UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY/JUNE 2018

COURSE NO: PE 374
COURSE NAME: **GATHERING & TRANSPORTATION OF OIL & GAS**
CLASS: PE III TIME: 3 HOURS

Name**:** _____Index Number: _____

ANSWER ALL QUESTIONS IN SECTIONS A ND B AND ANY TWO IN SECTION C

SECTION A (1 Mark Each for each correct answer. A wrong answer will attract a negative mark of 0.5 while unanswered question attracts no marks)

Read the following statements carefully and provide the correct answer to each of them (either TRUE or FALSE)

1. To obtain optimum diameter, yield strength and pumping/compressing horsepower required for a transmission system, several designs derived from complex engineering studies are required.
2. Oil or gas wells produce a mixture of hydrocarbon gas, condensate, or oil; water with dissolved minerals, salt other gases, including nitrogen, carbon dioxide, and possibly hydrogen sulphide; solids, including sand from the reservoir, dirt, scale, and corrosion products from the tubing.
3. For hydrocarbons (gas or liquid) to be sold, they must be separated from water and solids, measured, sold, and transported by pipeline, truck, or ocean tanker before it gets to the user.
4. Oil and gas processing facilities do serve as a main storage facility, processing plant or shipping point.
5. Pumps, flowlines, headers, separators, emulsion treaters, tanks, regulators (controllers), compressors, dehydrators, valves and associated equipment constitute a gathering system.
6. Flow lines are relatively small diameter pipes which connect each producing well to one or more of headers while a manifold is an assembly of pipework where different flow lines enter the headers via an isolation valves installed on a storage tank.
7. Gathering system, main transmission or interstate pipeline system, and distribution system are the three major types of pipelines along transportation route.
8. Oil and gas pipes are mostly made of mild carbon steel material.
9. Sampling and testing are usually done through draw-off or discharge valve of storage tanks.
10. Technical, economic or political, etc, always affect the choice of any large oil/gas export scheme. The power of cost per unit of additional throughput decreases with increasing pipe diameter.
11. Large-diameter and long distance pipelines imply very high initial capital investment.
12. Investment for subsea lines are much higher, depending on water depth.
13. The larger the diameter of the pipe, the lesser the transmission cost.

14. Common methods mostly used to install marine pipelines are the S-lay and L-lay methods.

15. For economic operation, it is important to use full pipeline utilisation.

16. A successful design of a transmission system requires a team-work of well-trained and experienced engineering, legal staff and field monitoring.

17. All oil and gas storage facilities have an earthen dike/dam built around them as a safety precaution in the event of fire or tank rupture.
18. Gasholders or gasometers are used to store oil and gas above the ground largely for balancing, not for long-term storage.
19. All pipe storage facilities require insulation.
20. Thief hatch allows measurements to be made and samples extracted from all oil and gas storage facilities.
21. Bolted welded storage tanks are tanks that can easily be transported to desired locations and erected by hand, easily dismantled and re-erected at new locations?
22. Base gas (sacrificial gas or cushion gas) is the volume of gas that is intended as temporal inventory in a storage reservoir to maintain adequate pressure and deliverability rates throughout the withdrawal season.
23. Lease Automatic Custody Transfer (LACT) unit helps with accurate measuring and sampling of the crude oil.
24. Sampling and testing are carried out in accordance with standards set up and adopted by America Production Institute (API) and America Society for Testing Materials (ASTM).
25. The tank should be equipped with at least three sampling taps placed equidistant throughout the tank height and extending at last 3 metres inside the tank shell.
26. Satellites, microwave towers, digital transformers, fibre optic lines, or dedicated telephone lines are some communication media that could be used to links the SCADA to remote stations.
27. The size, complexity and operations of a pipeline influences the degree of sophistication of the automation of a pipeline system.
28. A cavern of a depleted reservoir is developed by cavern leaching process.
29. A closed control loop exists where a process variable is measured, compared to a setpoint, and an action is taken to correct any deviation from the process variable.
30. A delivery connection is usually placed two feet above the bottom of a tank to leave space for the collection of BS&W.
31. A gas vent line is installed on tanks to aid in thiefing samples from a tank.
32. A load disturbance happens when an undesired change in one of the factors (physical parameters) affects a process variable.
33. A pipeline route should be selected from, and marked on, both a highway map and a cadastral map.
34. A safety case is a narrative that literally makes a case that an adequate level of safety has been reached for an installation.
35. A thorough field examination is only way to identify all of the local permits required for a proposed pipeline.
36. Accuracies of automatic control system relies on accurate online data collected. Cables that transmits signals must be shielded, grounded, isolated from electromagnetic noises.

37. All these several items enter into the total investment necessary to put an underground storage field into operation; cost of acquisition, development, rubber lining, cushion gas, dehydration, compression, transmission.
38. An earthen dike/dam may be built around underground storage facilities as a safety precaution in the event of fire or tank rupture.
39. An Error is the difference between the measured variable and the setpoint and can be either positive or negative.
40. As gas temperature is reduced to approximately −163 °C (−260 °F), it occupies about 600 times more space than gas stored underground.
41. Base or cushion gas is the volume of gas that is intended as partial inventory in a storage reservoir to maintain adequate pressure and deliverability rates throughout the withdrawal season.
42. Cathodic protection, external coating, galvanised, epoxy resin, coal tar are some coatings available for the protection of storage facilities.
43. Control algorithm helps to answer questions such as; how far should a valve be opened or closed in response to a given change in setpoint.
44. Control loops in a process control industry work require three tasks to control a process. These includes measurement, comparison and adjustment.
45. Corrosion is defined as being the gradual damage of pipe due to chemical or electrochemical reactions of pipes with their environment.
46. Doubling the diameter of pipeline, other factors remaining constant; the pipeline capacity increases more than sixfold, cost approximately doubles and cost per unit delivered decreases to one-six of original unit cost.
47. Drills should be carried out frequently to ensure all personnel are familiar with emergency action plans.
48. For economic operation, pipeline should be preserved from full pipeline utilisation.
49. Imperfect coating/lining can result in pipeline leaks known as holiday**.**
50. Pipeline refers to a long line of connected segments of pipes, with pumps, valves, control devices, and other equipment or facilities needed for operating the system. Generally, pipelines have a minimum diameter of 4 feet and minimum length of 1 mile (1.6 km).
51. Process control technology is the tool that enables manufacturers to keep their operations running within specified limits. This help to set more precise limits to maximise profitability, reduce variability, ensure quality and safety.
52. Risk is just simply the probability of occurrence of a damaging event.
53. Strapping assists in determining the holding capacity (volume) of a tank before putting into use.
54. The first largest cause of leak in storage tanks and pipelines is caused by corrosion.
55. The primary use of internal coatings is to protect the inside surface of the tank against corrosion while also protecting the stored contents from leakages.
56. The purpose for stock tanks having a bottom drain outlet is for the removal of the saleable products.
57. Trenchless technology involves installing an in situ lining, or a bigger new pipe inside the old pipe which requires minimum digging.
58. Compression is used in all aspects of the natural gas industry, including gas lift, reinjection of gas for pressure maintenance, gas gathering, gas processing operations, transmission and distribution systems, and reducing gas volume for shipment by tankers or for storage.
59. Pumps are used in production facilities to move liquid from a high pressure or high elevation location to one of a lower pressure or elevation.
60. The major underground storage reservoirs for gas are depleted gas reservoirs, aquifer reservoirs, salt cavern reservoirs and gasometers.

SECTION B (20 marks) (Each correct answer is worth 2 marks)

1. What are the two types of gathering patterns (lines) used in gathering oil and gas and which is mostly adopted in large fields?
2. Why is the danger of pipeline leaks and rupture dependent mainly on the type of fluid?
3. What is Pipeline integrity monitoring?
4. Pipeline leaks and ruptures have many causes. Most common cause is third-party damage. The second largest cause is corrosion. Where (which area) is corrosion-caused leaks and rupture most common in?
5. What is a defect in pipeline operations?
6. What are the primary uses of internal coatings?
7. The size and number of tanks in a lease battery will depend upon what two factors?
8. List any two equipment/units that could be used to take samples from a tank for analysis?
9. Why should sampling (e.g. specific gravity) be perform at standard conditions?
10. Why is sampling and testing oil and gas necessary to be carried out before selling?

SECTION C (Answer any two questions, each question is 10 marks)

1.

a) A field engineer went to the field to take the temperature of crude oil in a tank. The temperature of the oil was far greater than the surrounding temperature. What two operations may cause the oil in the tank to have different temperatures from the atmospheric temperature around the tank? *(2 marks)*

b) With reference in question 1a, two liquids (A and B) are produced from a certain field with densities 7 ppg and 8.33 ppg at room temperature respectively. Determine

i. The API gravities of each sample (A and B) *(4 marks)*

ii. The possible liquids; A and B. *(2 marks)*

iii. What is the main source of error in this exercise? *(2 marks)*

2. Consider a 4-in pipeline that is 10 miles long. Assuming that the compression and delivery pressures will maintain unchanged, calculate gas capacity increases by using the following measures of improvement:

a) Replace three miles of the 4-in pipeline by a 6-in pipeline segment *(2 marks)*

b) Place a 6-in parallel pipeline to share gas transmission; *(2 marks)*

c) Loop three miles of the 4-in pipeline with a 6-in pipeline segment *(2 marks)*

d) Sketch the respective diagrams indicating the respective values, *(3 marks)*

e) Which of the improvements would give the maximum improvement capacity? *(1 mark)*

3.

a) What is the difference between a closed control loop and an open control loop? *(2 marks)*

b) Re-sketch Fig. 1 and inset the following parameters: Feedback Path, Process, Manipulated Variable, Actuator, Controller, Sensor, Set Point, Controlled Variable, Measuring Element, and Control Element. *(8 marks)*

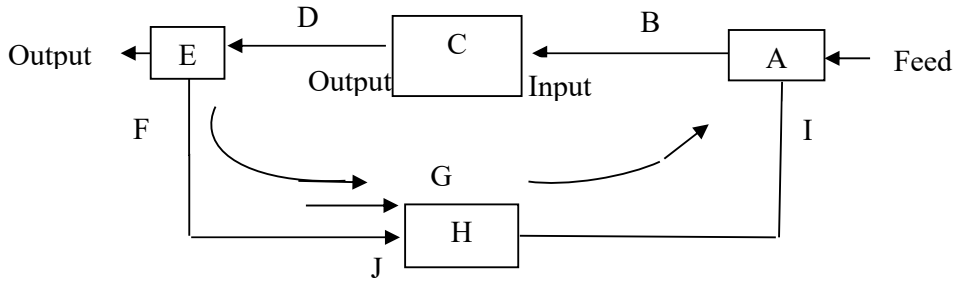

Fig. 1 Block Diagram of a Process Control Loop

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