

The Open University of Sri Lanka  
Faculty of Engineering Technology



Study Programme	: Mater of Technology in Industrial Engineering
Name of the Examination	: Final Examination
Course Code and Title	: <b>MEX7119 – Maintenance Management</b>
Academic Year	: 2015/16
Date	: 19 <sup>th</sup> November 2016
Time	: 0930hr-1230hr
Duration	: 3 hours

**General instructions**

1. Read all instructions carefully before answering the questions.
2. This question paper has **eight** questions. All questions carry equal marks.
3. Answer **five** questions only.

**Question 01**

- a) Discuss the difference between Preventive Maintenance and Total Productive Maintenance with suitable examples.
- b) Discuss the importance of Business Centered Maintenance in organizations.
- c) Describe the important components of Conditioned Based Maintenance (CBM) with suitable examples.
- d) Give reasons with suitable examples to focus more on Conditioned Based Maintenance than Preventive Maintenance in order to minimize the cost of maintenance without sacrificing reliability.

**Question 02**

- a) What do you mean by maintenance philosophy?
- b) Discuss the factors that influence the maintenance load forecasting.
- c) Discuss the maintenance capacity planning and its importance to have an effective maintenance management system.
- d) Scheduling of maintenance activities are an important factor which influence the Successfulness of the implementation. Do you agree? Justify your answer.

**Question 03**

- a) Discuss the major issues that you have to face in improving labor productivity of your maintenance staff.
- b) The performance of maintenance workers can be improved through a combination of Motivation and training. Discuss the major areas that have to consider in preparing a suitable training program for your maintenance staff.
- c) Discuss the benefits that you can enjoy as maintenance manager by implementing Total Productive Maintenance (TPM).

**Question 04**

- a) Discuss the major factors that reflect the quality of your maintenance process.
- b) A garment manufacturing company operates 260 days per annum on two shifts. Each shift covers 08 hours to produce Rs. 500,000.00 worth items per day. During the last year factory could operate only for 200 days. According to the maintenance manager entire plant stopped for 160 hrs due to major breakdowns and in addition 100 hrs stoppages due to planned maintenance. Production had to slow down by 80% process rate for 320 hrs due to labor unrest during the year. Poor quality of raw material affected the process rate by 60% for 160 hrs during the year. The total value of the rejected garments during the year was Rs. 2mn.

**Calculate the following.**

- (i) Utilization of the facility.
- (ii) Availability of the facility.
- (iii) Process rate.
- (iv) Quality rate.
- (v) Overall equipment effectiveness.

**Question 05**

- a) Briefly explain the typical causes for unreliability in manufacturing.
- b) Briefly explain the reliability design techniques that are employed to meet the specified reliability.
- c) Explain the procedural steps in the Failure Mode, Effect and Criticality Analysis (FMEC)

**Question 06**

- a) The basic measure associated with Total Productive Maintenance (TPM) has been the Overall Equipment Effectiveness or OEE. Elaborate on the statement with suitable examples.
- b) Three repairable systems behave according to a homogeneous Poisson process. System 1 starts its operation at time 0 and System 2 starts its life when System 1 has been operating for 150 hours and System 3 starts life when System 1 has been operating for 250 hours. Up to now the Systems 1, 2 and 3 have been operating for 400, 250, and 150 hours respectively with only eight failures.

**Calculate;**

- (i) The estimated failure rate ( $\lambda$ ).
- (ii) Estimated Mean Time Between Failures (MTBF).
- (iii) If the particular system has a MTBF of 125 hours, what is the probability of having one failure in a total of 150 hours of operation?

Note: Probability of failures.  $P(x) = \frac{e^{-m} m^x}{x}$

**Question 07**

- a) Explain Total Productive Maintenance (TPM), and describe its objectives.
- b) Describe direct and indirect benefits of TPM to an organization.
- c) As the Maintenance Manager you are in a committee which is to introduce TPM to your organization. Explain the stages in introducing the TPM to your organization.

**Question 08**

- a) What are the advantages of a Computerized Maintenance Management System (CMMS) to an organization?
- b) As the new Maintenance Manager, you are required to develop a CMMS for your organization. Explain the steps you would follow in designing a CMMS for the organization.
- c) Taking an example from the industry explain, how you would implement a CMMS paying special contribution to the critical equipment involved.

**END**