



TECHNICAL UNIVERSITY OF MOMBASA

School of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION 2024/2025

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 4503 RELIABILITY ENGINEERING

END OF SEMESTER EXAMINATION

SERIES: NOVEMBER 2025

TIME: 2 HOURS

DATE: November 2025

Instructions to Candidates

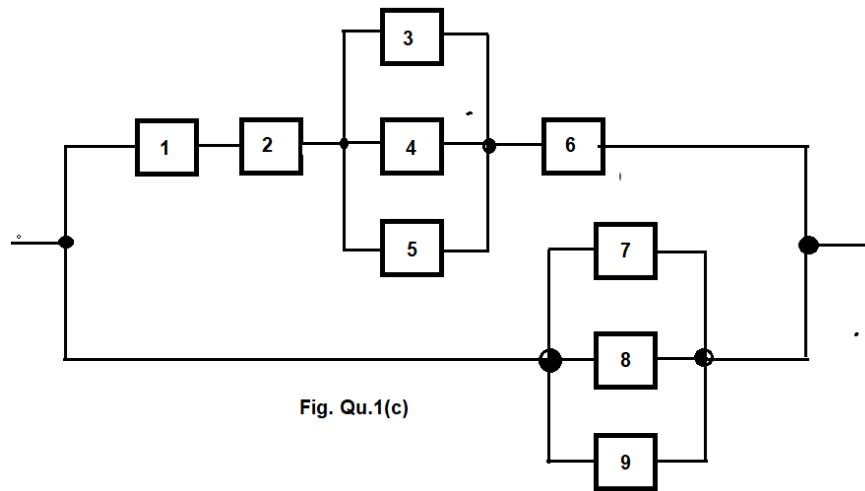
You should have the following for this examination

Answer Booklet, examination pass and student ID

Answer Question ONE and any other TWO questions

Question ONE (Compulsory)

- (a) Distinguish between maintenance and maintainability. (2 marks)
- (b) Highlight the FOUR parts to the problem of achieving good maintainability. (4 marks)
- (c) The system shown in Fig.Qu.1(c) is made up of 10 components. Components 3, 4, and 5 are NOT identical and at least one components of this group must be available for the system success. Components 7, 8,9 and 10 are NOT identical and at least two components of this group must be available for the system success.
 - (i) Determine an expression for system reliability in terms of R values given.
 - (ii) Evaluate the system reliability if the reliabilities of 3, 4 & 5 are 0.6, 0.65 & 0.7 respectively. Also, reliabilities of 7, 8, 9, &10 are 0.8, 0.85, 0.9, &0.95 respectively. All other components have similar reliabilities of 0.85. (14 marks)



Question TWO

- (a) Distinguish between reliability and availability (2 marks)
- (b) Reliability engineering is about failure analysis and failure prevention. Highlight any FOUR ways of achieving these objectives. (4 marks)
- (c) (i) By making appropriate assumptions show that
- $$R(t) = e^{-\lambda t}$$
- (ii) A system design requires 10 identical components in parallel. If the overall reliability must not be less than 0.97, determine the minimum reliability of each component. (14 marks)

Question THREE

- (a) Giving appropriate examples explain how the following factors underscore the importance of reliability in engineering systems:
- (i) High acquisition cost (ii) System complexity (iii) Global competition (9 marks)
- (b) Distinguish between fault tree analysis and fault modes effects analysis (2 marks)
- (c) Highlight FOUR basic steps of establishing reliability centred maintenance (RCM) (4 marks)
- (d) The probability of each engine of a three-engine aircraft completing a flight without failure is 0.98. The probability of completing the flight with one engine faulty is 0.54. If more than one engine is faulty the flight is cancelled. Determine the probability of the aircraft reaching its destination. (5 marks)

Question FOUR

- (a) Describe FOUR overall objectives of reliability engineering. (8 marks)
- (b) With the aid of an appropriate sketch describe the relationship between cost and reliability. (6 marks)
- (c) Develop a troubleshooting guide to help a student troubleshoot a non-functioning project. (6 marks)

Question FIVE

- (a) For the following environmental conditions explain at least TWO ways in which equipment reliability is affected.
- (i) Temperature (ii) Humidity (iii) Dust (iv) Vibrations (8 marks)
- (b) The probability of a power failure in a period of one year at a particular location is 6%. Determine the probability of experiencing:
- (i) No failure (ii) At least one failure during a five year period (6 marks)
- (c) A communication system comprises units A, B, C, D, E and is normally unattended apart from monthly maintenance visits. The failure rates for each unit are as follows:

Unit	A	B	C	D	E
Faults/1000	0.0030	0.0015	0.008	0.05	0.003
hrs				5	

Units C and D are duplicated with automatic switching so that the system is operative if either of the twin units is working.

- (i) Draw the reliability diagram and determine:
- (ii) The reliability of the system
- (iii) How many visits to repair are likely during a ten year period. (6 marks)