# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY FACULTY OF INDUSTRIAL TECHNOLOGY <br> Department of Industrial and Manufacturing Engineering Bachelors of Engineering in Industrial and Manufacturing Engineering (Hons) First Semester Exams February 2010 <br> Manufacturing Systems TIE5101 

Duration: 3 hours
Answer: FIVE (5) Questions AT LEAST TWO QUESTIONS FROM EACH SECTION

## SECTION A: FLEXIBLE MANUFACTURING SYSTEMS

## QUESTION 1

a) Discuss briefly two types of tool allocation policies.
b) Eight part types are being considered for production on a new machine. These parts are currently purchased. For each part type a decision will be made to either make all its units on the new machine or to continue to purchase all units. This is necessary to ensure quality consistency. Total estimated savings per month to make the product internally are ( $50,75,67,213,96,88,434,26$ ), respectively. The hours required per week to produce the product demand are $(9,22,7,32,15,19$, 60,3 ), respectively. If the machine available 80 hrs per week and overtime hours could be arranged at a cost of $\$ 10$ per hour for up to 18 hours per week, four weeks per month, what products should be made internally?

## QUESTION 2

a) Describe briefly three types of flexibility.
b) The following jobs are available for manufacture on an FMS. The FMS has one Coating Station and One Enameling machine. The coating can hold many parts but the Enamelling can hold only three parts types. All parts that start with the same letter use the same tool head. Parts say V\#\# parts could be done on the Enamelling machine and require only one tool head. Machines are available 15 hours per day. Select the jobs to be run every T days.

|  |  |  | Unit Processing Hours |  |
| :--- | :--- | :--- | :--- | :--- |
| Part Type | No. of Units | Due Date | Coating | Enameling |
| V45 | 20 | 2 | 0.4 | 0.10 |
| V45 | 10 | 1 | 0.3 | 0.05 |
| V65 | 5 | 3 | 1.0 | 0.05 |
| W25 | 10 | 2 | 0.8 | 0.20 |
| X67 | 10 | 3 | 0.5 |  |
| X67 | 20 | 2 | 0.5 |  |
| Y33 | 50 | 2 | 0.4 | 0.05 |
| Y77 | 50 | 1 | 0.2 | 0.1 |
| Z51 | 10 | 1 | 0.1 | 0.1 |

## QUESTION 3

a) Discuss briefly two facility layouts in an FMS plant.
b) Consider the data in Table 3.1 which represent a demand of 100 units of each part type. Assume that an incremental approach is to be used to select parts and to load machines. Furthermore, all machines of the same type must carry the same tools. No more than six parts of any type can be in the process at one time. Normal throughput time is 2 hours for a part. Formulate the decision problem of part loading as a mathematical program.

Table 3.1: Part Data

| Part | Operation | Machine Type | Total Machine Hours | Tools |
| :---: | :---: | :---: | :---: | :---: |
| 31 E 245 | 1 | A | 1.5 | A1 |
|  | 2 | A | 2.4 | A2 |
|  | 3 | A | 1.2 | A3 |
|  | 4 | B | 12.6 | B2 |
|  |  |  |  |  |
| 20E139 | 1 | B | 7.1 | B1 |
|  | 2 | B | 1.3 | B5 |
|  | 3 | A | 1.6 | A5 |
|  | 4 | B | 4.5 | B3 |
|  | 5 | A | 2.5 | A7 |
|  |  |  |  |  |
| 10F865 | 1 | A | 1.4 | A6 |
|  | 2 | B | 3.9 | B3 |
|  | 3 | A | 2.4 | A5 |
|  | 4 | A | 1.6 | A1 |
|  | 5 | B | 2.8 | B2 |
|  |  |  |  |  |
| 24F621 | 1 | A | 2.4 | A7 |
|  | 2 | A | 1.5 | A6 |
|  | 3 | B | 4.8 | B6 |
|  | 4 | B | 3.3 | B9 |

## SECTION B: M ATERIAL HANDLING

## QUESTION 4

a) Describe the unit load concept in material handling and its two advantages.
b) Discuss briefly any two main questions to be considered in a specific checklist for material handling systems.
c) Briefly discuss five material handling principles.

## QUESTION 5

a) Discuss two types of material handling costs and two ways to reduce them.
b) What are the design steps to be followed in material handling design?

## QUESTION 6

a) What are the factors that you would consider in selection of material handling equipment?
b) Describe four characteristics of industrial trucks.

## QUESTION 7

a) Briefly discuss two type of conveyors.
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b) Discuss, citing examples, how material handling can be used in an area to improve productivity in the company where you were attached.

## END OF EXAM

