Automation Production Systems and Computer Integrated Manufacturing 5th edition Groover Solutions Manual

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Chapter 1
INTRODUCTION

REVIEW QUESTIONS

1.1 What is a production system?

Answer: As defined in the text, a production system is a collection of people, equipment, and procedures organized to perform the manufacturing operations of a company.

1.2 Production systems consist of two major components. Name and briefly define them.

Answer: The two major components given in the text are (1) facilities, which consist of the factory, the equipment in the factory, and the way the equipment is organized; and (2) manufacturing support systems, which are the procedures used by the company to manage production and to solve the technical and logistics problems encountered in ordering materials, moving the work through the factory, and ensuring that products meet quality standards. Product design and certain business functions are included among the manufacturing support systems.

1.3 What are manufacturing systems, and how are they distinguished from production systems?

Answer: A manufacturing system is a logical grouping of equipment in the factory and the worker(s) who operate(s) it. Examples include worker-machine systems, production lines, and machine cells. A production system is a larger system that includes a collection of manufacturing systems and the support systems used to manage them. A manufacturing system is a subset of the production system.

1.4 Manufacturing systems are divided into three categories, according to worker participation. Name the three categories.

Answer: The three categories are (1) manual work systems, (2) worker-machine systems, and (3) automated systems.

1.5 What are the four functions included within the scope of manufacturing support systems?

Answer: As identified in the text, the four functions are (1) business functions, (2) product design, (3) manufacturing planning, and (4) manufacturing control.

1.6 Three basic types of automation are defined in the text. What is fixed automation and what are some of its features?

Answer: Fixed automation is a system in which the sequence of processing (or assembly) operations is fixed by the equipment configuration. Each operation in the sequence is usually simple, but the integration and coordination of many such operations in one piece of equipment makes the system complex. Typical features of fixed automation are (1) high initial investment for custom-engineered equipment, (2) high production rates, and (3) relatively inflexible in accommodating product variety.

1.7 What is programmable automation and what are some of its features?

Answer: In programmable automation, the production equipment is designed with the capability to change the sequence of operations to accommodate different part or product configurations. The operation sequence is controlled by a program, which is a set of instructions coded so that they can be read and interpreted by the system. Some of the

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features of programmable automation are (1) high investment in general purpose equipment, (2) lost production time due to changeovers of physical setup and reprogramming, (3) lower production rates than fixed automation, (4) flexibility to deal with variations and changes in product configuration, and (5) most suitable for batch production.

1.8 What is flexible automation and what are some of its features?

Answer: Flexible automation is an extension of programmable automation. A flexible automated system is capable of producing a variety of parts (or products) with virtually no time lost for changeovers from one part style to the next. There is no lost production time while reprogramming the system and altering the physical setup. Accordingly, the system can produce various mixes and schedules of parts or products instead of requiring that they be made in batches. Features of flexible automation are (1) high investment for a custom-engineered system, (2) continuous production of variable mixtures of products, (3) medium production rates, and (4) flexibility to deal with product design variations

1.9 What is computer-integrated manufacturing?

Answer: As defined in the text, computer-integrated manufacturing (CIM) denotes the pervasive use of computer systems to design the products, plan the production, control the operations, and perform the various information-processing functions needed in a manufacturing firm. True CIM involves integrating all of these functions in one system that operates throughout the enterprise.

1.10 What are some of the reasons why companies automate their operations?

Answer: The reasons give in the text are (1) increase labor productivity, (2) reduce labor cost, (3) mitigate the effects of labor shortages, (4) reduce or eliminate routine manual and clerical tasks, (5) improve worker safety, (6) improve product quality, (7) reduce manufacturing lead time, (8) accomplish processes that cannot be done manually, and (9) avoid the high cost of not automating.

1.11 Identify three situations in which manual labor is preferred over automation.

Answer: The five situations listed in the text are the following: (1) The task is technologically too difficult to automate. (2) Short product life cycle. (3) Customized product. (4) To cope with ups and downs in demand. (5) To reduce risk of product failure.

1.12 Human workers will be needed in factory operations, even in the most highly automated operations. The text identifies at least four types of work for which humans will be needed. Name them.

Answer: The four types of work identified in the text are (1) equipment maintenance, (2) programming and computer operations, (3) engineering project work, and (4) plant management.

1.13 What is the USA Principle? What does each of the letters stand for?

Answer: The USA Principle is a common sense approach to automation and process improvement projects. U means “understand the existing process,” S stands for “simplify the process,” and A stands for “automate the process.”

1.14 The text lists ten strategies for automation and process improvement. Identify five of these strategies.

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Answer: The ten strategies listed in the text are (1) specialization of operations, (2) combined operations, (3) simultaneous operations, (4) integration of operations, (5) increased flexibility, (6) improved material handling and storage, (7) on-line inspection, (8) process control and optimization, (9) plant operations control, and (10) computer-integrated manufacturing (CIM).

1.15 What is an automation migration strategy?

Answer: As defined in the text, an automation migration strategy is a formalized plan for evolving the manufacturing systems used to produce new products as demand grows.

1.16 What are the three phases of a typical automation migration strategy?

Answer: As defined in the text, the three typical phases are the following: Phase 1: Manual production using single-station manned cells operating independently. Phase 2: Automated production using single-station automated cells operating independently. Phase 3: Automated integrated production using a multi-station automated system with serial operations and automated transfer of work units between stations.

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