



# UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2015

COURSE NO : PE 378  
COURSE NAME: **TRANSPORTATION OF OIL AND GAS**  
CLASS : PE III TIME: **3 HOURS**

Name: \_\_\_\_\_ Index Number: \_\_\_\_\_

## **ANSWER SECTIONS A AND B ON THE QUESTION PAPER**

### **SECTION A (1 Mark Each)**

1. A \_\_\_\_\_ exists where a process variable is measured, compared to a setpoint, and an action is taken to correct any deviation from the setpoint.
2. A \_\_\_\_\_ is a value for a process variable that is desired to be maintained.
3. Pipeline refers to a long line of connected segments of pipe, with Pumps, Valves, Control Devices, and other equipment or facilities needed for operating the system. Generally, pipelines have a minimum diameter of \_\_\_\_\_ and minimum length of \_\_\_\_\_.
4. The factor that is changed to keep the measured variable at setpoint is termed?
5. The \_\_\_\_\_ is the condition of the process fluid that must be kept at the designated setpoint normally held within tight given limits.
6. Sampling and testing are carried out in accordance with what standards?
7. \_\_\_\_\_ is the difference between the measured variable and the setpoint and can be either positive or negative.
8. How can one identify all of the local permits required for a proposed pipeline?
9. Agencies typically charged with oversight duties of pipelines are commonly known as the what?
10. The second largest cause of leak is caused by what?
11. \_\_\_\_\_ and graduate is used for measuring the API gravity of the oil.
12. \_\_\_\_\_ is used for measuring the height of the oil in the tanks.
13. A \_\_\_\_\_ is used for measuring BS&W content.
14. Which of the underground reservoirs is generally the least desirable and most expensive type of natural gas storage facility?
15. Imperfect coating/lining can result in pipeline leaks known as \_\_\_\_\_.
16. Which areas will it be advisable to use wooden barrel and or fibreglass tanks?
17. What is the purpose for stock tanks having a bottom drain outlet?
18. Which storage tank can be fabricated easily and arranged in less space than other types of tanks and therefore used offshore?
19. \_\_\_\_\_ is use to distinguish between laminar and turbulent fluid flow.

20. There are two types of pipeline maintenance, what are they?

a.

b.

**SECTION B (2 Marks Each)**

1. What is a Pipeline?

2. What is trenchless technology?

3. For economic operation, how should a pipeline be utilised?

4. Several items enter into the total investment necessary to put an underground storage field into operation. List any four of such items to be considered.

a.

c.

b.

5. List any four coatings available for the protection of storage facilities.

a.

c.

b.

d.

6. List any four advantages of using pipeline system over the other forms of transportation systems.

a.

c.

b.

d.

7. The Primary Energy Losses in single-phase gas flow in pipes are of Frictional Losses. This frictional losses result from two main causes. What are they?

a.

b.

8. Based on the first law of thermal dynamics, the total pressure gradient is made up of three distinct components. What are these components?

a.

b.

c.

9. What is the primary use of internal coatings?

10. To secure high-quality coatings, consideration must be given to the three main factors such as;

a.

b.

c.

11. What is a Base or cushion gas

12. List the three types of underground storage reservoirs.

- a.
- b.
- c.

13. Sampling and Testing are usually done through \_\_\_\_\_. The primary tool lowered through the hatch is the \_\_\_\_\_ and the process is known as \_\_\_\_\_ the tank.

14. The degree of sophistication of automation or computer system in pipe laying maintenance of equipment depends on what?

- a.
- b.
- c.

15. The automatic control system generally includes three parts. What are these parts?

- a.
- b.
- c.

16. Accuracies of automatic control system relies on accurate online data collected. How can this be achieved?

17. Which scale affects the justification of multiproduct lines? And when this scale is achieved three parameters are affected. What are the three factors affected?

- a.
  - i.
  - ii.
  - iii.

18. Prior to the certification of any transportation project, a proposed project must undergo an extensive pre-filing and filing process. List any three of such filing processes.

- a.
- b.
- c.

19. What is a permit or license agreement and an easement?

20. Process control technology is the tool that enables manufacturers to keep their operations running within specified limits. This help to set more precise limits which includes, list any three benefits.

- a.
- b.
- c.

21. Control loops in the process control industry work require three tasks to control a process. What are these tasks?

- a.
- b.
- c.

22. Training for new employees and contractors, and periodic training of existing employees is necessary to educate personnel. What are three importance of training? :

- a.
- b.
- c.

23. When should a pre-startup safety and environmental review be performed?

24. Different approach to safety has evolved which is based on developing a Safety Case. This involve calculating an \_\_\_\_\_ to show the risk to any individual working in the facility is As\_\_\_\_\_.

25. A Safety Case is a narrative that literally makes the case that an adequate level of safety has been reached for an installation. This requires looking at all potential hazards which could lead to what three major events?

- a.
- b.
- c,

**SECTION C (30 Marks)**

1. What is a thief and how does it operate or how is it use in sampling of oil? (10 marks)
2. For the following data given for a horizontal pipeline, predict **gas flow rate in cubic ft/hr** through the pipeline. Use both the (20 marks)
  - i. Trial and-error method for friction factor (Without the Reynolds number-dependent friction factor). Assume an initial flow rate of 12,000,000 cubic feet per day (cfd).
  - ii. Weymouth equation
  - iii. Comparing the two results from i and ii, which one would you recommended to management and why assuming all other conditions remain the same for the two methods?

Data

$$\begin{array}{llll}
 D = 12.09 \text{ in} & L = 200 \text{ mi} & e = 0.0006 \text{ in} & T = 80 \text{ }^\circ\text{F} \\
 \gamma_g = 0.7 & Z_{\text{avg}} = 0.9188 & \mu = 0.0099 \text{ cp} & T_b = \\
 520 \text{ }^\circ\text{R} \quad P_b = 14.7 \text{ psia} & P_1 = 600 \text{ psia} & P_2 = 200 \text{ psia} &
 \end{array}$$

$$\frac{1}{\sqrt{f}} = 1.14 - 2 \log \left( e_D + \frac{21.25}{N_{Re}^{0.9}} \right) \quad N_{Re} \approx \frac{0.48 q_h \gamma_g}{\mu D} \quad q_h = \frac{3.23 T_b}{P_b} \sqrt{\frac{1}{f}} \sqrt{\frac{(P_1^2 - P_2^2) D^5}{\gamma_g \bar{T} z L}}$$

$$q_h = \frac{18.062 T_b}{P_b} \sqrt{\frac{(P_1^2 - P_2^2) D^{16/3}}{\gamma_g \bar{T} z L}}$$

Examiner: Richard Amorin