UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 7 Examination in Engineering: March 2021

Module Number: ME 7301 **Module Name: Maintenance Management**

[Three Hours]

[Answer **all questions**, each question carries **10** marks]

Q1. a) Due to financial restrictions imposed by the COVID-19 pandemic, the CEO of a particular company is seeking justifications to continue the activities of the maintenance department in the company in the regular manner, without closing down the maintenance operations in the company. Assuming that you are a maintenance consultant to the CEO, provide a brief justification in this regard.

[4.0 Marks]

b) State at least **three** key difficulties in practicing maintenance management in a medium-scale Sri Lankan manufacturing organisation.

[3.0 Marks]

c) If you were newly appointed as the chief maintenance engineer of the organisation mentioned in Q1 (b), discuss how you will overcome the difficulties stated by you in answering Q1 (b).

[3.0 Marks]

Q2. a) State at least **six** ways of reducing the frequency and the severity of machine breakdowns of a given manufacturing plant.

[3.0 Marks]

b) Compare the advantages and disadvantages offered by time-based, usage-based and condition-based preventive maintenance activities.

[3.0 Marks]

c) State the procedure to identify and rectify the recurrent breakdowns of critical machines in a manufacturing plant by using relevant maintenance analysis techniques.

[4.0 Marks]

Q3. a) Name **four** of the key documents used in maintenance communication systems and discuss their practical applications.

[2.0 Marks]

b) Briefly describe the benefits of adhering to the ISO quality standards by a manufacturing organisation.

[2.0 Marks]

c) Suggest a suitable procedure to introduce 5S concept to a maintenance department of a manufacturing organisation, assuming that you are the head of the department. However, assume that your staff have no prior knowledge about the 5S concept or its benefits.

[6.0 Marks]

Q4. a) Distinguish between idea generation and Kaizen within a manufacturing organisation, targeting productivity improvements.

[3.0 Marks]

b) How do you justify Kaizen as a Key performance indicator (KPI) in a production organisation?

[3.0 Marks]

c) Briefly explain **five** possible ways of promoting Kaizens in private sector organisations.

[4.0 Marks]

Q5. a) Briefly explain the benefits of incorporating condition monitoring and predictive maintenance activities to improve KPIs in plant maintenance.

[5.0 Marks]

b) Briefly explain **five** commonly used condition monitoring equipment in the industry and their applications.

[5.0 Marks]

Q6. a) **Table Q6 (a)** presents a summary of breakdown data of a critical machine of a production organisation observed for the year 2020, where the machine had been planned for production for the whole year (365 days). Answer the following questions.

i. Calculate the MTBF of this machine and state **four** key measures that can be taken to improve this KPI.

ii. Calculate the MTTR of this machine and state **four** key measures that can be taken to improve this KPI.

[2.0 Marks]

b) A semi-automated tyre production machine in a particular manufacturing organization operates in 12 hour shifts. **Table Q6 (b)** presents the average time consumed for special reasons within a 12-hour production shift. It is known that the average quality loss is 35 tyres per shift out of its nominal production of 110 tyres per shift. Average cycle time to produce a tyre is 4 min.

i. Calculate the Overall Equipment Efficiency (OEE 1) of the machine.

ii. Draw the OEE Chart.

iii. Find the OEE loss due to breakdowns.

iv. Suggest measures to improve the OEE 1 of this machine.

[8.0 Marks]

Table Q6(a). Summary of breakdown data of a critical machine

Breakdown description	Day of the year the breakdown occurred	Repair time (min)
Chain failure	25	130
Motor key failure	111	160
Limit switch failure	170	40
Bearing failure	250	180
Hydraulic pump failure	301	300
Cooling system failure	341	700

Table Q6(b). Average time consumed for special reasons within a 12-hour production shift of a semi-automated tyre production machine

Description	Time (min)
Tea and Meals	60
Preventive Maintenance	50
Breakdown	60
Change over	30