



**UNIVERSITY COLLEGE TATI (UC TATI)**

**FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: BME 3053
COURSE	: MAINTENANCE PLANNING & CONTROL
SEMESTER/SESSION	: 1-2022/2023
DURATION	: 3 HOURS

**Instructions:**

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO**  
**THIS BOOKLET CONTAINS 5 PRINTED PAGES INCLUDING COVER PAGE**

**QUESTION 1**

- a) **Discuss** how maintenance can increase the profitability of company. (4 Marks)
- b) **Illustrate** how maintenance management principles are relevance in the service industry. (4 Marks)
- c) **Identify** the need for replacement and describe some important replacement situations. (6 Marks)
- d) Robot KUKA enters the waiting line at the rate four per day. The maintenance department services the equipment on a FIFO basis. The average repair time is one hour and half and nine-hour day working. **Calculate:**
- i. Average waiting time in the line. (2 Marks)
  - ii. Probability that two units are in the system. (3 Marks)

**QUESTION 2**

- a) **Discuss** how preventive maintenance effort level effect on corrective and preventive maintenance cost. (3 Marks)
- b) **Discover** the need for a multi-disciplinary approach to maintenance. (4 Marks)
- c) **Determine** the criteria's to be used in determining which assets may be acceptable candidates for a corrective maintenance program. (6 Marks)
- d) Assume that the equipment is operated 320 workdays for 8 hours per day and with a known MTBF of 180 hours. Failure costs are estimated at \$4500 per occurrence. A PM maintenance option would cost \$500 per scheduled routine. **Evaluate** the PM program if performing the PM routine every 100 hours reduces the probability of failure to 35%. (8 Marks)
- e) Read the case study carefully. The next question is based on the case study attached.

Commonwealth Edison (ComEd), providing electrical power to over 3.4 million customers in northern Illinois including Chicago, experienced severe power outages that affected more than 100,000 residential and business customers during the summers of the late 1990s and 2000. In addition to significant economic and financial losses, these outages contributed to the deaths of hundreds of people. A report to the Illinois Commerce Commission puts the blame clearly and squarely on Comed's failure to spend money to maintain its substations and power lines. The report states that some of Comed's circuits are more than 70 years old and in dire need of replacement. In addition, the company has failed to protect some of its substations against lightning strikes. The company plan for temperature no higher than 93 degrees Fahrenheit, even though July temperatures routinely reach 96 degrees. These high temperatures stress the system and caused it collapse repeatedly, leaving thousands of customers without power, sometimes for several days. Failure or breakdown of a substation or a transformer tends to overload other poorly maintained and already loaded transformer and substations, and so on, creating a domino effect of breakdowns and exacerbating the problem.

In your opinion, **recommend** the actions and lesson learnt that could the plight of COMED can be prevented. (6 Marks)

**QUESTION 3**

a) **Discover** the methods for improving system reliability. (2 Marks)

b) **Calculate** the reliability calculation for the engineering system in Figure 1. (7 Marks)

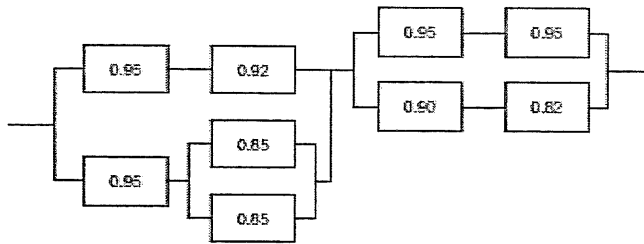


Figure 1: Engineering System

c) **Prepare** a sample form for conducting FMECA. (10 Marks)

d) Assuming an exponential failure rate and a MTBF of 250 hours, **calculate**:

- i. The failure rate (2 Marks)
- ii. Reliability at 150, 250, 350 hours of operation (6 Marks)

## MAINTENANCE PLANNING &amp; CONTROL (BME 3053)

**QUESTION 4**

- a) **Describe** the major challenges in TPM implementation and give suggestions on how to overcome it. (8 Marks)
- b) Consider the following data collected in a manufacturing process from one of the machines. Loading time = 700 minutes, downtime = 30 minutes, theoretical cycle time = 2 minutes, processed amount = 290 parts, and the number of parts rejected = 10. **Calculate** the following:
- i. Availability (3 Marks)
  - ii. Performance efficiency (3 Marks)
  - iii. Rate of quality (3 Marks)
  - iv. Overall equipment effectiveness (OEE) (3 Marks)
- c) **Conclude** an effective organization for TPM implementation. (3 Marks)
- d) **Recommend** an education and training program for TPM implementation. (4 Marks)

-----End of question-----

**RUBRIC**

<b>Criteria</b>	<b>Marks</b>
All question answered will be marked according to answer scheme	/100

