THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
MASTER OF TECHNOLOGY IN INDUSTRIAL ENGINEERING – LEVEL 7
FINAL EXAMINATION – 2011/2012
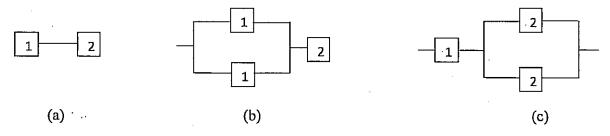**MEX 7119 – MAINTENANCE MANAGEMENT**
DATE   : *11 March 2012*
TIME   : *0930 hrs – 1230 hrs*
DURATION : Three (03) hours

Answer five (05) questions only. All questions carry equal marks.

Q1. (i) Discuss the relationship among Performance, Cost and Reliability with suitable examples.

(ii) Derive expressions for reliability of three systems given below.

(a)   (b)   (c)

(iii) Suppose that in the systems shown in Figure, the two components have the same cost and the reliability of 1 and 2 are 0.7 and 0.95 respectively. If it is permissible to add two components to the system, would it be preferable to replace component 1 by three components in parallel or to replace components 1 and 2 each by simple parallel systems.

Q2. (i)   Discuss the difference between Operational Availability and Intrinsic Availability

(ii) A Power generation plant is expected to run 24 hours a day continuously and 7 days a week. Based on the manufacturers recommendations, there are planned shut downs for maintenance. According to past performances there is a 50% probability that the time between failures is 250hrs or more. The mean time between repairs is noted as 8 hours. Calculate the availability of the system assuming both failure time and repair time are exponentially distributed.

(iii) Discuss the factors that have to be considered in evaluating system effectiveness with suitable examples.

Q3. (i) Discuss the factors that you have to consider to forecast your maintenance load.

 (ii) Discuss the difficulties that you have to face when implementing your maintenance program.

 (iii) As a maintenance manager describe the steps that you suggest to your subordinates to overcome the difficulties given in (c).

Q4. (i) Discuss the factors that have to be considered in implementing a quality control system for your maintenance process.

 (ii) Discuss the factors influencing the quality of maintenance.

 (iii) Discuss the factors that you have to consider in implementing a suitable training program for your maintenance staff.

Q5. (i) A refinery is required to operate 340 days per year to give 1200 tonnes of finished product in a 24 hour working day. However production was 240 hours during the last year due to 08 major breakdowns. The time taken for preventive maintenance was 160 hours but stopped the plant entirely due to delays in importing crude oil for 180 hours. Due to poor quality crude oil of one shipment the process operated at a slower rate, 80%, for 360 hours. During the last year the refinery had rejected 1500 tonnes of refined oil (finished products) due to non compliance with required standards. Further production was hampered due to work to rule campaign organized by the production staff by 60 hours at 40% rate.

   (i) Calculate the plant availability.
   (ii) Calculate the process rate.
   (iii)Calculate the quality rate.

Q6. (i) Discuss the factors influencing equipment life cycle cost.

   (ii) Discuss the major component of Cost of maintenance.

   (iii) What do you mean by integrated maintenance.

   (iv) Discuss the advantages of centralized maintenance.

Q7. (i) Maintenance and maintainability are two important features in maintenance management process. Discuss the differences between these two with suitable examples.

(ii) Discuss the importance of Metrics from Maintenance point of view.

(iii) Discuss the factors influencing equipment reliability

(iv) Discuss the ways of improving operational / production reliability of a system familiar to you.

Q8 . (i) You are appointed to as a chairman of a board of survey to find out the suitability of a used 130 Tonne mobile crane which you have been using for last 25 years. Discuss the factors that you have to consider to decide whether the crane should be condemned or allowed for further use.

(ii) 130 Tonne Mobile crane which has been used for last 25 years is having very poor availability, thus interrupting operational functions very often. However your maintenance engineer suggests you to use it for another 05 years after doing a major overhaul which covers the entire crane as option 1. The total cost of complete overhauling is Rs. 25 million and the annual maintenance cost after overhauling is Rs. 2 million. According to your maintenance engineer, the local representative of the same crane manufacturer offered a same capacity reconditioned crane for Rs. 80 million with 20 years life span as option 2. Old crane will perform same as the reconditioned crane offered by the local agent after the overhaul. The annual operational and maintenance cost of old crane and reconditioned crane are Rs. 5 and 1.5 million respectively. Old crane is having a scrap value of Rs. 5 million. Advice your maintenance engineer as to which option is more economical.

The cost of capital is 20% and capital recovery factor is given by

$i(1 + i)^n / [(1 + i)^n - 1]$