Register No: …….

**M.E DEGREE EXAMINATIONS: APRIL/MAY 2011**

Second Semester

**INDUSTRIAL ENGINEERING**

IEE505: Operations Scheduling

**Time: Three Hours** **Maximum Marks: 100**

**Answer ALL Questions:-**

**PART A (10 x 2 = 20 Marks)**

1. What is the role of scheduling?
2. Consider the following single machine-scheduling problem with weights

| Job(j) | 1 | 2 | 3 | 4 | 6 |
|---|---|---|---|---|---|
| Processing($t_j$) | 15 | 4 | 5 | 14 | 8 |
| Weight (w) | 1 | 2 | 1 | 2 | 3 |

Determine the sequence, which will minimize the weighted mean flow time of the above Problem. Also find the weighted mean flow time.

3. List the activities of scheduling.
4. State out the steps in $H_m$ algorithm?
5. Indicate the features of Gantt chart?
6. What are the characteristics of the flow-shop scheduling problem?
7. Distinguish between Semi-Active and Active Schedule.
8. List out the priority in dispatching rules.
9. What is meant by Assembly line balancing?
10. State the rules for formulating Tree search method.

**PART B (5 x16 = 80 Marks)**

11. a) The processing times for five jobs and their due dates are given for a single machine scheduling below.

| Job j | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Processing($t_j$)hrs | 9 | 7 | 5 | 11 | 6 |
| Due date(in days) ($d_j$) | 16 | 20 | 25 | 15 | 40 |

(a) Determine the sequence

(b) Total completion time

(c) Average completion time

(d) Average number of jobs in the system and average job lateness using the following priority sequencing rules-(i) Shortest Processing Time (SPT), (ii) Earliest Due Date (EDD), (iii) Longest Processing Time (LPT)

**(OR)**

b) Consider the following single machine scheduling problem.

| Job j | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Processing time $t_j$ | 4 | 3 | 7 | 2 | 2 |
| Due date $d_j$ | 5 | 6 | 8 | 8 | 17 |

Determine the optimal sequence which will minimize the mean tardiness using branch and bound algorithm.

12. a) Reduce the weighted mean flow time in a five machine problem using Hi algorithm.

| Jop j | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Processing Time tj | 5 | 21 | 16 | 6 | 26 | 19 | 50 | 41 | 32 | 22 |
| Weight (wj) | 4 | 5 | 3 | 1 | 4 | 2 | 5 | 4 | 3 | 2 |

**(O R)**

b) (i) Describe the MUNTZ-COFFMAN algorithm.

(ii) Consider the job set given blow, when number of parallel identical machine available is two. Determine the minimum make span using the MUNTZ-COFFMAN algorithm.

| Job j | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Processing time tj | 2 | 2 | 2 | 1 | 1 |
| sj | 5 | 5 | 4 | 5 | - |

13. a) (i) Demonstrate the steps in Johnson's Algorithm.

(ii) Consider the following two machines and six jobs flow shop-scheduling problem. Using Johnson's algorithm, obtain the optimal sequence, which will minimize the make span.

| | Processing time | |
|---|---|---|
| Job | M/c–1 | M/c–2 |
| 1 | 5 | 4 |
| 2 | 2 | 3 |
| 3 | 13 | 14 |
| 4 | 10 | 1 |
| 5 | 8 | 9 |
| 6 | 12 | 11 |

**(OR)**

b) (i) Discuss the procedure followed in Palmer's heuristic used to solve flow shop problems.

(ii) The processing time data of a flow shop scheduling problem is given below.

| Job | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| M /c-1 | 10 | 8 | 12 | 15 |
| M /c-2 | 15 | 10 | 7 | 20 |
| M /c-3 | 23 | 7 | 10 | 6 |

Solve for optimal make span schedule using Palmer's method.

14. a) Use graphical method to minimize the time needed to process the following jobs on the machines shown (i.e. for each machine, find the job which should be scheduled first). Also, calculate the total time elapsed to complete both jobs.

| Job 1 | Sequence | A | - | B | - | C | - | D | - | E |
|---|---|---|---|---|---|---|---|---|---|---|
| | Time(hrs) | 3 | | 4 | | 2 | | 6 | | 2 |
| Job 2 | Sequence | B | - | C | - | A | - | D | - | E |
| | Time(hrs) | 5 | | 4 | | 3 | | 2 | | 6 |

**(OR)**

b) Consider a four-job, three-machine job shop problem with the following processing times. Find the schedule using non-delay schedule generation heuristic with following rules. $1^{st}$ level-MWKR, $2^{nd}$ level-SPT, $3^{rd}$ level –random

| Processing times operation | | | | Routings operation | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | | 1 | 2 | 3 |
| Job 1 | 4 | 3 | 2 | Job 1 | 1 | 2 | 3 |
| Job 2 | 1 | 4 | 4 | Job 2 | 2 | 1 | 3 |
| Job 3 | 3 | 2 | 3 | Job 3 | 3 | 2 | 1 |
| Job 4 | 3 | 3 | 1 | Job 4 | 2 | 3 | 1 |

15. a) Explain the Giffler Thomson algorithm with suitable example

**(OR)**

b) A company is setting an assembly line to produce 24 units per eight hour shift. Design an assembly line using RPW (Rank Positional Weight) method. The information regarding work elements in terms of times and immediate predecessors are given

| Work element no | Time (sec) | Immediate predecessors | Positional weight |
|---|---|---|---|
| 1 | 5 | - | 33 |
| 2 | 3 | 1 | 16 |
| 3 | 7 | 1 | 28 |
| 4 | 5 | 1 | 22 |
| 5 | 6 | 3 | 21 |
| 6 | 3 | 3 | 18 |
| 7 | 4 | 2 | 13 |
| 8 | 6 | 5,6 | 15 |
| 9 | 8 | 4 | 17 |
| 10 | 9 | 7,8,9 | 9 |

(i) What is the desired cycle time?

(ii) Construct the precedence diagram.

(iii) What is the theoretical number of stations?

(iv) What are the efficiency and balance delay of the solution obtained?

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