UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	RELIABILITY AND TESTABILITY IC DEVICE
COURSE CODE	:	BEJ 43803
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**. 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

TERBUKA

Q1 (a) Explain in details different between fault and failure.

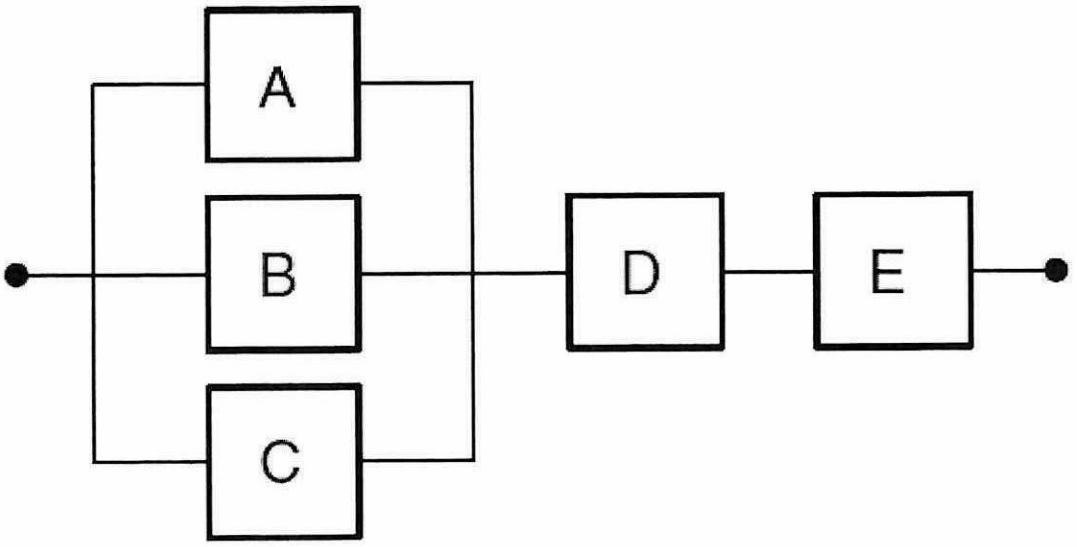
(10 marks)

(b) Calculate the reliability and sketch fault tree of the following system.

(i) $R_A=R_B=R_C=0.80$

$R_D= 0.95$

$R_E =0.85$



(15 marks)

Q2 **(a)** Define term and the purpose of failure analysis.

(8 marks)

(b) Creating a failure analysis document can give focus to key persons when it is already needed to check physical signs and symptoms of failure. With this, failure assessment can be more in-depth, which is a great way for your organization to understand how you have acquired these failures or how malfunctions existed within the different areas or materials on your operations. As a failure analysis engineer, you are given sample from customer request for Non Destructive Test (NDT) with complaining no current flow between input pin and output pin. Therefore, you need to provide 8D report to customer to answer the report.

(17 marks)

TERBUKA

Q3 A microprocessor system is used to control and monitor the lighting system at a theatre. A reliability analysis of the above system revealed the following details:

(a) The major failure event that the microprocessor will not operate is dependent upon either the single failure event of known cause (i.e., the microprocessor fails) or the major failure event that there is no current being supplied to the microprocessor.

(b) The major failure event that there is no current being supplied to the microprocessor is dependent upon four mutually exclusive events as follows:
1. Major failure event—switch open.
2. Single failure event of known cause—open-circuit wiring failure.
3. Major failure event—fuse fails to open.
4. Single failure event of known cause—power supply down.

(c) The major failure event of the switch being open is dependent upon two mutually exclusive events as follows:
1. Single failure event of known cause—switch failure open.
2. Single failure event of unknown cause—switch open.

(d) The major event that the fuse fails open is dependent upon two mutually exclusive events as follows:
1. Single failure event of known cause—fuse fails to open.
2. Major failure event—overload in circuit.

(e) The major event of an overload in the circuit is dependent upon two mutually exclusive events as follows:
1. Single failure event of known cause—short circuit in wiring.
2. Single failure event of known cause—surge on power supply.

Design a fault tree diagram for the microprocessor system by using the correct elementary fault tree symbols.

(25 marks)

Q4 Sketch the system and develop the mathematical expression for the reliability of the following three system configurations assuming that each component in the system is identical and can exist in either an operational state or a failed state. The reliability of each component is given by the following expression:

$$\boldsymbol{R(t) = e^{-\lambda t}}$$

For each system configuration calculate the system reliability given the following individual component parameters:

$$\lambda = \mathbf{0.00439\ failures/h}\ ,\ \boldsymbol{t = 24\ h}$$

(i) Sketch System configuration 1: simple parallel redundant system.

System success criterion: one or more components operating required for system success.

(5 marks)

TERBUKA

(ii) Sketch System configuration 2: bimodal parallel-to-series redundant system. Parallel subsystem success criterion: one or more components operating required for subsystem success. System success criterion: both subsystems operating successfully.

(10 marks)

(iii) Sketch System configuration 3: bimodal series-to-parallel redundant system .Series subsystem success criterion: both components operating for subsystem success. System success criterion: one or more subsystems operating successfully.

(10 marks)

- END OF QUESTIONS -

TERBUKA