INDUSTRIAL ENGINEERING

INTRODUCTION

Industrial Engineering defined

- **Industrial Engineering** is defined by the Institute of Industrial Engineers as **:**
- **A branch of Engineering "concerned with the design, improvement, and installation of integrated systems of people, material, equipment, and energy. It draws on the specialized knowledge and skills in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems."**

BACKGROUND

- **The advent of industrial engineering is frequently associated with the industrial revolution in the 19th century.**
- **It was during this period that household production was replaced by production in factories.**

BACKGROUND

- Frederick Winslow Taylor is usually recognised as the founder of Industrial Engineering and Scientific Management. His pioneering work in the design, measurement planning and scheduling of work from 1880 to the time of his death in 1915 was the impetus for the conceptualization and growth of industrial engineering.

BACKGROUND

- Taylor introduced the concept of time study, methods engineering, tool standardization, costing methods, routing, employee job selection, and incentives.
- The term ‘classical’ has been applied to the traditional industrial engineering activities of Fred W. Taylor and Frank and Lillian Gilbreth.

BACKGROUND

- These classical techniques have had and continue to have great practical value, and for decades have been considered the hallmark of industrial engineering.
- Modern industrial engineering techniques address the more quantitative computer-systems approach to the solution of industrial engineering problems.

Classical Activities

- The classical activities are
  - methods,
  - job standards,
  - plant layout,
  - and costs;
- They are vital to effective management
- Many of the quantitative systems models need data which are obtained by time study, synthetic time standards, or work sampling.

Industrial Engineer

- For an industrial engineer to be effective, he or she has to have the capability of evaluating and utilizing the appropriate classical and the more sophisticated management-science operations research techniques in solving unstructured real life problems.
- He or she has to have good interpersonal skills and be very observant.

ACTIVITIES

- **Industrial Engineering** is similar to the other major engineering specializations(civil, mechanical, electrical, and chemical).
- Because it is also concerned with analysis and design, and applying the laws and materials of nature to useful, and constructive purposes.
- It is different from these other fields of engineering in that it is specifically concerned with equipment and systems in which people are an integral part.

The industrial engineer

- The industrial engineer must be able to use mathematics, materials, machinery, devices, chemistry, electricity, electronics, and so on, just as all the other types of engineers.
- But, unlike them, the industrial engineer must also understand and be able to integrate people into his or her designs and must know their physical, physiological, psychological, and other characteristics – singly and in groups.

Activities

- The early, and still major, activities of industrial engineers include
  - work methods analysis and improvement,
  - work measurement and the establishment of standards, wage rates and incentives
  - job and workplace design,
  - plant layout, assembly line balancing
  - material handling,
  - cost reduction
  - production planning and scheduling,
  - inventory control,
  - maintenance scheduling, equipment evaluation,
  - overall productivity improvement

Activities

- All these activities were done, almost exclusively in the early days, in manufacturing industries.
- As technology evolved, additional activities were added to this list. These include
  - machine tool analysis,
  - numerically controlled machine installation and programming.

Activities (cont.)

- linear programming,
- queuing theory,
- simulations, management information systems,
- human/machines systems design,
- ergonomics,
- biomechanics, and the use of robots and automation

Activities

- It was also found that the industrial engineering techniques that were used successfully in the factory could also be applied in
- the office,
- laboratory,
- classroom,
- hospital (including the operating room),
- banks,
- the government,
- the military and other non-industrial sectors.

Activities

- The production function is dynamic by its inherent activities .
- Traditional industrial engineers are frequently called upon to determine the impact of product mix variances, and
- equipment additions or deletions on facilities arrangement and
- line balancing in the manufacturing area.

Activities

- This task has become more complex with the additional energy computations and pollution level considerations.
- This complicated system of interrelated activities is almost impossible to evaluate manually;
- however, through the use of simulation on a computer, answers to “what if” types of questions which provide significant inputs to the decision maker.

METHODS ENGINEERING

- A technique used by progressive management to improve productivity and reduce costs in both direct and indirect operations of manufacturing and non-manufacturing business organisations.
- Methods engineering is applicable to any enterprise where human effort is required.

METHODS ENGINEERING

- **It can be defined as the systematic procedure for subjecting all direct and indirect operations to close scrutiny in order to introduce improvements that will make work easier to perform and will allow work to be done smoother, in less time, with less energy, effort, and fatigue, and with less investment per unit.**
- The ultimate objective of methods engineering is profit improvement.

METHODS ENGINEERING

- Methods engineering includes five activities:
  - Planning,
  - methods study,
  - standardisation,
  - work measurement,
  - and controls

PLANNING

- Methods engineering, through planning, first identifies the amount of time that should be spent on a project so as to get as much of the potential savings as is practical.
- Invariably the most profitable jobs to study are those with the most repetition, the highest labour content (human work as distinguished from mechanical or process work), the highest labour cost, or the longest life span.

METHODS STUDY

- Next, through methods study, methods are improved by observing what is currently being done and then by developing better ways of doing it.

STANDARDISATION

- After ideal methods have been devised, standardisation of equipment, methods, and working conditions takes place.
- The standardisation phase includes the training of the operator to follow the standard method.

WORK MEASUREMENT

- After all this is done, the number of standard hours in which operators working with standard job or method to do their job is determined by measurement.
- Work Measurement methods
  - stop-clock time studies
  - Work sampling
  - Standard data

CONTROLS

- Finally, the established method is periodically audited, and various management controls are adjusted with the new time data.
- The system may include a plan for compensating labour that encourages attaining or surpassing a standard performance.

METHODS ENGINEERING

Fig. 1 – Elements of Methods Engineering