IBIE - A

Integral Basic course
Industrial Engineering - A

Work-Study
Technical Pre-Calculation
Decision Calculation

LPI

Table of contents **Page**

1. INTRODUCTION

1.1 Starting-points

In the company/department the lean production concept has usually been introduced as a basic concept.
The training course Work Study (WS) is the first and main part of the Integral Basic Industrial Engineering - A course, IBIE-A for short, and directly connected adapted to the basic concept of the organization.

The Work Study program has been conceived on the basis of the following starting-points:

- Practical course; based on recognisable and concrete problems and themes.
- There will be a direct connection of the program to the description of the jobs of designers, staff members of the organization and efficiency department, planning officers and trainee group leaders.
- Connection to the certified training course (Euro) Industrial Engineering. All lessons and acticities of the course must attended and all exercises and tests must been attended and made. The examination and certification of the WS internal P(E)MT system must have been concluded positively. A practical assignment must be conducted and concluded, containing as much as possible aspects of the course. A report and a presentation must be conducted. International program for speakers of English.
- On request the current practice in the department can be taken into account in
  the training course.
- Evaluation will take place during and after the training course.

1.2 Aim of the Training Course

The lean production concept makes far-reaching demands with relation to the integration of processes, flexibility, quality of the processes, and the relations with clients and supplier. These demands are dealt with by teams of staff members from different disciplines. The eventual working-method on the production floor has been highly standardised, while improvements are continuously being looked for and introduced.
Apart from an extensive basic knowledge of methods and techniques within the teams, this concept necessitates the availability of skills to introduce solutions.

Usually the department will have a programme running with relation to team building. For this reason it has been decided to deal with this aspect during the course only as far as the **necessity** of team building is concerned. The emphasis will therefore be laid on methods and techniques.

After finishing the training course its members must be able to:

- identify problems, choose the right method of investigation in order to define solutions and to indicate advantages and disadvantages of the proposals (including financial ones).
- apply work study methods and techniques
- (re)calculate the (integral) cost price or indicate the consequences of the improvements with respect to the cost price.
- support management with business economical decision calculations.

1.3 Target Group

Staff supporting the middle management in the field of business administration in a (changing) organization, with the aim of safeguarding the continuity as much as possible by means of a continuous process of productivity improvement.
What we have particularly in mind here are developers, designers, staff members in the organization and efficiency department, planning officers and group leaders etc.

1.4 Adaptation of the Training Course to a Specific Target Group

The training course for Production Engineers/Cost Engineers comprises three separate constituent routes, viz.

- Work Study
- Technical Precalculation and Subsequent Costing
- Decision Calculations on financial investments

The target group comprises those who are directly involved in the production process or are directly related to the production process: prospective scientific managers, production engineers, cost engineers, productivity improvers, notably staff working in the O&E department. The course is also important for staff working in departments such as development, industrial mechanisation c.q. engineering department, production, planning etc. By shifting the accents in

parts of the course, by adding and/or removing certain components, the course can be adapted to a target group from a specific environment or a target group at a certain level in the organization.

An RWF is highly desirable for prospective Work Study Specialist, Industrial Engineers, the middle management from the direct production environment and planning officers or time-and-motion staff.

The minimum number of course members is 6, unless the costs do not present insurmountable problems.

2. ORGANIZATION TRAINING PROGRAMME WORK STUDY

2.1 Contents

- The introduction includes the following elements:
  - the aim of the course
  - meeting of course members to get acquainted
  - the importance of the integral practical assignment WS.

- The training must lead to pass certificates in the certified route Industrial Engineering. On account of this starting-point three examinations have been integrated in the course. After the VWF (RWF), TPC and DC modules have been completed, an examination will take place. This examination will have to be taken outside the given training path. One period into which a course day has been divided has been reserved for each examination. The integral practical assignment has been included in the course as an WS examination.

- The presentation of the practical assignment will include the following. The practical assignment, which has been discussed with the course members in the introductory unit, will have to be executed in the course member's own day-to-day practice. In the first place a course member will have to produce a report, secondly he will have to present his findings orally. During the oral presentation the employer and line executives will (preferably) be present. The course has been planned on the basis of approx. 3 presentations per day-period.

2.2 Procedure and Organization

- The course members (but this also applies to their office-manager) must take into account that the various assignments will have to be executed during working hours. Apart from this the course members must bear in mind that there will be homework in the form of:
  - reading the course material that will come up for discussion in the next Block
  - working on the practical assignment, which will have to be finished by the end of the course.

- The course can be planned in two ways as follows:
  I. Course to be completed in 4-5 months in 3-day units; the period in between the units has been chosen in such a way that the total course will

comprise approx. 22 weeks. In between the units the practical assignment (P.A.) will be worked on; all this will result in an increase in the study load so that an appeal will have to be made to the self-motivation of the members of the course as well as the organisation itself.

A course day is composed of three or two (the third day) day-periods.

morning	09.00 - 12.30 hours
afternoon	13.30 - 17.15 hours
evening	17.45 - 20.00 hours (approx.)

II. Course to be completed in 2-3 months in 5-day units. Two consecutive units for work study and two consecutive units for Technical Precalculation and Decision Calculations. Between these two blocks a period of 4 to 6 weeks to work on the Practical Assignment.

A course day is composed of the three day-periods as follows :

morning	08.30 - 12.30 hours
afternoon	13.30 - 17.45 hours
evening	18.15 - 20.15 hours (approx.)

A course unit is composed of three or five days consisting of day-periods as follows :

Day 1	Day 2/4	Day 3/5	
			09.00/08.30 hours
			13.30 hours
			17.45/18.15 hours
			20.00/20.15 hours

2.3 Core Teaching Staff

After an agreement has been reached on the contents of the programme, the teaching staff can be definitively decided on.
The course will be directed by Mr. G. de Vrij. This means that he will maintain the contacts with the organization, look after the supervision of the practical assignment and be responsible for the certification route. Apart from this he will act as a core teacher for the subject scientific management.

G. de Vrij
Studied Physics and has been active with Philips NV in the Physical Laboratory, the Central Precalculation and Planning Department and the Centre for Quantitative Methods. He has been active since 1986 as a trainer/consultant with the KPMG Lighthouse Training Group, his field of special attention is Work Study and Ready Work Factor. Since March 1994 he is a trainer/consultant with KPMG Lighthouse Industrial Operations, Training Group. Since 2000 for Atos Consulting and since 2003 for Liberty Productivity Improvement.

3. SHORT DESCRIPTION OF THE SUBJECTS

3.1 Work Study

Setting

The search for better methods of working is as old as mankind, as it has been trying to do things better or more with less exertion. The rise of the industrial revolution in the USA and England has lead to a more scientific study of human labour.

F.W. Taylor (1856-1915) was the first to analyse the organization and to see it as a separate and full-fledged management discipline. He is considered the founder of Scientific Management, or Work Study.

Other important contributors to the development of Work Study were Frank and Lillian Gilbreth, Ch. Bédaux, W. Shewhart and C. Tippett.

In the British Standard 3138: 1969 Work Study is defined as follows:

Work Study is the generic term for those techniques, such as method study and time-and-motion study, that are used to examine human labour in all its aspects. They lead systematically to the study of all the factors affecting the efficiency and costs of the situation in question, with the aim of improving productivity.

Work Study has four methods. The first we mention is general methods. The second occupies itself with the method; the third with time. The latter two are called respectively, method study and time measurement or time-and-motion study. The fourth method occupies itself with special problem solving techniques, like SMED.

The **general methods** are certain techniques to gain a quick insight into the nature and magnitude of the problems.

Method study is the systematic recording and critical assessment of existing and new methods of work, with a view to developing easier and more effective methods which will lead to productivity improvement in order to realise a reduction in costs.

Time-and-motion study is the application of techniques by means of which the time can be determined needed by a worker to execute a task. This method is used especially to establish standards, or to equilibrate sequential work stations.

The **special techniques** are applied to solve special problems that may arise. Reduction of change-over times; Failure Mode and Effect Analysis, Systematic Lay-out Planning, and others.

General methods

In order to make situations more transparent many techniques have been developed. They will help to clarify what exactly is happening and how the situation can be improved. A number of techniques, such as the Process Chart and Flow Diagram, have already been dealt with.

Other techniques are:

- The Pie Chart
- The Bar Chart
- The circle graph (pie chart)
- The Pareto analysis
- The cause and effect diagram (Ishikawa).
- Histogram
- Correlation diagram
- Statistical Process Control (basics)

Method study

In order to be able to perform method study in the right way the following phases have to be passed through:

1. Choose the task you want to study.
2. Collect the facts of direct observations and put these on record.
3. Collect the facts in a critical way and analyse everything that is happening.
4. Develop the most effective method, taking into account all circumstances.
5. Introduce the new method.
6. Check the results.
7. Maintain the new method.

During the course these phases will be discussed in detail and passed in review with the course member. Among the tools that are supplied for collecting and recording of data are:

- Production Chart
- Process Chart
- Flow Process Chart
- Multiple Activity Chart
- 2-hands Analysis

Time-and-motion Study

Time-and-motion study is the application of techniques that have been developed to determine the time a qualified worker will need to execute a specific task in a satisfactory way.

Time-and-motion study is applied:

- As a tool for the management for determining capacities and performances
- As a basis for productivity improvement
- For planning purposes

Techniques have been developed for time-and-motion study. These range from estimates to very accurate time-and-motion systems.

Just as in the case of Method Study the starting-point is the choice of the action that is to be studied. Some of the motives for this are:

- The action is new
- The method has been changed
- The material has been changed
- Complaints about the standard-time
- A low output
- Necessity to improve the method

Before starting the study, one has to be sure that the worker is sufficiently qualified and that the method of working is correct. At the same time the working conditions must be right.

Work Factor System

Very easy Work Factor, VWF

VWF is a technique derived from RWF (see RWF)

These techniques are concerned with the calculation of time on the basis of standard elements and methods. The course member is taught how and when to apply the method.

Ready Work Factor, RWF

A frequently applied technique i.a. with many Philips divisions.

Insight and skill in the RWF system. This system measures work c.q. motions with the help of motion times defined beforehand for short and long cyclical work.

Thus it supplies information about the work method and its improvement. At the same time RWF is an excellent tool to balance production lines with manual assembly.

The following subjects are dealt with:

- Standard elements of the RWF system
- RWF times table
- Notation of a motion analysis
- Mental processes
- Analysing processes
- Arranging work stations
- Improvement of work methods

Allowances for Rest and Personal Care

Periods of rest are an addition to the basic time in order to give the worker an opportunity to recover himself from physical and mental fatigue. In addition the worker's personal needs are met by allowing him to leave the shop floor e.g. for washing, drinking or going to the toilet. Periods of rest allowed are usually calculated in percentages of the work time, on the basis of the idea that the work will be almost equally strenuous during the whole work period. If, however, one element of the work, for instance, is much heavier than the rest, another calculation is made. This will then often be an additional percentage of time for rest which is fitted in with the standard time.

Periods of rest are calculated on the basis of tables consisting of case studies of comparable exertions.

For this purpose a subdivision is made into:

- Average forces required
- Posture while working
- Vibration and jolts during the work
- Short cyclical work/long cyclical work
- Obligation to wear special clothes
- Extent of concentration
- Monotony of the work
- Strain on the eyes
- Noise
- Temperature/ventilation/dust/dirt/wetness

The course teaches how to analyse and apply these tables

Machine- and Process-restricted Work

Mechanisation and automation are becoming more and more important in production processes.

Since machines and plants are becoming more and more complicated and

expensive, efficiency is beginning to play an ever more important part.
In the course it will be established which time is man-, process- or machine-tied and how, amongst other things, padding-out times, change-over times and bottle-necks between the work stations will have to be handled.

Allowances for Organisational Impediments

To assist production employees in this work and to assist them to reach this target (budget) much effort and planning has to be done, which in principle is regarded as waste.
Organisational losses due to :

- employees not on target
- team building and group-session
- registration and administration of production
- cleaning the work area
- etc.

Allowances for Technical Impediments

Machinery and technical processes will not produce during 100% production on working hours.
Technical losses are due to :

- repair and maintenance
- start-up times
- down-times
- operating on more than one machine
- etc.

Rejects and Reject factor

Definitions of rejects and calculation of reject factor; for work floor, for management and for commercial sector.

Auxiliary Techniques and Subjects

In the course several more different subjects and techniques will be dealt with and practised extensively.
Below some of these are briefly described.

Single Minute Exchange of Die (SMED)

SMED - the abbreviation for Single Minute Exchange of Die - is the method,

developed by the Japanese Shingo, to arrive at an change-over reduction in production systems. Shingo's rule says that, with all machines the change-over time can be reduced to some minutes, even if it would at present still take several days. For this purpose he distinguishes between "internal change-over time" (the necessary time for the change-over of the machine-parts) and the "external change-over time" (the necessary time for the organization of this change-over). Especially in the organisational approach much time can be saved.

Without appreciable additional investments the change-over time can be reduced by 75%. A great advantage of the SMED-method is, that the change-over reduction and, consequently, increase in flexibility is also possible in production systems that are based on mechanical and manual techniques, without necessarily requiring automated solutions.

Change-over reduction is based on a necessary condition for a flexible production system, the cyclical approach:

1. Orientation: Producing a flow process chart to get an overall picture of the total
2. Multi-diagram: Making a production process multi-diagram of the change-over activities of the total production chain.
3. Bottle-neck: Establishing which is the bottle-neck machine (priorities).
4. Analysis: The detailed analysis of the change-over activities of the machine (SMED-method step 1 and 2).
5. Improvements: Working out improvement proposals (SMED step 3) and
6. Introduction: Implementation of the improvements.
7. Evaluation: Evaluation of the new change-over method.

The Multi Moment Recording technique (MMR)

The Multi Moment Recording technique (M.M.R.) is an analytic method, in which the observations are made at a-select moments.

It is based on the spot-check technique, this means that, if random observations are made of a phenomenon which is taking place with a certain continuity, these observations will then be representative of the phenomenon itself.

However, this applies only if certain rules are observed and even then it applies with certain tolerances and with one definite probability.

The method, the rules and the conditions are dealt with and practised in the course.

Problem Analysis (PA)

In production one is regularly confronted with deviations from the standard laid down beforehand.

A production standard, a quality standard or a delivery reliability standard etc. is not being met. Why? It requires the attention of the management and the staff to discover its cause.

Problem solving is becoming more and more difficult. There are often so many changes in the production process, the materials, the organization, the staff, ... One loses all track of the situation. A systematic, logical analysis is, therefore, necessary to find the true cause. For it is this problem that must be solved.

PA is a method directed at:

- detecting the true cause of an undesirable situation (problem)
  or
- explaining an unexpected deviation between a known standard and reality
- taking the right measure to remove the true cause.

Instruction Skills

An adequately executed method study will result in an improved or new method of work and new standards.

This new/improved method of work and the corresponding standards will still have to be put into practice. This means that the operators must be retrained.

This is a very important matter and must take place very carefully. For in practice, method improvements that did not obtain the intended results or failed entirely have, more than once, proved to be due to a bad introduction.

A breaking-point in the introduction is the motivation and the training of the workers in question. The success of the introduction of the new/improved method of work demands a good and exact instruction.

For this there are various possibilities.

If the improvement implies only a small alteration of the method of work, a summary instruction will suffice.

In case of very important and radical changes, however, it is advisable to set up a specific training for this purpose.

Systematic Layout Planning (Basis)

The simple systematic layout planning consists of a set of 6 procedures or steps that should be followed or taken in order to be able to make a layout of a specified area.

In principle each layout will consist of:
1. the relations between the various functions or activities
2. space in a certain quantity and kind of every activity
3. establishing the proportion between the relation and the space in the layout.

The six steps of the basic SLP follow these three elements, at the same time forming a certain pattern. Each step has its own symbol:
1. Triangle - relation diagram
2. Square - physical data
3. Asterisk - activity diagram
4. Circle - adjustment of the diagrams c.q. layout
5. Hexagon - examination and evaluation of all factors
6. Rectangle - layout plan.

During the course the six steps will be dealt with and worked out in an exercise.

Systematic Materials Handling

In every company there arises a flow of goods, from the purchase of raw materials to the delivery of the final products to trade.
Because of the great importance of the flow of goods, methods are sought to control it.
These control methods relate to the acquisition of materials, to stocks and to possibilities of production, as well as to handling (Materials Handling).
By materials handling is understood:

- All actions that are performed in relation to production, transport and storage of
  goods, i.e.: the transport, movement or forwarding of products, semi-finished articles, parts or raw materials by the company together with their storage, as well as the connection to the incoming and the outbound traffic.
- These activities require a space adjusted to this (lay-out and lay-out planning).

In this whole the following elements may be distinguished:

- Materials, goods;
- Activities, space;
- Methods:
  - Materials Handling;
  - Layout.

Ergonomics

Since practically all human labour is done by using all kinds of tools, it may be said that ergonomics is also concerned with the study of the relation between working man and his tools, with a view to obtaining a tool adapted to man with which he is able to work effectively. The conditions of the working circumstances have been determined by law.

As a final result it may be expected that the course member will be able to distinguish production-ergonomical aspects, will know how to assess the value of ergonomics in the designing of systems, and will also be able to place the approach, task and part of the specialist in ergonomics or human engineer in the design process.

The following subjects will come up for discussion:

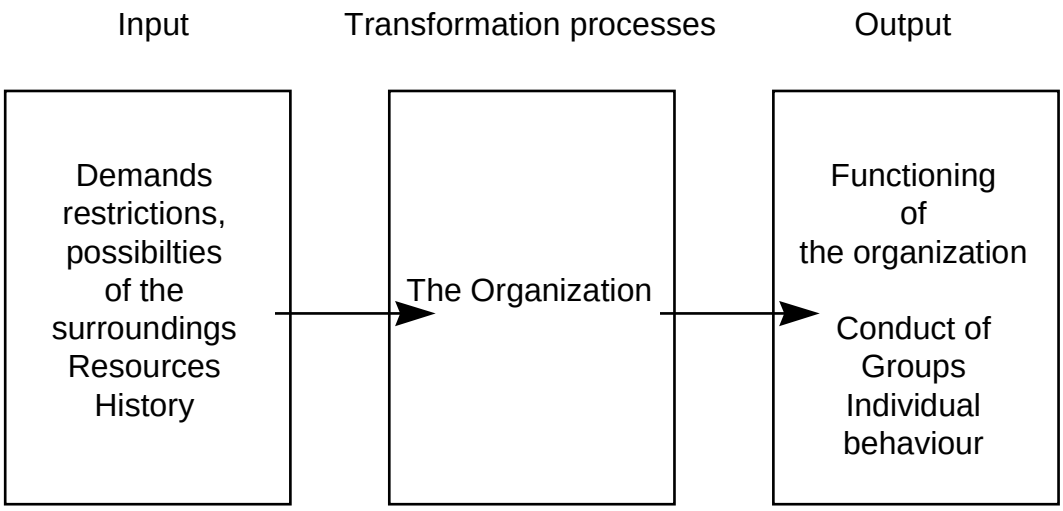
- Contents, sphere of activity and manner of working
- Man and motion
- Man and observation
- Man and surroundings
- Man and safety
- Man at work

Relation of Work Study Specialist and Employer

Some aspects that are of importance in taking the relationship between the work study specialist and his employer up to a desirable level and keeping it there will be discussed.

Organisations

According to system theory "organisations in operation" must be seen as "transformation processes" in open exchange with their surroundings. There is an input, a conversion and an output. The output is what the organization achieves. One can look at what the organization does as a whole, at the behaviour of groups from/in the organization and at the conduct of functionaries attached to the organization. The input consists of the resources of the organization, the history of the organization which makes itself felt in its present-day functioning and the possibilities, restrictions and demands that are made by its surroundings.



An organization itself comprises 4 important components, viz.:

1. the tasks or duties
2. the individuals who perform these tasks
3. the formal arrangements in the form of structures, processes, systems, meant to motivate the individuals and to facilitate the discharge of duties.
4. a set of informal arrangements in the form of structures, processes, systems, meant to motivate the individuals and facilitate the discharge of duties.

These four components are linked to each other and influence each other mutually. They must be attuned to each other, for example:

- the type of work must be in keeping with the nature of the people (skills),
- remuneration, arrangements for consultation etc. must fit in with education, achievement, sense of justice of the people.

The more the four components are in keeping with each other, the more effective the organization.

Multi-disciplinary Co-operation

Co-operation is the combination of self-interests. This combination takes place with a view to a common goal. Other disciplines often speak a different language. Communication and conflict-handling and the aiming at win-win situations form a central part of this unit in the course. We also try to ascertain which elements are essential for effective teamwork.

The way he conducts himself is of essential importance for the function of a systems analyst.

In the training course attention will be paid to verbal and non-verbal communication, decision-making in groups and co-operation. Some skills will be practised.

Reduction of Stocks

Against the background of JIT (Just in Time) and KANBAN the current production system of a department will be discussed. Short through-put times, great flexibility, high reliability and life expectancy, no waste of time, capacity and money are essential for this.

Quality Improvement via Problem Analysis, FMEA, etc.

In the last part of the course attention is paid systematically and practically to methods, techniques and ideas in the field of quality improvement and quality assurance.

Practical Assignment WS

The WS course is structured round the theme of improving existing production systems and helping to build new production systems.
The subjects discussed and conveyed during the course can be seen as providing approaches to, methods for and materials in support of this theme.
The main subjects are:

- Method study
- Time study
- Systematic Layout Planning
- Work Factor (Very easy Work Factor and Ready Work Factor)
- Rapid Tool Setting (Single Minute Exchange of Die)
- Ergonomics
- Elimination of Waste
- Problem Analysis
- Failure Mode and Effect Analysis

To a large extend the WS course deals with the influencies between human activities and manufacturing factors. The course contains two major learning processes viz. learning by course and learning by doing.
To stimulate learning by doing the participants will be confronted during the lectures with practical situations, whereas during the course they will perform an actual project in the form of a practical assignment.

The assignment

Your assignment is to centre round the theme of the course and to integrate wherever possible, the subjects discussed and the knowledge acquired during the course.
Analyse an existing production process in a department with the methods and means of the above mentioned main subjects.

Find a work environment and method of work and conduct a study which will lead to an improvement of the work method. The study must consist of a method study and

a time-and-motion study. To state the problem clearly use the general techniques. The production process to be analysed may consist of both manual and a combination of manual assembling and man-machine-activities.
The assignment should be integrated as much as possible within your normal job activities.
The description, investigation, analysis and results are to be specified in a report.

Conditions and stipulations

The assignment should focus on an actual, real life situation in the working environment of the participant.
The assignment should comprise a feasible solution and should consequently lead to a (future) real life implementation, and therefore be calculated in terms of (expected) profit.
There should be a problem owner and an assignment manager. They need not necessarily be one and the same person. Together with the participants they will describe, state and sign the assignment 'contract'.
The problem owner and assignment manager will support the participant by coaching him. Supply all the necessary information and know-how, arrangements for dates and time to spend, etc.

The investigation

The investigation should entail at least the following elements:
- statement on the company and the departments' organization and products
- description of the department and method / process of manufacturing
- description of the problem or the problematic situation
- analysis of the actual present situation:
  . production scheme
  . layout and routing scheme
  . Flow Process Chart
  . multi-scheme, man-machine scheme and / or 2-hand analysis
  . time-study with PEMTS - VWF/RWF
  . SMED, FMEA, Problem analysis, KAN BAN, SLP, Ergonomics
- diagnosis based on the information gathered
- formulation of the improvements
- description of the improved methods and means:

- new Flow Process Chart (improved situation if necessary)
- improved layout and routing scheme
- improved multi-scheme, man-machine-scheme and / or 2-hand analysis
- improved situation by SMED, FMEA, Problem analysis, KAN BAN, SLP, Ergonomics

Reporting

Produce a report in which at least the elements above have been stated and clarified.
Participants will send in two copies of the written report to the course management.
Data will be visualized with Pie-charts, Bar-charts, Pareto-analysis, Ishikawa-diagram, etc. If appropriate SPC reporting methods will be shown.

Presentation

Participants will present the findings of their investigations to the course management. The presentation will last for at least 30 minutes.

After the assignment has been concluded successfully to the opinion of the course management, the participants will receive the certificate “Work Study” analyst.

3.2 Technical PreCalculation, TPC

The training course Technical Pre-Calculation, TPC, also part of the education and training for the Integral Basic Industrial Engineer-A course, IBIE-A, for Improvement Engineer or Cost Engineer, comprises the following subjects and themes :

- Goals, Targets and Plans
- Budgets and responsibilities
- Activities and cost allocation : cost allocation methods
- Cost price calculation systems : Manufacturing Cost price, Direct Costing, ABC, Integral Cost price
- Multi-Level Budgeting : Organizational levels
- Cost price of materials **(M)**
- Costs of purchase and storage costs of materials **(M**
- Operational activities **(L)**
  * man costs
  * machine costs
  * costs of special tools and / or packing
  * calculation time
- Costs of organizational levels **(O)**
- Total production costs **(MLO)**
- Costs of other organizational units : development, financing, etc.
- Indexing and trends
- Financial post calculation and evaluation : result on expenditures, utilization (fixed costs) and efficiency
- Business signaling, control and management
- Exercises for each part and subject
- Integral exercise

All subjects mentioned above must have been attended and studied in detail satisfactory and the tests have been completed sufficiently.
The exam is conducted satisfactory. The practical assignment is performed and assessed as sufficient.

3.3 Decision Calculation, DC

The training course Decision Calculations, DC, also part of the education and training for the Integral Basic Industrial Engineer-A course, IBIE-A, for Improvement Engineer or Cost Engineer, comprises the following subjects and themes :

- Business Economical Thinking
- Decision Calculations (theory)
- The decision process
- Decision criteria :
  - Profit Margin, PM
  - Pay-Out Time, POT
  - Economic Pay-back Time, EPBT
  - Return On Investments, ROI
  - Business Economical “Rentability”, BER
  - Net Present Value, NPV
  - Surplus Method, SM
- Business economical
- Taxes and Fiscal affairs
- Project and monitoring
- Generating alternatives
- Quantifying uncertainties :
  - Pessimistic vrs Optimistic approach
  - Sensitivity analysis
  - Monte Carlo simulation
  - Decision Tree analysis
- Collection of data
- Using GAMMA-1, GAMMA-!+ and Monte Carlo analyses on PC
- Exercises and tests

All subjects mentioned above must have been attended and studied in detail and the tests have been completed sufficiently.
The exam is conducted satisfactory. The practical assignment is performed and assessed as sufficient.

LPI

INTEGRAL BASIC COURSE WORK STUDY & COST ENGINEERING: IBIE-A

Period 1: Productivity Improvement, General approach

	Monday, Week 1	Tuesday, Week 1	Wednesday, Week 1	Thursday, Week 1	Friday, Week 1	Saturday, Week 1
08.30	Introduction / Pract. Ass. **Method Study** General Techniques: - 7 tools: Pareto, etc. - Fish bone diagram - Histograms ***)** - Plot and Correlation ***)**	**Method Study** Process level: - Production Chart - Process Chart - Layout & Routing Chart - Needle and Threat Chart - Exercise	**Method Study** Activity/Operations level: - Multi Scheme - Man- Machine Scheme - Combined Scheme - Man Scheme - Exercises	**Time Study** PEMTS: - VWF - Theory - Assembly - Exercises	**Time Study** - Stop Watch Method/ Bedaux Method - Exercises - Tempo Rating - Exercises - Allowances	**Time Study** - Machine-efficiency - Exercises - Multi-Moment Sampling ***)** (Ratio Delay) - Exercise in groups
12.30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
14.00	- Exercises WS-notions: - Elimination of Waste - Performance Indicators and control loops - Exercises	- Flow Process Chart, FPC - Case: Exercise in groups Chair: present situation	Movements level: - 2-Hands analysis - Rules of Barnes - Exercises **Time Study** PEMTS:	- VWF - Special Assemblies - Specialties - Exercises	- Allowance for Rest & Personal Care, Div. - Exercises - Performance Calc. - Exercises - Machine- & process restricted work - Exercises - Allowances	**VWF-examination *)**
17.45	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES
18.15	- Efficiency, Effectiveness and Productivity - Exercises	- Flow Process Chart, FPC - Case: Exercise in groups Chair: improved situation	- Very easy Work-Factor - Introduction - VWF-therbligs - Reach, Move, Grasp - Exercises	- VWF - Exercises - Pre-test	- Normal Allowance Factor (NAF) - Technical Efficiency Factor (TEF) - Reject Factor (REJF) - Exercises	- Practical Assignment - Discussion
21.00	DINNER	DINNER	DINNER	DINNER	DINNER	DINNER

P.M. Overload of program on Saturday morning September 21 and VWF-discussion and VWF-exam. Practical assignment discussions.
Working on Practical Assignments: Start your PA and set up the first draught of your FPC, to be finished before WS-2. ***) Later in module 5/2.**

LPI

INTEGRAL BASIC COURSE WORK STUDY & COST ENGINEERING: IBIE-A

Period 2: Special Productivity Improvement Techniques

	Monday, Week 2	Tuesday, Week 2	Wednesday, Week 2	Thursday, Week 2	Friday, Week 2	Saturday, Week 2
08.30	Introduction Practical Assignments **Integral Work Study Problem** - Introduction - Calculation of yield without rejects and scrap	**Improvement Techniques** **SMED** - Single Minute Exchange of Die Phase 1 and 2 - Exercise in groups, present situation	**Ergonomics** - Theory - Exercises	**Systematic Material Handling Analysis, SMHA** - Theory (basics) - Exercises	**Logistics** - Order systems - 2-Bin - KANBAN - JIT - DBR - TOC - Exercises	**Skills** - Presentational skills - Visual Gathering - Train the Trainer - Organisation and Teambuilding - Practical Assignment - Discussion
12.30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
14.00	Integral WS problem - Calculation of yield including rejects and scrap The influence and impact of rejects and wastes.	- SMED Phase 3 and 4 - Exercise in groups, present situation	- Theory - Exercises in groups **Problem Analysis, PA** - Problem solving Technique	**Systematic Lay-out Planning, SLP** - Theory (basics) - Exercise in groups	**Theory Of Constraints, TOC** - Exercise **KaiZen**	**VWF-(re-)examination**
17.45	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES
18.15	**Performance Analysis** The costs of non-performances of individuals and units/groups Theory Exercise individual/group	- SMED - Exercise in groups, improved situation	- Exercises in problem solving, in groups	**Work Instruction Skills** - Theory - Exercises	**Failure Mode and Effect Analysis, FMEA** - Theory - Exercise in groups - Maturity Grid	
21.00	DINNER	DINNER	DINNER	DINNER	DINNER	DINNER

P.M. Overload of programme on Saturday morning October 26: Presentations, Train the Trainer, Organization and Teambuilding, etc. and PA
Working on Practical Assignments: Make use of special techniques to improve operations, activities and movements. Set up the improved FPC.

LPI

INTEGRAL BASIC COURSE WORK STUDY & COST ENGINEERING: IBIE-A

Period 3: Cost Prices and Technical Pre-Calculation

	Monday, Week 3	Tuesday, Week 3	Wednesday, Week 3	Thursday, Week 3	Friday, Week 3	Saturday, Week 3
08.30	Introduction Practical Assignment **Cost Prices and Systems** - Introduction - Theory - Cost Price Systems - Examples	TPC - Theory - Materials - Allowance Materials - Exercises	TPC - Theory - Allowances organisation - Exercises	TPC - Quantities and Money - Indices and Trends - Exercises	TPC - Exercises - 1st Integral Exercise	**TPC-examination**
12.30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
14.00	TPC - Theory - Cost Prices - Exercise/Example	TPC - Theory - Total Material - Exercises - Operations - Capacity Calculation	TPC - Theory - Total MLO - Exercises	TPC - Expenditure Result - Fixed Cost Result - Efficiency Result - Exercises	TPC - Integral Exercise Preparation on exam	
17.45	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	
18.15	**Technical Pre-Calculation, TPC** - Theory - Budgeting - Rejects and Scrap - Exercises	TPC - Calculation Time - Exercises - Operations - Rejects - Exercises	TPC - Setting up a TPC system for a factory - Exercise	TPC - Dupont Schemes	TPC - Integral Exercise, cont.	
21.00	DINNER	DINNER	DINNER	DINNER	DINNER	

P.M. Overload of program on Saturday morning November 30: TPC-examination
Working on Practical Assignments: Finish WS-PA and indicate impact of WS-improvement on Cost Price. Compare TPC and Factory Code Price.

LPI

INTEGRAL BASIC COURSE WORK STUDY & COST ENGINEERING: IBIE-A

Period 4: Business Economical Thinking, Decision Making and Decision Calculations

	Monday, Week 4	Tuesday, Week 4	Wednesday, Week 4	Thursday, Week 4	Friday, January 24	Saturday, Week 4
08.30	Introduction Practical Assignment **Business Economical Thinking, BET** - Introduction - Theory - Exercises	DC - Methods of Assessment for Companies: - ROTA - RONA - IFO - RONOC, - EPR, etc.	DC - Net Present Value - Exercise - Surplus Method: - Theory	DC - Uncertainties - Alternatives - Exercises	DC - Exercises - 1st Integral Exercise Use of Computer models Use of computer	**BET + DC examination**
12.30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
14.00	**Business Economical Thinking, cont.** - Theory - Exercises	DC - Methods of Assessment for Investment Projects: - ROI - IRR - PM - POT, EPBT	DC - Surplus Method: - Theory - Exercises	DC - Decision Trees - Exercises - Option Theory	DC - Integral Exercise Preparation on exam	
17.45	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	
18.15	**Decision Calculation, DC** - Introduction - Theory: a Project -	DC - Discounting - Exercises	DC - Surplus Method - Taxes - Exercises	DC - GAMMA-1 Formular - Exercises	- Integral Exercise, cont.	
21.00	DINNER	DINNER	DINNER	DINNER	DINNER	

P.M. Overload of program on Saturday morning January 25: BET and DC examination

Working on Practical Assignment: Find a project (old or new) and make a BET-analysis and perform the necessary DC-calculations.

LPI

INTEGRAL BASIC COURSE WORK STUDY & COST ENGINEERING: IBIE-A

Period 5: Manufacturing Excellence: Quality Control and Quality Improvement

	Monday, Week 5	Tuesday, Week 5	Wednesday, Week 5	Thursday, Week 5	Friday, Week 5
08.30	**Introduction Variability** - SPC or PCM, Statistical Process Control, or Process Capability Management - Exercise	DOE - Multi-Vari Chart - Exercise - Paired Comparisons - Exercises - Components Search - Exercise	DOE - ISO-Plots - Exercise - Pre-Control - PC-lines	Re-examinations Preparations for IBIE-presentation	Presentation – 3 Discussion Presentation – 4 Discussion Presentation – 5 Discussion
12.30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
14.00	**Taguchi Thinking** - Orthogonal Arrays - Inner/Outer Arrays - Effect Plots	DOE - Product/Process Search - Variables Search - Exercise - Full Factorials - Exercise	Learning-in - Theory - Exercise Overload of IBIE-A - Histogram - Correlation	Re-examinations Preparations for IBIE-presentation	Presentation – 6 Discussion Presentation – 7 Discussion Presentation – 8 Discussion
17.45	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES	SANDWICHES
18.15	**Design Of Experiments** - Introduction - Cp and Cpk - Exercises	DOE - B vrs C - Exercise - Scatter Plots - Exercise	Overload of IBIE-A MMO	Presentation – 1 Discussion Presentation – 2 Discussion	Presentation – 9 Discussion Certification
21.00	DINNER	DINNER	DINNER	DINNER	DINNER

P.M. Overload of programme on Wednesday afternoon and evening, March 12: Possibility for re-examinations and preparations for presentations.
Working on Practical Assignments.