**IENG112 Notes #2**

**Systems and System Engineering**

The central notion of IENG/OR/MANE is ***system***.

A ***system*** is a set of ***elements*** which

* interact among each other,
* behave as a *single unit*, and this unit is the system itself, and
* the interactions of the elements create new properties *on the level of the system*.

**1. Modern history**

around 1945: Ludwig von Bertalanffy (biologist), Norbert Wiener (mathematician) and Ross Ashby (psychiatrist and cybernatist)

**Examples**

* **Human being.** A human being is more than just brain plus heart plus kidney plus skin plus etc.
* **Production system.** It consists of
  1. machines to produce the products,
  2. workers (human being) controlling the machines,
  3. raw material from which the products are produced,
  4. transportation equipment and personnel,
  5. storing equipment,
  6. information,
  7. ***decisions,*** and
  8. energy supply.

**New property on the level of the system:** *production,**capacity.*

**Behavior as a single unit:** *supplies customers and/or other production units.*

**2. Black box approach**

* One component of a system can be another system. Then it is a subsystem. For example the blood system of human beings.
* Sometimes the structure of the subsystems is not known.
* For the description of the system it is enough to know that what is the answer of the subsystem for the possible inputs.

output

input

Subsystem

**3. Systems in production environment**

**Warning:** the list of elements in the example may not contain all components.

**3.1 Workshop**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Elements** | | | | |
| room/hall | raw materials | transportation equipment | storing equipment  for tools | information  collecting equipments |
| machines | workers | storing equipment for  finished and semi-finished | technological  instructions | decision procedures |
| tools | energy supply | storing equipment for  raw material | schedules | safety equipments |
| inspection | | | | |

**3.2 Facility**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Elements** | | | | |
| location | rooms | heating | inside transportation  possibilities | connection to  airports |
| plot | energy supply | cooling | connection to roads | connection to  harbor |
| building(s) | water supply | internet | connection to railways | parking lot |
| production/service equipment | | | | |

**3.3 Production control system**

|  |  |  |  |
| --- | --- | --- | --- |
| **Elements** | | | |
| information collection | database for  technology | distribution control | Capacity Requirement  Planning (CRP) |
| forecasting | Bill-Of-Materials  (BOM) | purchasing | budget planning |
| customer contracts | daily schedule:  Shop Floor Control (SFC) | Master Production  Schedule (MPS) | long term  planning |
| supplier contracts | inventory control | Material Requirement  Planning (MRP) |  |

**4. Line and staff**

* expressions taken from military organization
* ***Line***: superior-ordinate, belongs of the main duty of the organization

For example: CEO, director of a factory, foreman, and worker.

* ***Staff***: advisors in special areas.
* For example: accounting, finance, and maintenance.