



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

EED 218: ELECTRICAL MEASUREMENTS AND TESTING III

DATE: 12/11/2020

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Question One and any Other Two Questions

QUESTION ONE (30 MARKS)

- a) Describe the various classifications of failure (8 marks)
- b) Distinguish between Early failure and Wear-out failure with respect to equipment reliability (4 marks)
- c) List three benefits of carrying maintenance on an equipment (3 marks)
- d) Describe three types of maintenance (9 marks)
- e) Explain three factors affecting reliability of an equipment (6 marks)

QUESTION TWO (20 MARKS)

- a) With an aid of a labeled diagram, explain the manufacturing cost against reliability for an equipment (7 marks)
- b) In a test in production of resistors, 1000 resistors were operated over a period of 10,000 hours. Out of this number, 15 resistors failed. Determine the
 - i. average failure rate in percentage
 - ii. failure rate per hour
 - iii. MTTF (7 marks)

- c) An electronic circuit is made up of four types of components as follows; 30 transistors, 50 resistors, 35 capacitors and 10 diodes. If the average failure rate in ($\times 10^{-6}/h$) is 0.07, 0.03, 0.1 and 0.2 respectively, determine
- Circuit failure rate
 - MTBF
- (6 marks)

QUESTION THREE (20 MARKS)

- a) State five factors affecting MTTR. (5 marks)
- b)
 - Describe the term availability
 - An instrument has an MTBF of 3000 hours and an MTTR of 50 hours. Determine its percentage availability. (4 marks)
- c) A small-scale power plant has an estimated MTBF of 20,000 hours. Determine the probability of the plant working successfully for each of the following times
- 200 hours
 - 10,000 hours (4 marks)
- d) Determine the unreliability of the plant in 3(c) if operated for 12,000 hours (3 marks)
- e) A power supply, oscillator and amplifier are all used in a system. If the MTBFs are 20,000 hrs, 75,000 hrs and 50,000 hrs respectively and the system is operated for 1000 hrs. determine
- Individual reliabilities
 - System reliability (4 marks)

QUESTION FOUR (20 MARKS)

- a) Distinguish between systematic and random testing methods (4 marks)
- b) With an aid of a diagram describe the half-split method of fault location (7 marks)
- c) State three assumptions made when applying the half-split method of fault location (3 marks)
- d) A industrial control unit has 40 blocks, determine the number of checks when using each of the following fault location methods
- input/output
 - half-split (6 marks)

QUESTION FIVE (20 MARKS)

- a) Describe the term hazardous area (2 marks)
- b) State with a reasons four hazardous areas and the measures for counteracting the effects.
(8 marks)
- c) Explain two relevant regulations regarding hazardous area (2 marks)
- d) Describe two electrical wiring systems used in hazardous areas (8 marks)