

University of Ruhuna- Faculty of Technology
Bachelor of Engineering Technology

Level 3 (Semester 1) End Examination, July 2020

Course Unit: ENT 3122 Electrical/Electronic and Mechanical Equipment Maintenance
Time Allowed: 2 hours

Answer all **four (04)** questions

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- Q1. I. Briefly explain the concept of Total Productive Maintenance (TPM), based on its **five** pillars. [5.0]
- II. Name **six** shop-floor losses you can observe in a factory environment. [3.0]
- III. What is Overall Equipment Effectiveness (OEE) and how would you use it in the TPM implementation process? [5.0]
- IV. A production line produces 320 pairs of shoes per day with about 3 defective pairs per every two days. Current performance rate of this line is 85%. After a new conveyor was installed, the production rate was increased by 10% with zero defects. Find the percentage increase of OEE after the new conveyor. [12.0]
- Q2. I. What should be the mission of a maintenance department of an organization? [5.0]
- II. What are the main **three** types of maintenance work? [5.0]
- III. Explain how a “predictive maintenance” program can be beneficial to an organization. [5.0]
- IV. List **four** most common predictive maintenance techniques and **four** non-destructive testing techniques. [4.0]
- V. a) Why do you think that the periodic maintenance is essential in an electrical grid substation? [3.0]
- b) What are the periodic maintenance methods, which can be adopted to a transformer in an electrical grid substation? [3.0]

- Q3. I. What factors a “smart maintenance improvement goal” should have? [4.0]
- II. List **five** most common causes of failure of a machine? [5.0]
- III. The MTTR and MTBF of a machine is 2 hrs and 168 hrs, respectively. Calculate how many production hours are annually lost in this machine due to maintenance faults. [6.0]
- IV. An organization has to invest 750,000 LKR on a machine, which can increase the production rate by 10% leading to 25,000 LKR of savings per month. Based on this case, answer the following questions. [10.0]
- Calculate the simple payback period of the investment.
 - Calculate the percentage rate of return.
 - Comment on whether you recommend this investment or not. Justify your answer.
- Q4. I. What is the purpose of performing an insulation resistance test of an electrical equipment? [5.0]
- II. Table Q4 (II) presents a summary of test results obtained in preventive maintenance activities of a 400V, three-phase induction motor from year 2000 to 2004.

Table Q4 (II): Insulation resistance of three phase induction motor

Date (year-month-date)	Insulation resistance three-phase to ground (MΩ)
2015-10-01 (Initial acceptance test)	400.0
2016-04-01	390.0
2016-10-01	380.0
2017-04-01	370.0
2017-10-01	360.0
2018-04-01	350.0
2018-10-01	001.0
2019-04-01	385.0
2019-10-01	375.0

- Plot the insulation resistance in a line-graph in y- axis, against time in x-axis. [6.0]
- Identify **three** key trends of insulation resistance variation in the graph and discuss possible reasons for each. [9.0]
- What are the key benefits of keeping insulation resistance records of an electrical equipment over a long period of time? [5.0]