

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF INDUSTRIAL TECHNOLOGY**

**DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING**

**Bachelor of Engineering Honours Degree Industrial & Manufacturing Engineering**

**1<sup>st</sup> SEMESTER EXAMINATIONS – FEBRUARY 2010**

**MAINTENANCE ENGINEERING TIE 3110**

**ANSWER ANY FIVE (5) QUESTIONS**

***TIME ALLOWED: 3 HRS***

**QUESTION 1**

- (a) State two most important objectives of maintenance. [2]
- (b) Identify the factors to be considered to determine the appropriate form of maintenance organization. [5]
- (c) What are maintenance records? [4]
- (d) Write an expression for determining the reliability of a system when its elements are arranged in parallel. [3]
- (e) Describe the steps an industrial organization undertakes in order to fully implement Computerised Maintenance Management System (CMMS) [6]

**QUESTION 2**

- (a) Describe the steps which an organization follows in order to implement Total Productive Maintenance (TPM) [5]
- (b) Write short notes on the following
  - (i) Capacity Assurance Technician [3]
  - (ii) Team Based Maintenance [2]
  - (iii) Maintenance Performance [5]
  - (iv) Measurement Pyramid [5]

### **QUESTION 3**

Table Q3 shows a list of activities to be carried out in the planning and scheduling of a plant shut down.

**Table Q3**

No.	Description of activity	Inter-relationship	Activity duration (hours)
1	Preparation	Independent of all	2
2	Open up vessels	Depends upon 1	8
3	Remove run-off valve	Depends upon 1	10
4	Refit run – off valve	Depends upon 2	4
5	Repair cage cables	Depends upon 3 and 4	6
6	Fit in new rollers	Depends upon 2 ,3 and5	5
7	Sign off	Depends upon 4 and 6	6

Carry out a network analysis and calculate the shut down duration and the degrees of criticality of the various activities. [20]

### **QUESTION 4**

Real Time Analysis is one form of Condition Based Maintenance used in some industrial organization. In detail mention:

- (a) the conditions to be monitored [4]
- (b) the application [3]
- (c) the P-F intervals [2]
- (d) the principle of operation [5]
- (e) the skills [2]
- (f) the advantages and disadvantages of this method . [4]

### **QUESTION 5**

- (a) Distinguish between preventive and predictive maintenance. [5]
- (b) Discuss the development of preventive maintenance schedule. [5]
- (c) Discuss briefly the maintenance requirements of process equipment . [5]
- (d) Explain briefly the safety aspects in maintenance of process equipment. [5]

## **QUESTION 6**

- (a) Carry out an ‘ABC’ Analysis from the operating records shown in table Q 6. [10]
- (i) Draw a graph showing the cumulative cost as a function of the number of failures. [5]
- (ii) Mention the machines which are found in zone A, B and C. [5]

**Table Q6**

Machine number $i$	Hours Downtime $C_i$	Number of failures $F_i$
1	100	4
2	32	15
3	50	4
4	19	14
5	4	3
6	30	8
7	40	12
8	80	2
9	55	3
10	150	5
11	160	1
12	5	2
13	10	7
14	20	11
15	80	6
16	60	9
17	120	13
18	30	10
19	60	11
20	35	7

**End of examination**