National Exams December 2013

07-Mec-B4, Integrated Manufacturing Systems

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is an OPEN BOOK EXAM.
   Any non-communicating calculator is permitted.

3. Any five questions constitute a complete paper. Only the first five (5) questions as they appear in your answer book will be marked.

4. Each question is of equal value.

5. Some questions require an answer in essay format. Clarity and organization of the answer are important.

Question 1:

a) What is the role of process planning in a discrete parts manufacturing industry?

b) How does process planning affect part quality and manufacturing costs?

c) What factors need to be considered by a company in evaluating and selecting the best process planning system?

Question 2:

Determine the control limits for the data shown in the table below

x_1	x_2	x_3	x_4
0.55	0.60	0.57	0.55
0.59	0.55	0.60	0.58
0.55	0.50	0.55	0.51
0.54	0.57	0.50	0.50
0.58	0.58	0.60	0.56
0.60	0.61	0.55	0.61

Question 3:

a) What is a manufacturing cell? Why was it developed?

b) Describe the principle of flexible manufacturing systems. Why do they require major capital investment?

c) Why is a flexible manufacturing system capable of producing a wide range of lot sizes?

d) What are the benefits of just-in-time production? Why is it called a pull system?

e) Explain the function of a local area network.

Question 4:

a) A manufacturer is ring rolling ball-bearing races (see Fig. 1). The inner surface has a surface roughness specification of 0.10 μm ± 0.05 μm. Measurements taken from rolled rings indicate a mean roughness of 0.112 μm with a standard deviation of 0.02 μm. 30,000 rings per month are manufactured and the cost of discarding a defective ring is \$5.00. It is known that by changing lubricants to a special emulsion, the mean roughness could be made essentially equal to the design specification. What additional cost per month can be justified for the lubricant?

b) For the data of Quantitative Problem 4(a), assume that the lubricant change can cause the manufacturing process to achieve a roughness of 0.09 μm. What additional cost per month for the lubricant can be justified? What if the lubricant did not add any new cost?

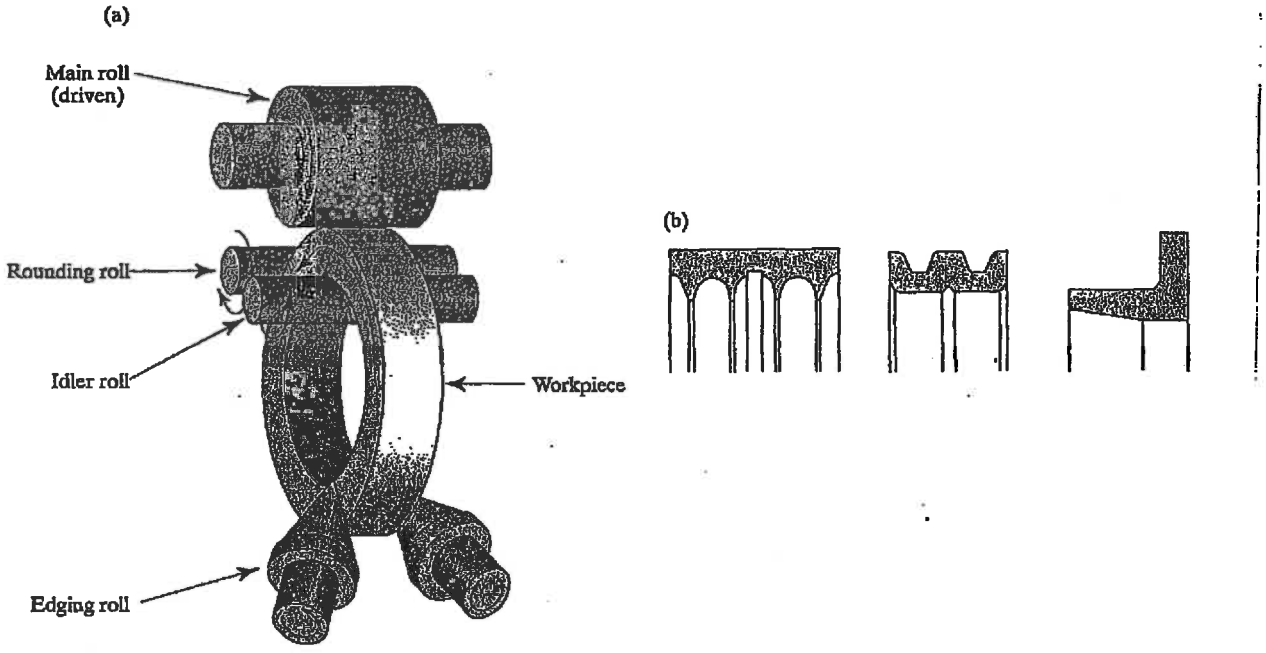

FIGURE 1 (a) Schematic illustration of a ring-rolling operation. Thickness reduction results in an increase in the part diameter. (b) Examples of cross-sections that can be formed by ring rolling.

Question 5:

The following tasks must be performed on an assembly line in the sequence and times specified below.

Task	Task Time (seconds)	Task which must precede
A	50	-
B.....	40	-
C.....	20	A
D.....	45	A, C
E.....	20	A, C
F.....	25	A, C, D
G.....	10	A, C, E
H.....	35	A, B, C, D, E, F

a) Draw the schematic diagram.

b) What is the theoretical minimum number of stations required to meet a forecasted demand of 400 units per eight-hour day?

c) Select a balancing rule and balance the line in the minimum number of stations to produce 400 units per day.

Question 6:

The Green Manufacturing Company has leased facilities to manufacture a new product. The following data have been formulated from cost and market studies:

Estimated annual sales	24,000 units
Estimated costs:	
Materials	$96,000.
Direct labor	14,400.
Overhead	24,000.
Administrative expenses	28,000.

Selling expenses are expected to be 15% of sales. The required profit is $1.02 per unit.

a) What should the selling price be per unit?

b) What is the breakeven point in dollars and units if overhead and administrative expenses are fixed but other costs are variable?

Question 7:

The historical demand for a product is: January, 80; February, 100; March, 60; April, 80; and May, 90.

a. Using a simple four-month moving average, what is the forecast for June? If June experienced a demand of 100, what would your forecast be for July?

b. Using single exponential smoothing with $\alpha = 0.20$, if the forecast for January had been 70, compute what the exponentially smoothed forecast would have been for the remaining months through June.

c. Using least squares regression analysis, compute a forecast for June, July, and August.

d. Using a weighted moving average with weights of 0.30, 0.25, 0.20, 0.15, and 0.10, what is June's forecast?