

W 2615

M.E. DEGREE EXAMINATION, JANUARY 2007.

Elective

Industrial Engineering

IE 1622 — OPERATIONS SCHEDULING

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between sequencing and scheduling.
2. List and explain the performance measures of single machine scheduling problems.
3. Give the steps of McNaughton's Algorithm.
4. What is the meaning of weighted mean flow time?
5. State the condition to be satisfied for the extension of Johnson's Algorithm to the 3 m/c flow shop makespan sequence.
6. How is CDS heuristic related with Johnson's algorithm?
7. Define active schedule with respect to job shop models.
8. What is meant by dynamic job shop scheduling?
9. Give the name of the two types of Kanban.
10. State the objectives of assembly line balancing.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Consider the following set of jobs that are to be scheduled in 3 identical processors in parallel.

Job j :	1	2	3	4	5	6	7	8	9
Processing time t_j :	6	5	7	3	4	8	10	2	13

Find a non pre-emptive schedule resulting from the LPT heuristic procedure. (10)

- (ii) Solve the problem given in (i) to minimize the makespan assuming preemption is permitted. (6)

Or

- (b) Apply Dynamic programming to solve the single machine sequencing problem. (16)

Job	1	2	3	4
t_j	5	3	9	4
d_j	6	4	12	8

12. (a) (i) Consider the following data of a single machine scheduling problem.

Job ' j ' :	1	2	3	4	5	6	7	8
Processing time ' t_j ' :	5	12	9	10	2	14	7	6
Due date ' d_j ' :	10	18	10	16	6	25	15	18

Find the job sequence for minimum number of tardy jobs. (10)

- (ii) Discuss each of the objectives listed below and the relationship each has with job shop performance :

- (1) Reduce WIP inventory
- (2) Provide a high level of customer service
- (3) Improve factory efficiency. (6)

Or

- (b) Rita bakes breads and cakes in her home for parties and other affairs on a contract basis. Jane has only one oven for baking. One particular Monday morning she finds that she has agreed to complete five jobs for that day. Her husband James will make deliveries, which require about 15 minutes each. The time required for baking and promised time of delivery of the day order are given in the following table :

Job :	1	2	3	4	5	6
Time required (min) :	72	40	132	30	186	25
Promised time :	11.30 a.m.	10.00 a.m.	11.00 a.m.	1.00 p.m.	12.00 noon	2.00 p.m.

Suppose that she begins baking at 8 am, determine the sequence in which she should perform the jobs in order to minimise

- (i) Mean flow time (8)
 (ii) Number of tardy jobs. (8)
 (i) Consider the following job times for a three machine problem. Assume that the jobs are processed in the sequence A-B-C.

Job	Machine		
	A	B	C
1	4	5	8
2	9	6	10
3	8	2	6
4	6	3	7
5	5	4	11

Find the optimal sequence for minimum makespan and draw its corresponding Gantt chart. (10)

- (ii) Describe the permutation flow shop with an example. (6)

Or

- (b) (i) The processing time data of a flow shop scheduling problem is given below :

Job	Processing Time		
	M/C1	M/C2	M/C3
1	10	15	23
2	8	10	7
3	12	7	10
4	15	20	6

Solve for optimal makespan schedule using Palmer's method. (8)

- (ii) State the characteristics of flow shop scheduling problem. (8)

14. (a) For a three machine (A, B and C) job shop, the following data are given :

Job	Job routing and processing times	Due date
1	B (2), C (5)	9
2	A (6), B (1), C (3)	15
3	B (1), A (4)	10
4	C (3), A (2), B (5)	12
5	A (5), C (4), B (1)	14

Obtain the schedules using the following rules and draw their corresponding Gantt chart.

- (i) Earliest Due Date First (EDD) (5)
- (ii) Shortest Processing Time (SPT) (5)
- (iii) Least Slack Time First (LST). (6)

Or

- (b) Apply Branch and Bound technique to solve the single machine problem with following data : (16)

Job :	1	2	3	4
Processing time :	10	7	14	9
Due date :	10	9	17	15

- 15. (a) Find an active feasible schedule with Giffler and Thompson procedure as schedule generation method and SPT rule as conflict resolution mechanism for the following job shop scheduling problem.

Component - Operation Matrix

Operation No. 'k' \ Job No. 'j'	1	2	3	4	5
1	$M_{jk} = 3$ $T_{jk} = 7$	2	1	4	5
2	2	1	4	3	5
3	10	5	8	12	5
	3	4	2	1	-
	3	12	10	13	-

M_{jk} — Machine identifier for k th operation of job 'j'

T_{jk} — Operation time for k th operation of job 'j'. (16)

Or

- (b) Consider the following assembly network relations of a product. The number of shifts per day is one and the number of working hours is 8. The company aims to produce 40 units of the product per day.

Operation No. :	1	2	3	4	5	6	7	8	9
Immediate preceding tasks :	-	1	1	1	3,4	2,7	2,4,5	4	6,8
Task duration (min) :	8	3	2	4	7	4	5	6	8

Find the optimal number of work stations using Rank Positional weight method. Also compute the balancing efficiency. (16)