



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018**

COURSE NAME : INDUSTRIAL RELIABILITY
COURSE CODE : BWB 32003
PROGRAMME CODE : BWQ
EXAMINATION DATE : JUNE/JULY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

TERBUKA

THIS EXAMINATION PAPER CONSISTS OF **THREE (3)** PAGES

- Q1** (a) Describe **FOUR (4)** main reasons how an item could fail. (8 marks)
- (b) Explain when we should choose to implement the following types of censoring:
- (i) Type I. (3 marks)
 - (ii) Type II. (4 marks)
 - (iii) Interval. (3 marks)
 - (iv) Random Right. (2 marks)
- (c) A component is exponentially distributed with failure rate in fails in time (FIT) is 130. Suppose a non-repairable system that used 15 similar components will fail whenever the first failure of its component happens. Calculate the probability that system is functioning up to 10,000 hours. (6 marks)

Q2 **Table Q2** shows the failure time in hours of ten similar (non-repairable) components. Answer the following question based on data in **Table Q2**.

Table Q2: Failures time in hours

75	81	89	104	112	138	139	150	163	187
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- (a) By using basic probability concept, calculate the following:
- (i) Reliability at 160 hours. (5 marks)
 - (ii) Reliability between 100 and 150 hours. (7 marks)
 - (iii) Failure rate at 4th failure. (6 marks)
- (b) Given that the components are known to be an exponential distribution. Suppose at the beginning of the experiment, there were 15 components that were put in test. The test was terminated at 200 hours.
- (i) Estimate the parameter of the distribution. (8 marks)
 - (ii) Estimate the mean time to failure.



(4 marks)

(iii) Construct the 95% confidence interval of the parameter estimation.
(10 marks)

(iv) Construct 95% confidence interval of the mean time to failure.
(3 marks)

Q3 (a) Explain the comparison between non-repairable and repairable system in terms of the following;

(i) failure rate. (4 marks)

(ii) lifetime. (4 marks)

(iii) probability of functioning. (2 marks)

(b) Given the $100(1-\alpha)\%$ confidence interval for the probability of survival to time t as follow:

$$\hat{S}(t) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{S}(t)(1-\hat{S}(t))}{n}}$$

Explain the suitable situations to apply this formula. (6 marks)

Q4 (a) Explain **FOUR (4)** conditions when using the chi-square goodness of fit test. (8 marks)

(b) A repairable system that has failure and repair sequence is modelled by an alternating renewal process. The time to failure being exponentially distributed with a mean of 500 hours meanwhile, the repair time being exponentially distributed with a mean of 20 hours. Compute:

(i) the limiting availability. (5 marks)

(ii) the limiting unavailability. (3 marks)

-END OF QUESTIONS -