NATIONAL EXAMS December 2017

04-Env-A5, Air Quality and Pollution Control Engineering

3 hours duration

NOTES

1. If doubt exists as to the interpretation of any questions, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is an Open book exam.

3. Candidates may use one of two calculators, the Casio or Sharp approved models. Write the name and model designation of the calculator on the first inside left hand sheet of the exam work book.

4. Four (4) for a total of five (5) questions constitute a complete paper. Only the four (4) answers as they appear in your work book(s), will be marked.

5. Each question is worth a total of 25 marks with the section marks indicated in brackets ( ) at the left margin of the question. The complete Marking Scheme is also provided on the final page. A completed exam consists of four (4) answered questions with a possible maximum score of 100 marks.

Problem 1

Provide answers to the following questions related to *source and classifications of atmospheric pollutants, indoor and outdoor air pollutants and health and ecological impacts*.

(8) (i) what is air pollution? Provide definition and examples of air pollution, include specific sources.

(8) (ii) Describe two (2) different types of indoor air pollutants, their potential health impacts and briefly explain two (2) related health and two (2) related ecological impacts associated with each

(4) (iii) What is indoor pollution? Provide an example, describe specific substance and impact on human health.

(5) (iv) What is classification of atmospheric pollutants?

Problem 2

Provide answers to the following questions related to influence of *solar radiation and wind fields on stack plumes, dispersion and deposition modelling of atmospheric pollutants and Eddy and Gaussian diffusion models.*

(10) (i) What is Pasquill stability classes? When describing provide what it is composed of. Give examples of how it is used in Gaussian dispersion models.

(10) (ii) name 4 types of plume behavior. Select 3 and draw a simple diagram (i.e. side view) and describe the behavior in terms of distance away from the stack and dispersion.

(5) (iii) describe one (1) air quality model, <u>other</u> than dispersion model.

Problem 3

Provide answers to the following equations related to *measurement techniques of air pollutants, characteristics of various air pollutant particulates and health and aesthetic considerations of $PM_{2.5}$ and PM_{10}.*

(10) (i) List three (3) measurement techniques. Describe in detail how each technique works, for which pollutant it should be used and what are the limitations and advantages of each.

(5) (ii) What are health and aesthetic considerations of particulate matter as air pollutant. Start by describing origin of the emissions.

(5) (iii) Define $PM_{2.5}$ and PM_{10}. Describe 3 (3) key differences in the health effects and aesthetics between the $PM_{2.5}$ and PM_{10} categories of particulate pollutants.

(5) (iv) what is total suspended particulate matter? What is condensable and filterable particulate matter? Provide examples of condensable and filterable particulate matter.

Problem 4

Provide answers to the following questions related to *air toxics, mobile sources of air pollutants, noxious pollutants and odour control and emission trading.*

(10) (i) what are mobile sources, give 4 examples, what substances are commonly associated these sources? Briefly describe how the emissions can be reduced or eliminated.

(10) (ii) What is odour? What are units of odour? Describe industrial source of odour emissions.

(5) (iii) Describe one program (federal or provincial), give full name, which regulates emissions of your choice. Describe the substance and source.

Problem 5

Provide answers to the following questions related to *behavior of gaseous pollutants (CO, SO_x, NO_x, etc) in the atmosphere and monitoring and control of particulate emissions.*

(10) (i) describe how following pollution control technologies work and comment when best to apply each: baghouse, electrostatic precipitator and cyclone.

(6) (ii) List and describe monitoring techniques of stack emissions, one for emissions of particulate, one for emissions of CO, one for emissions of SO_x.

(9) (iii) select three (3) gaseous pollutant (CO, SO_2, NOx, PM) describe their behavior in the atmosphere.

Marking Scheme

1. (i) 8, (ii) 8, (iii) 4, (iv) 5 , 25 marks total
2. (i) 8, (ii) 10, (iii)5, 25 marks total
3. (i) 10, (ii) 5, (iii) 5, (iv) 5, 25 marks total
4. (i) 10, (ii).10, (iii) 5, 25 marks total
5. (i) 10, (ii) 6, (iii) 9, 25 marks total