

EXPERIENTIAL LEARNING FOR INDUSTRIAL ENGINEERING STUDENTS

An industrial engineering technician specializes in designing new systems and improving current systems for the optimal use of resources and manpower to financially benefit any organization. Your involvement as a technician may be found in the design and planning of new projects.

The industrial engineering technician must ensure that the design elements of the project are compatible and that the capital, plant, manpower, and raw materials are optimally employed so that, consequently, the project is feasible and economically viable. You, as an industrial engineering technician, will therefore co-ordinate a variety of disciplines and your work and experience will extend across the entire spectrum of the enterprise's activities.

As an industrial engineering technician you will be expected to specialise in the investigation, improvement, design and implementation of integrated systems comprising capital, plant, manpower, and raw materials. Your objective will be to establish optimum utilisation of all the production factors and you will utilise the principles and techniques of engineering, industrial economics and management in order to design the systems to obtain the desired physical and economic results.

Your experiential learning period will most probably be your first exposure to industry. Although we recognise that most students at this stage, are rather anxious, this opportunity for experiential learning should give you a relative soft landing in the real world. You will be expected to perform your best, but in a relatively controlled environment and with the coaching of the mentor and a Technikon lecturer. The experiential learning period will also give you the opportunity to build confidence in your own abilities and build employers' confidence in your abilities.

During this time you will also develop an appreciation of the meaning of work and its impact on those performing it. You must thus develop empathy for the workers who will later have to perform the tasks that you have designed and also recognise the wider impact of your recommendation on the organisation as a whole.

This period of training offers many challenges that you are expected to tackle professionally and with integrity. The Department of Industrial Engineering & Production Management would like to wish you good luck as you embark on this discovery of real world practices.

The rest of this document should provide yourself and your mentor with information with regard to this experiential learning process.

Should you need academic assistance at any time you are most welcome to contact us at the numbers provided.

SCOPE

Experiential learning should comprise at least 6 months per semester. The actual duration can be extended at the discretion of the employer (mentor), based on the student's performance.

Note: Students will only receive credit for blocks of 26 weeks duration. Two or three weeks vacation work is not recognised as experiential learning.

Each of the 26 weeks must be documented in the SUMMARY OF EXPERIENTIAL LEARNING table that can be found in the "Evaluation of Experiential learning" document.

TRAINING CONCEPT FOR FIRST SEMESTER (P1)

Students may be inexperienced as far as the workplace is concerned. The **first two months** of experiential learning is at the disposal of the employer, to provide induction and occupational safety training as well as other workplace related training. Employers are encouraged to enrol students for courses and seminars. This training should ensure that the student will be able to function effectively and safely in the workplace.

All students **must receive practical workshop training of at least two week's** duration. If the student's employer does not have workshop facilities, such training can also be purchased at Technical Colleges or at the Atomic Energy Corporation.

During the last four months of P1 the student is expected to do project work under the guidance of a mentor. An ideal training situation would be for the student to complete two mini projects in the remainder of this semester. One project should be in the organisation's operational function and one in the support function. The student must realise that the same improvement principles hold for both the operational and the support functions.

Each mini project should comprise the following:

- Approximately one month of actual work as an entry-level operator in the function. This develops an appreciation for work and its implications for the rest of the organisation, as well as empathy for the worker.
- Approximately one month of study to investigate possible improvements in the relevant area. The mentor may assist the actual selection of a study theme.

These projects are performed under supervision of the mentor and in close collaboration with the training official. The student must be involved as far as possible in the compilation of project documentation, reporting and presentation of results.

TRAINING CONCEPT FOR THE SECOND SEMESTER (P2)

The student should now be more familiar with the work environment, and should be able to work more independently.

Again, the ideal situation would be for a student to complete approximately four different mini projects now without the one month's duration of line experience per project. The student should now be able to understand the implications of work - by observing work being done, rather than by actually performing the relevant tasks.

It is important for an effective training process that the students get exposed to as many different industrial engineering projects as possible and important for the development of independent workers that students start to identify opportunities for improvement on their own.

Therefore in each report it is expected that the student indicates who initiated the project and that in at least one of the projects, the student should have identified the opportunity by him/herself.

STUDENT'S RESPONSIBILITIES

The student's primary responsibility is to find a suitable employer, and to deliver work at a standard that exceeds the employer's expectations.

The students also have the following responsibilities with respect to the Vaal Triangle Technikon:

Month	Responsibility per semester
1	Register within 30 days of commencing practical training.
1	Submit a <u>training program</u> for approval. See § Training Program below.
4	Submit a <u>three monthly progress report</u> . See § Three Monthly Progress Report below. See “Semester & Progress Report Guidelines” under the Appendix “Report Guidelines”.
7	Submit: <ol style="list-style-type: none"> 1. A <u>semester report</u> See § Semester Report below. See “Semester & Progress Report Guidelines” under the Appendix “Report Guidelines”. 2. A <u>project report</u> See § Project Report below. See “Project Report Guidelines for Experiential learning” under the Appendix “Report Guidelines”. 3. A <u>semester evaluation</u> (attached as appendix A to this document). See § Semester Evaluation below. See “Evaluation of Experiential learning” form under Appendix “Student evaluation”.

Please note that students must register per semester. A training program, reports and the evaluation are similarly submitted per semester. Some guidelines are now provided for each report.

Training Program

This program is essentially a schedule indicating what a student will do and for which duration, as well as the training objective for each activity (i.e. which techniques will likely be used or applied per activity). By endorsing the program, the company effectively commits itself to support the student throughout its duration.

The proposed program should reflect that the student would obtain fair exposure to as many different techniques as possible. This is the main criterion for approval evaluation. If in any way possible, the names of the project leaders/mentors/supervisors and their telephone numbers must be included.

The program is not focussed on daily activities, but rather on chunks of two weeks or four weeks each.

Three Monthly Progress Report

The student must indicate:

- 1 Who initiated each project?
- 2 Project duration.
- 3 What was my role?
- 4 What have I done?
- 5 Has the project been accepted?
- 6 Has any recommendations been implemented yet?
- 7 What has my employer saved (potential or actually realised savings) per project?
- 8 What have I learnt?

Semester Evaluation

This is a standard form, which is attached to this document, as Appendix "Student Evaluation". Take note that the employer/mentor is the primary evaluation authority. The Technikon is not present in the work situation and thus cannot evaluate your rendered work.

The Technikon is responsible for visiting the work place, to sort out any problems but particularly to ensure that training is of sufficient standard to fit in with SERTEC's and ECSA's requirements.

Semester Report

Content is similar to the three monthly reports. The length should be approximately 1 000 words.

Project Report

A project report should be compiled for each of the projects completed in the semester. It is not acceptable to submit a mere collage of the various study sheets and project documents used in the project.

The project report should satisfy the following requirements:

- Brevity - nobody has time to read reports, however valuable they are. A maximum length of 2 000 words.
- Marketing of recommendations - does the report make the best use of the time that the reader is willing to invest, and effectively sell the recommendations? Will the reader know exactly what the cost and benefits of the recommendations will be?
- Technical validity of recommendations - do the recommendations make technical sense in terms of the particular subject discipline?

Logbook

This department does not require submission of a student's logbook or experiential diary. We do recommend that the student start using a diary, as this is an essential tool for time management. It will also assist the mentor in tracking the time spent per activity.

SOME POSSIBLE APPLICATIONS

The 1998-99 Occupational Outlook Handbook made the following statement with regards to the nature of industrial engineering work:

"Industrial engineers determine the most effective ways for organisations to use the basic factors of production - people, machines, materials, information and energy - to make or process a product or service. They are the bridges between management goals and operational performance. They are more concerned with increasing productivity through the management of people, methods of business organisation, and technology than are engineers in other specialities, who generally work more with products or processes.

To solve organisational, production and related problems most efficiently, industrial engineers carefully study the product and its requirements, use mathematical methods such as operations research to meet those requirements, and design manufacturing and information systems.

They develop management control systems to aid in financial planning and cost analysis, design production planning and control systems to co-ordinate activities and control product quality, and design or improve systems for the physical distribution of goods and service. Industrial engineers determine which plant location has the best combination of raw materials availability, transportation and costs. They also develop wage and salary administration systems and job evaluation programs. Many industrial engineers move into management positions because the work is closely related."

Industrial engineering technicians should be able to perform/assist with the following:

- Materials handling
- Process design
- Jig and tool design
- Line balancing
- Automation
- Facilities and workplace design
- Product design
- Method design
- Work measurement
- System, procedure and policy development and design.
- Quality control
- Costing
- Value analysis
- Time study
- Activity sampling
- Process charting
- Feasibility studies.

To assist with the understanding of the Industrial Engineering syllabus, a summary of the key concepts addressed in each of the subjects have been included:

Engineering Work Study I

Introduction to Work Study; Productivity; Choice of method study techniques; Method study (standard level); Work measurement (Time Study); Human factors; Ergonomics; Working conditions and environment; Jigs and fixtures (introduction); Computer applications.

Production Engineering I

Operating strategies; Forecasting; Process planning and designing; Trade-off analysis; Automated processes; Allocating resources with LP; Decision trees; Facility location; Aggregate planning; Master production schedules; Inventory systems; Material requirements planning; Lot-sizing for MRP and CRP.

Mechanics I

Statics; Centre of gravity; Friction; Dynamics; Momentum and impulse; Work energy and power; Radial acceleration.

Computer Skills I

Computer hardware; Software; Computer utilisation.

Electrical Engineering I

Basic electrical units; Direct current circuits; Storage cells.

Mathematics I

Basic mathematics; Differentiation I; Integration I; Complex numbers/hyperbolic functions; Graphs; Trigonometry; Statics.

Qualitative Techniques I

Introduction; Descriptive techniques; Probability and probability distributions; Sample selection and sampling theory; Statistical process control; Hypothesis testing; Regression analysis; Acceptance sampling.

Mechanical Manufacturing Engineering I

Safety and safety legislation; Identification and application of materials; Elementary measuring equipment; Elementary hand and machine tools.

Quality Assurance II

Introduction to quality; Quality improvement and cost reduction; Strategic quality management; Developing a quality culture; Designing for quality; Inspection and test and sampling plans; Assessment of quality; Control of quality; Organisation for quality; Understanding customer needs; Manufacture; Inspection test and measurement; Quality Assurance.

Engineering Work Study II

Work environment design; Value engineering; Proposed method implementation; Standard data; Formula construction; Predetermined time systems; Work sampling; Standard follow-up and times; Wage payment; Training other management practices.

Communication Skills I

Effective Study Skills; Speaking and Listening; Communication in small groups; Meetings; Fact finding, information gathering; Interviews.

Production Engineering II

Capacity management; Forecasting; Linear programming; Transportation algorithms; Assignment problems; Scheduling product focused; Manufacturing; Planning and scheduling service; JIT manufacturing; Activity scheduling; MRP I and MRP II; Project planning and control; Scheduling batch processing; Design and scheduling flow; Processing systems; Material and purchasing; Maintenance management and reliability.

Manufacturing Relations II

Introduction; Personnel and the personnel function; Job design, analysis and evaluation; Interviewing; Human relations: Importance, Motivation theories, Organisation climate, Stress, Conflict handling; Labour relations; Labour economy: Demand and supply, Collective bargaining, Law machinery, Acknowledged agreements, Negotiations.

Mechanical Engineering Drawing I

Sabs 0111: Part 1-1990 Instruments; Sketching; Orthographic projection; Intersection; Development and interpenetration; Ellipse; Machine drawing: Tolerances and machining symbols, Drawing on orthographic projection; Sectional views of assemblies of machine parts and costing.

Mechanical Manufacturing Eng II

Fault diagnosis; Failure analysis; Test methods, interpretation and action; Power metallurgy; Metal forming; Erosion; Plastics-moulding and machining; Welding and joining; Obtaining finish and accuracy.

Costing II

Elements of cost; The introduction of elementary accounts; Absorption/marginal costing; Cost - volume – profit analyses; Budget; Standard costing variance analysis.

Facility Layout and Materials Handling II

Introduction; Facilities in general; Elementary flow system: Material, People, Equipment, Information; Process design; Auxiliary Services; Employee Services; Handling systems: Types, Designs, Constructing, Evaluation; The problems with material handling; Area location; Layout Evaluation; Selling the layout.

Engineering Work Study III

Information systems analysis and design; Performance improvement programmes; Entrepreneurship theory; Financial plan; Marketing plan; Business plan.

Industrial Accounting III

Introduction: The finance function; Financial analysis; Planning and control; Working capital management: Working capital, Inventory models, Credit management; Investment decisions: Capital budgeting techniques, Risk and investment return, Cost of capital, Capital structure and leverage.

Operational Research III

Introduction; Decision theory; Decisions trees; Linear programming and formulation; Transportation and network algorithms; Markov analysis; Project management; Simulation; Dynamic programming; Game theory and applications; Use of software packages.

Automation III

Introduction: What is production? What is automation? What is a system? Automation considerations; Levels of automation; Jigs and fixtures and its applications; Press work and material usage; Fundamentals of manufacturing and High volume production systems; Numerical control production systems; Press work processes: Features of tools: Design of progression tooling, Calculation for minimum material usage; Pneumatic and hydraulic automation of a workstation; Transfer machine; CNC machines: Types, Classification, Writing a programme; The selection of the correct level of automation (cycle time, quantity, economy and other); Laboratory project; Associated operations: Automatic feeding and orientation: Electronic detection of size, Color and proximity, Pneumatic autosizing; Project: Design of a automotive system; Design a workstation; Design an automated workstation or selected standard production machines or design a transfer machine for this application.

Industrial Leadership III

Managers, diversity and change; Environment competitive advantage & quality operations; International management; Managing ethics and social responsibilities; Fundamentals of planning; Strategic management; Organising; Human resource Management; Leading; Motivation; Communication; Interpersonal skills; Group Dynamics; Innovation and planned change; Controlling.

Contact numbers

Should you need assistance please do not hesitate to contact us immediately.

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