NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering Honours Degree Industrial & Manufacturing Engineering

1st EXAMINATIONS APRIL 2009

MAINTENANCE ENGINEERING – TIE 3110

<u>**Instructions to Candidates**</u>
<u>Time allowed:</u> 3 hours
Answer any five questions

<u>**Question 1**</u>
(a) State two most important objectives of maintenance.   [2]
(b) Identify the factors to be considered to determine the appropriate form of
     maintenance organization.   [2]
(c) What are maintenance records?   [2]
(d) Write expression for determining the reliability of a system when its elements are
     arranged in parallel.   [2]
(e) Define Total Productive Maintenance.   [2]
(f) Distinguish between preventive and predictive maintenance.   [5]
(g) Discuss the development of preventive maintenance schedule.   [5]

<u>**Question 2**</u>
(a) Explain how condition based maintenance differs from failure maintenance and
      fixed time replacement   [4]
(b) Identify and briefly discuss four various types of:
      i. On-load monitoring techniques   [8]
      ii. Off-load monitoring techniques   [8]

<u>**Question 3**</u>
(a) Describe the behavior of physical equipment when in service   [10]
(b) Describe the factors which determine the availability of a mechanical system   [10]

<u>**Question 4**</u>
(a) With the aid of a diagram define the following terms :
     (i) Mean Time To Failure   [3]
     (ii) Mean Time To Repair   [3]
     (iii) Mean Time Between Failure   [4]
     (iv) Mean Up Time   [3]
     (v) Mean Down Time   [3]
(b) Distinguish between theoretical and practical availability   [4]

Question 5

Carry out an 'ABC' Analysis from the operating records shown in table Q10   [10]

(i) Draw the 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 Q10

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	4
12	5	3
13	10	8
14	20	8
15	40	12
16	10	4
17	80	2
18	60	14
19	30	10
20	20	7

Question 6

Write short notes on:
(a)   Maintenace Policy   [5]
(b)   Machine Failure Pattern   [5]
(c)   Computerised Maintenance Information System   [5]
(d)   Redundancy Systems   [5]

End of Examination!!!