INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: BACHELOR OF PETROLEUM ENGINEERING

YEAR/SEM: YEAR 4/SEMESTER 2

COURSE CODE: PTE4261

NAME: RISK ANALYSIS AND MANAGEMENT IN OIL & GAS

DATE: 2025-04-15

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

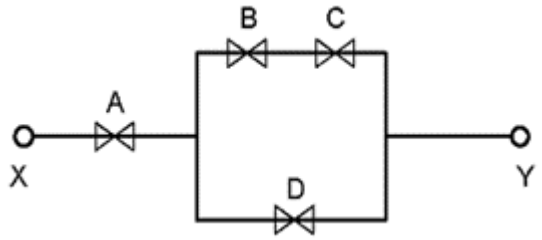
1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A - This section comprises 4 questions, each for 20 marks - Answer any THREE questions for full marks - The marks for every question is indicated

Question 1:

Consider the gas condensate piping system shown below in which valves A, B, C and D are initially closed.



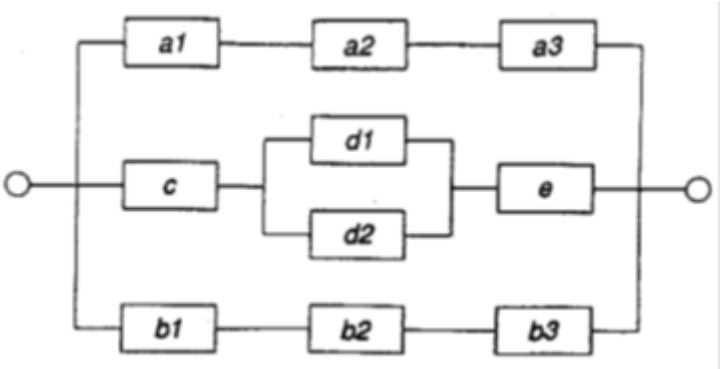
Calculate the probability that flow will not occur between X and Y when a signal is sent to all valves to open, given that valve failures are statistically independent and the probabilities of failure of individual valves and their actuators are

$$P(F_A) = P(F_B) = P(F_C) = P(F_D) = 1$$

where F_A is the event that valve A will not open, etc *[20 marks]*

Question 2:

Draw the fault tree for system failure for the following network diagram and write down the corresponding logical expression for this event *[20 marks]*



Question 3:

(a) Data in Table 1 has been made available from a Wind Turbine manufacturer.

Wind Turbine Data																				
Up Time (yrs)	0.91		0.09		0.97		0.52		0.75		1.00		0.92		0.14		0.93		0.28	
Repair Time (yrs)		0.1		0.1		0.2		0.2		0.2		0.5		0.2		0.1		0.2		0.

From this data, calculate:

i. Mean Time To Failure (MTTF) *[6 marks]*

ii. Mean Time To Repair (MTTR) *[6 marks]*

(b) A company operating in the Albertine Graben employs 625 individuals in year 1, 600 in year 2, and 688 in year 3. Over the course of the three-year period, the company experienced 4 fatalities. Caudate the FAR? *[8 marks]*

Question 4:

The logical expression for the occurrence of the top event T is given by

$$T = A \cap (B \cup C) \cap [D \cup (E \cap F \cap$$

Construct an equivalent block network diagram and fault tree. Â *[20 marks]*

Section B - This section comprises 4 questions, each for 20 marks - Answer any TWO questions for full marks - The marks for every question is indicated

Question 1:

(a) Use the event of BLOWOUT as an example, discuss in details all the associated failure events that may occur in the process. *[10 marks]*

(b) Why is it important to consider safety during pipe line construction for transporting sour oil? *[5 marks]*

(c) Clearly account in sufficient details for each of the following:

i. Serious Injury Rate (SIR). *[2.5 marks]*

ii. Potential Loss of Life (PLL). *[2.5 marks]*

Question 2:

Shed enough lights on each of the following terms:

i. Hazard *[4 marks]*

ii. Accident sequence *[4 marks]*

iii. Consequences *[4 marks]*

iv. Risk *[4 marks]*

v. ALARP *[4 marks]*

Question 3:

Write clear short notes on the following key concepts as applied in reliability theory

i. Reliability *[5 marks]*
ii. Quality *[5 marks]*
iii. Availability *[5 marks]*
iv. Maintainability *[5 marks]*

Question 4:

Briefly account for how reliability theory can be used for each of the following

i. Environmental protection *[5 marks]*
ii. Quality management and assurance *[5 marks]*
iii. Optimization of maintenance and operation *[5 marks]*
iv. Engineering design *[5 marks]*