

THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
MASTER OF TECHNOLOGY IN INDUSTRIAL ENGINEERING – LEVEL 07
FINAL EXAMINATION – 2006/2007
MEX7119 – MAINTENANCE MANAGEMENT
DATE : 20TH MARCH 2007
TIME : 0930 HRS. – 1230 HRS.
DURATION : THREE HOURS

035



ANSWER ANY FIVE (05) QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

1. (i) Discuss the difference between maintenance and maintainability.
- (ii) Describe the importance of FMECA (Failure Modes Effects & Causes Analysis) as a maintainability tool. State the basic steps involved clearly.
- (iii) Repairs of an electrical pump will be affected due to the following reasons as noted by the maintenance staff. The probability of occurring this situation is also given in the table.

| Reasons | | Probability of Occurrence |
|--|---|---------------------------|
| Lack of skill man power | | .01 |
| Lack of spare parts | Parts are out of stock | .02 |
| | Parts are no longer available in the market | .03 |
| Required tools /- facilities are not available | | .04 |
| Pump is beyond economic repair limits | | .05 |

- (a) Identify the top level faults, basic and intermediate faults of the electrical pump.
 - (b) Draw the fault tree diagram.
 - (c) Determine the probability of occurrence of the top level fault event.
2. (i) With examples, describe the two components of Cost of Assets.
 - (ii) Briefly describe the steps involved in Life Cycle Costing.
 - (iii) What is overall equipment effectiveness?
 - (iv) Manufacturing company can run their plant for 22 hours a day due to various breakdowns and repair activities though the production was planned for twenty four hour operation. The plant is producing only 10,000 units per day. However, according to the specifications the plant is capable of producing 600 units per hour. It was noted that the number of rejects due to reasons such as poor machine performance was 300 units per day. Calculate the overall equipment effectiveness of the plant.

In order to meet the plant requirement it is necessary to operate the plant at 75% efficiency. Calculate the revenue loss (cost of unreliability) due to present plant condition if the selling price of a unit is Rs 8/-.

3. (i) Why do maintenance departments prefer to have a well prepared preventive maintenance program?
- (ii) What are the factors determining the frequency of preventive maintenance program?
- (iii) The table given below shows the Operation Cost (OC), Maintenance Cost (MC) and Salvage Value (SV) of a pump purchased at a price of Rs 20,000/- at the end of the every year.

Find the economic life of the machine assuming zero interest rate.

| Year | Cumulative OC at the end of year (Rs.) | Cumulative MC at the end of year (Rs.) | SV at the end of year (Rs.) |
|------|--|--|-----------------------------|
| 1 | 2,000 | 200 | 10,000 |
| 2 | 3,000 | 300 | 9,000 |
| 3 | 4,000 | 400 | 8,000 |
| 4 | 5,000 | 500 | 7,000 |
| 5 | 6,000 | 600 | 6,000 |
| 6 | 7,000 | 700 | 5,000 |
| 7 | 8,000 | 800 | 4,000 |
| 8 | 9,000 | 900 | 3,000 |
| 9 | 10,000 | 1,000 | 2,000 |
| 10 | 11,000 | 1,100 | 1,000 |

4. (i) Explain the Reliability Centered Maintenance.
 - (ii) What are the main objectives of the Reliability Centered Maintenance ?
 - (iii) A process is controlled by a device known as catalyst supply controller with an individual unit reliability of 0.576. The total cost of chemicals processed in a batch is Rs. 500,000.00. If there is a failure in the controlling device, the whole lot of chemicals will be wasted. The cost of providing a standby device is Rs. 80,000.00. Determine the optimal number of standby units required to control the process.
5. (i) What do you mean by strategic assets management?
 - (ii) Why strategic assets management concept is an important aspect for extracting value from production assets?
 - (iii) What are the core principals influencing the strategic assets management concept?

- (iv) Identify important differences between strategic assets management and other maintenance improvement processes.
6. (i) Outsourcing is one improving option that the maintenance manager has to implement in order to meet the tight schedules. What are the issues that govern the decision to outsource?
- (ii) "Stick adherence to the Original Equipment Manufacturers (OEM) instructions regarding preventive maintenance programs will increase the cost of maintenance unnecessarily". Comment on this.
- (iii) Why Total Productive Maintenance is an important aspect in improving overall equipment effectiveness?
7. (i) An important consideration in maintainability design is standardization. What are the benefits that can be achieved through standardization?
- (ii) Describe the major time component consisting of downtime of equipment with examples.
- (iii) Describe the major components involved in active repair time of an equipment. Among them identify the component which comes under the aspect of maintainability.
8. Maintenance training is a part of any productivity improvement program. However the training programs should be organized to achieve the set objectives of the maintenance department.
- (i) What are the sources and how do they contribute to identify the training needs of your organization?
- (ii) Name three types of training sources with examples.
- (iii) Describe the principals behind the Performance Based Training Programs.
- (iv) Briefly describe the steps involved in designing a maintenance training program.
9. (i) What are the factors causing fluctuation in material inventory in a maintenance work shop?
- (ii) Briefly describe the cost component involved in storing materials.
- (iii) Suggest suitable methodology to be used to control and minimize the inventory in a maintenance workshop.
- (iv) Discuss the important features of centralized and decentralized maintenance store houses.

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