)*
C. *Conservation of Agricultural Resources Act (Act 43 of 1983)*
D. *National Forest Act (Act 84 of 1998)*
E. *Environment Conservation Act (Act 73 of 1989)*

1.18 Some of the <u>proactive</u> tools to ensure environmental quality include:

(a) Strategic planning
(b) Environmental Impact Assessments
(c) Environmental laws
(d) Basic Assessments

A. (a), (b),
B. (a), (c), (d)
C. (a), (b), (c), (d)
D. (a), (b), (d)
E. (a), (d)

1.19 Issues that are of importance and that must be included in environmental assessments for local projects, by an independent environmental consultant, are:

(a) Consideration of alternatives
(b) Climate change
(c) Public participation process (PPP), viz. stakeholder engagement
(d) Ensure the approval of the environmental assessment and the project, by the authority

A. (a), (b), (c), (d) B. (c), (d)
C. (a), (b), (c) D. (a), (c)
E. (a), (b), (d)

1.20 The different categories of Environmental Management Plans (EMPs) include:

(a) Planning, Design and Survey phase EMP
(b) Construction phase EMP
(c) Operations Phase EMP
(d) Decommissioning Phase EMP

A. (a), (b), (c), (d) B. (b), (c), (d)
C. (a), (b), (c) D. (a), (c), (d)
E. (b), (d)

1.21 Birds are increasingly interacting with powerlines because

(a) there are less trees/forests for birds to use as foraging and nesting sites
(b) there are more powerlines everywhere, providing a suitable alternative to trees
(c) of the warmth given off by powerlines
(d) the glow around powerlines attracts insects which is a good food source for birds

A. (a), (c), (d) B. (a), (b), (c)
C. (a), (b) D. (a), (d)
E. (b), (c), (d)

1.22 Bird interactions with powerlines that cause problems for the birds and electricity supply include:

(a) Collisions causing injury/death
(b) Electrocutions causing death
(c) Bird excretions falling onto infrastructure and causing electrical faults
(d) Landing and perching on electricity towers/poles

A. (a), (b), (c), (d) B. (c), (d)
C. (a), (b), (c) D. (a), (c)
E. (a), (b), (d)

1.23 The main bird species that are injured or die through <u>collision</u> with powerlines include:

(a) Eagles
(b) Flamingos
(c) Wattled Crane
(d) Egyptian Geese

A. (a), (b) B. (c), (d)
C. (b), (c), (d) D. (a), (c)
E. (b), (d)

1.24 An Environmental Management System (EMS), based on ISO14001, is a self regulation approach to manage environmental issues and seeks to address all environmental incidents as follows…

A.	Identify	→	React	→	Cure
B.	Predict	→	Adapt	→	Avoid
C.	Identify	→	Predict	→	Cure
D.	Avoid	→	React	→	Adapt
E.	Investigate	→	Assess	→	Mitigate

1.25 National Water Week is one of the most common environmental events used in SA to create awareness about water issues and promote water savings. When is National Water Week celebrated in S.A?

A. 1st week of September
B. 1st week of January
C. 2nd week of December
D. 3rd week of March
E. 1st week of June

(25 x 2 = 50)

SECTION B: COMPULSORY: Write neatly and legibly in pen.

Question 2

2.1 "*A carbon footprint is 'the total set of GHG (greenhouse gas) emissions caused directly and indirectly by an individual, organisation, event or product' (UK Carbon Trust 2008).*

Calculate the total number of trees that the whole 2016 Enviro Eng class, i.e. 245 students, need to plant to offset their combined carbon footprint.

Note that approx. 400 trees can assimilate (absorb) 2 tons of carbon and the average carbon footprint of the UKZN Environmental Engineering student is 11 tons of CO_2 per year.

(1 mark for each step shown)

(8)

2.2 **State <u>two</u> (2) impacts of climate change on <u>weather</u>.**

(2)

2.3 Citizens also need to respond to climate change.

List any <u>four</u> (4) practical actions that Africans can take to reduce their own GHG emissions.

_____

_____

_____

_____

_____

(4)

2.4 "Ten percent of all bird species are likely to disappear by the year 2100, and another 15 percent could be on the brink of extinction**."**

List four (4) <u>solutions</u> you can provide to an electricity utility to minimise or prevent collision or electrocution of birds from powerlines

_____

_____

_____

_____

_____

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_____

_____

_____

_____

(6)

SECTION C: **Answer ONLY <u>three (3)</u> questions from this Section. Write neatly and legibly.**

Question 3

3.1 Noise pollution may disrupt the activity or balance of human or animal life.

List two (2) negative effects of noise on <u>wild animals</u>.

_____

_____

_____

_____

(4)

3.2 **List four (4) relevant issues in the world currently, that businesses and engineers need to take into consideration in their work.**

_____

_____

_____

_____

(4)

3.3 **Provide any two (2) good examples of the "environmental handprint" tool to ensure sustainability.**

_____

_____

_____

_____

(2)

Question 4

4.1 The loss of biodiversity (plant and animal life) is occurring rapidly across the planet.

List any four (4) <u>causes</u> of the loss of biodiversity.

_____

_____

_____

_____

_____

(4)

4.2 **What are three (3) anthropogenic (human-made) <u>sources</u> of CO_2?**

_____

_____

_____

_____

(3)

4.3 **List any three (3) benefits of sustainability.**

_____

_____

_____

_____

(3)

Question 5

5.1 The current environmental crisis on planet earth can be grouped into seven (7) root causes.

List four (4) <u>root causes</u> of the present environmental crisis in the world?

_____

_____

_____

_____

_____

(4)

5.2 **Calculate the carbon tax for a Toyota Hiace Siyaya minibus taxi which emits 251g/km? Show all calculations.**

_____

_____

_____

_____

_____

(4)

5.3 **List any two (2) significant bird species that are killed mainly through <u>electrocution</u> on powerline structures.**

_____

_____

_____

_____

(2)

Question 6

6.1 Without a doubt the biggest issue facing the environment is over population of humans.

List at least four (4) <u>effects</u> of over-population? In other words, what does over population lead to?

_____

_____

_____

_____

_____

(4)

6.2 The consequences of breaking an environmental law are the same as committing a criminal offence.

List <u>three</u> (3) consequences of breaking an environmental law?

_____

_____

_____

_____

(3)

6.3 **What are three (3) positive <u>environmental</u> impacts/benefits of providing electricity to rural communities?**

_____

_____

_____

_____

(3)

Question 7

7.1 Mitigation involves attempts to slow the process of global climate change by lowering the level of GHGs in the atmosphere.

List three (3) <u>mitigation</u> strategies that can be used to reduce GHGs.

_____

_____

_____

_____

(3)

7.2 Most companies are moving towards self-regulation for managing environmental issues, by developing and implementing an Environmental Management System (EMS).

State <u>four</u> (4) benefits/advantages of an EMS to a company.

_____

_____

_____

_____

_____

(4)

7.3 Electricity distribution has numerous negative environmental impacts.

List <u>three</u> (3) negative environmental impacts/risks of electricity distribution.

_____

_____

_____

(3)