ENSURING THE
EXPERTISE TO GROW
SOUTH AFRICA

Code of Practice for the Performance of Industrial Engineering Work

R-02-COP-IND

Revision 0: 25 August 2022

ENGINEERING COUNCIL OF SOUTH AFRICA
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ECSA

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DEFINITIONS

In this Code, any word or expression defined in the Act has that meaning, unless the context dictates otherwise:

Act means the Engineering Profession Act, 46 of 2000.

Candidate means a person who is registered in terms of section 19(2)(b) of the Act.

Category of registration means the categories of registration provided for in section 18(1)(a) of the Act, i.e. Professional Engineers, Professional Engineering Technologists, Professional Certificated Engineers and Professional Engineering Technicians.

Code of Conduct means the code of conduct for registered persons in terms of Act.

Competent Person means a person who has the required knowledge, training, experience and, where applicable, qualifications specific to the work or task being performed, provided that, where appropriate, qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 67 of 2008, those qualifications and that training are regarded as the required qualifications.

Council/ECSA means the Engineering Council of South Africa established in terms of section 2 of the Act.

Engineering Work means the work identified in terms of section 26 of the Act.

Registered Person means a person registered with the Engineering Council of South Africa in terms of the Act under one of the categories referred to in section 18.

Risk means the effect of uncertainty on the objectives of a design; it is expressed in terms of a combination of the consequences of an event and the likelihood of occurrence.

Industrial Engineer means a Professional Engineer registered in terms of 18(1)(a)(i) of the Act who has experience specifically in the sub-discipline of Industrial Engineering.

Industrial Engineering Technologist means a Professional Engineering Technologist registered in terms of section 18(1)(a)(i) of the Act who has experience specifically in the sub-discipline of Industrial Engineering.

Industrial Engineering Technician means a Professional Engineering Technician registered in terms of section 18(1)(a)(i) of the Act who has experience specifically in the sub-discipline of Industrial Engineering.

Industrial Engineering Work means Engineering Work identified identified in terms of section 26 of the Act specifically in the discipline of Industrial Engineering.

ABBREVIATIONS

3D	3-dimensional
ANYSYS	Analysis System
ArchiMate	Architecture Animate
CAD	Computer-Aided Design
CPD	Continuing Professional Development
CRM	Customer Relationship Management
DMAIC	Define, Measure, Analyse, Improve and Control
DoDAF	Department of Defence Architecture Framework
DSTG	Discipline-specific Training Guide
ECSA	Engineering Council of South Africa
FAST	Function Analysis Systems Technique
FMEA	Failure Modes and Effects Analysis
GERAM	Generalised Enterprise Reference Architecture and Methodology
IDEF	Integrated DEFinition Methods
ISO	International Organisation for Standardisation
JIT	Just In Time
MoDAF	Ministry of Defence Architecture Framework
PDCA	Plan, Do Check, Act
PDSA	Plan, Do, Study, Act
PERT	Project Evaluation and Review Technique
PIN	Percentage of Industry Sales
PMBOK	Project Management Body of Knowledge
Pr Eng	Professional Engineer

PRINCE2	Projects in Controlled Environments
Pr Tech Eng	Professional Engineering Technologist
Pr Cert Eng	Professional Certificated Engineer
Pr Techni Eng	Professional Engineering Technician
QFD	Quality Function Deployment
RCA	Root Cause Analysis
Reg Eng Tech	Registered Engineering Technician
SABS	South African Bureau of Standards
SAIIE	Southern African Institute for Industrial Engineering
SANS	South African National Standards
SOP	Standard Operating Procedures
SysML	Systems Modelling
TPM	Total Productive Maintenance
TQM	Total Quality Management
TWI	Training Within Industry
UAF	Unified Architecture Framework
UML	Unified Modelling Language
VSM	Value Stream Mapping

1. INTRODUCTION

This Code of Practice has been developed by the Engineering Council of South Africa (ECSA) to supplement the Code of Conduct for Registered Persons in conjunction with the Southern African Institute for Industrial Engineering (SAIIE). Section 27 of the Engineering Profession Act (Act 46 of 2000) empowers the Council to draw up Codes of Practice in addition to codes of conduct and requires all registered persons to comply with such codes; failure to do so constitutes improper conduct. Codes of conduct regulate behaviour while codes of practice regulate engineering practice.

Section 18(1) of the Act provides for the registration of professionals and candidates in four categories of registration: Professional Engineers, Professional Technologists, Professional Technicians, Professional Certificated Engineers, and registration in Specified Categories as prescribed by Council. Section 18(2) prohibits persons so registered from practising in a category other than that in which they are registered.

In line with these requirements, this Code of Practice classifies Engineering Work in the sub-discipline of Industrial Engineering in terms of its complexity and stipulates the category of registration and the level of competence required for the execution of such work.

The Code also details the ethical values and professional standards that ECSA expects all registered persons to adhere to as prescribed under the Code of Conduct for registered persons in terms of the Act.

2. POLICY STATEMENT

(a) This Code applies to the discipline of Industrial Engineering.

(b) The~~is~~ Code has reference to the Act, overarching Code of Practice for the performance of Engineering Work, competency standard for registration in Professional Categories (**R-02-STA-PE/PT/PN**) and other relevant ECSA policy documents.

(c) It classifies Industrial Engineering Work according to the complexity of the problem, nature of the environment, the methods employed, the risks involved and the consequences of failure.

(d) It sets out the level of competence required from persons registered in any of the categories of registration provided for in Section 18(1) of the Act for the performance of Industrial Engineering Work of varying complexities.

(e) This Code stipulates requirements for the practice of Industrial Engineering Work and provides a statement of recognised good practice.

(f) Where a Code, Act or Policy is referenced the latest version thereof applies.

3. PURPOSE

The purpose of this Code of Practice is to ensure that any person undertaking Industrial Engineering Work meets the prescribed requirements when practising and executing Industrial Engineering Work within the jurisdiction of the Act. This Code also sets appropriate levels of competence regulating the execution of Industrial Engineering Work and specifying technical standards and best practice. Among others, this Code of Practice ensures the following:

(a) Registered persons apply their specialised knowledge within their competence and skill in accordance with all relevant legislation.

(b) All Industrial Engineering Work is performed by a competent person and uniform competency and conduct standards apply to all registered persons.

(c) Industrial Engineering Work is performed in accordance with generally accepted norms and standards of the Industrial Engineering profession.

(d) Registered persons apply innovation in a responsible and appropriate manner within their category.

(e) Registered Persons apply their specialised knowledge and skill within their respective area of competence to ensure that engineering practice is appropriate, applicable, acceptable, affordable and sustainable.

(f) Registered Persons encourage innovation, promote social upliftment where possible in all aspects of Industrial Engineering and set examples within the profession.

4. APPLICABLE LEGISLATIVE FRAMEWORK

This Code should be read in conjunction with the following:

(a) Engineering Profession Act, 46 of 2000

(b) Code of Conduct

(c) Occupational Health and Safety Act, 85 of 1993

(d) Overarching Code of Practice for the performance of Engineering Work

(e) Identification of Engineering Work Regulations

(f) All other relevant legislation.

5. INDUSTRIAL ENGINEERING WORK

5.1 Nature of Industrial Engineering Work

Due to the dynamic nature of the profession, the diverse range of industries in which Industrial Engineers could be employed and the diverse range of sub-disciplines and specialised skills characterising the profession, it is virtually impossible to define a set of predetermined training paths for Industrial Engineers. Instead of predetermined paths, a set of guiding principles is proposed whereby Candidates can shape the course of their careers.

(a) The performance of Industrial Engineering Work requires solving industrial engineering problems and engaging in industrial engineering activities.

(b) Industrial Engineering Work encompasses a number of Industrial Engineering sub-disciplines, each dealing with a specific body of knowledge.

(c) Depending on the level of complexity, Industrial Engineering Work is carried out by registered persons possessing different levels of competence as typified by the various categories of registration given in Section 18(1) of the Act.

(d) Due to a common grounding in the mathematical and physical sciences, there are areas of overlap among the various sub-disciplines of Industrial Engineering as well as overlaps

with other professions. These overlaps generally occur at a basic level and divergence increases with the degree of specialisation.

5.2 Range of Industrial Engineering problems and activities

For the purposes of this Code, engineering problems and activities are classified as complex, broadly defined, well-defined and specifically defined problems. The basis of the classification of engineering problems is given in the **R-02-STA-PE/PT/PCE/PN** and **R-02-STA-SC** documents available on the ECSA website.

Industrial Engineering Work may, in terms of **Table 1**, be classified as work executed in one or more of the Fields/Areas in Column 2, involving one or more of the activities listed in Column 3 and making use of one or more of the Methods/Tools in Column 4. **Table 1** is a guideline and not an exhaustive list of Fields/Areas, Activities or Methods/Tools.

Table 1: Industrial Engineering Work

Number (Col.1)	Field/Area (Col. 2)	Activities (Column 3)	Methods/Tools (Column 4)
1	Asset Management	• Total lifecycle management • Strategic management • Data management • Maintenance planning & scheduling materials management	RCAs FMEAs Maintenance strategies SABS/SANS 55111/2020,55001/2020, 55002/2020
2	Business Engineering	• Strategic positioning • Alignment and transformation (facilitating a common vision across stakeholders) • Assessing the *status quo* • Validating various scenarios • Eliciting critical success factors and measuring the current and perceived ideal business against such	Data modelling & visualisation platforms (tableau, R, Power BI, R4Apps)
3	Data Analytics	• Statistical modelling and data mining • Descriptive, predictive and prescriptive analysis utilising data mining • Time series,	Statistical modelling Computer science/ programming Operations research and optimisation

Number (Col.1)	Field/Area (Col. 2)	Activities (Column 3)	Methods/Tools (Column 4)
		• Forecasting and machine learning • Optimisation and simulation.	
4	Engineering Economics	• Financial planning • Evaluation of alternative solutions • Feasibility studies execution • Develop and implement performance measurement standards • Project and contract management	Present/Future worth analysis Annual worth analysis Rate of return analysis Benefit/cost analysis Breakeven analysis Cost estimation Depreciation methods Sensitivity analysis Cash flows
5	General Management	• People management • Financial management • Planning & forecasting • Resource management • Organising • Leading • Controlling • Strategy development and execution • Productivity management • Communication management • Technology management • Digital transformation • Risk management	Strategy planning and methodologies Decision-making tools Balanced scorecard Benchmarking Employee engagement surveys Customer relationship management Change management Agile methodologies Data analytics
6	Lean Operations & 6 Sigma	• Continuous improvements • Product development	PDCA/PDSA DMAIC KATA KAIZEN VSM TWI TPM
7	Manufacturing & Production Engineering	• Continuous improvement • Root cause analysis • Process scheduling	Root cause analysis Kaizen 5S

Number (Col.1)	Field/Area (Col. 2)	Activities (Column 3)	Methods/Tools (Column 4)
		• Raw material analysis • Plant maintenance • Quality control and measurement • Metrology • Green manufacturing • Statistical process control	6 Sigma
8	Project Management	• Project definition • Project planning and scheduling • Cost estimation and budgeting • Project quality management • Project risk management • Project execution and control	PMBOK PRINCE 2 LEAN Network diagrams Critical path Gantt charts Theory of constraints methods PERT Lifecycle costing
9	Quality	• Quality of service • Value addition • Process quality • Process and variation control • Product quality, functionality and design. • Quality of systems and technology • Processes alignment • Quality of design projects and programs • Quality management systems • Policies and procedures	ISO 9000/9001, Total quality management Failure analysis Weibull analysis Failure modes and effects Fault tree analysis Event tree analysis Markov state analysis Reliability block diagram QFD Statistical process control
10	Supply Chain and Logistics Management	• CRM • Forecasting • Distribution • Inventory management • Logistics • Procurement • SOP • Sustainability	Aggregate scheduling Inventory management Scheduling JIT Distribution Network Models Algorithms Graph Theory Operations research

Number (Col.1)	Field/Area (Col. 2)	Activities (Column 3)	Methods/Tools (Column 4)
		• Demand side forecasting	
11	Systems and Reliability Engineering	• Requirements engineering • System architecting • System decomposition and aggregation • Element and component design • System implementation and integration • Verification and validation • Programme and project management • System lifecycle management • Stakeholder engagement and knowledge elicitation • Systems thinking • Systems science • General systems theory • Trade-off studies • Determination of systems efficiencies, etc. • Availability and reliability • System safety analysis	Model-based systems engineering Functional and logical decomposition Object-orientated systems engineering DoD systems design and analysis SysML UML IDEF ArchiMate UAF DoDAF MoDAF GERAM Capella Petri Nets Causal Loops Simulink Failure analysis Weibull analysis Failure modes and effects analysis Fault tree analysis Event tree analysis Markov state analysis Reliability block diagram
12	Value Management, Engineering, & Analysis	• Value Improvement practices • Technology selection • Process simplification • Reliability simulation & modelling • Customising standards and specifications • Energy optimisation	PIN analysis- perspective Modelling analysis FAST Diagramming 3D CAD

5.3 Industrial Engineering sub-disciplines

The Industrial Engineering sub-disciplines recognised by ECSA are provided in the Discipline-specific Training Guides **R-05-IND-PE**, **R-05-IND-PT** and **R-05-IND-PN** for each category of registration. These can be found on the ECSA website.

5.4 Categories of registration

Industrial Engineering professionals' category of registration is determined by the Council in terms of Section 18(1) of the Act. The categories of registration include:

a) Professional Engineer (PrEng) registered in terms of Section 18(1)(a)(i) of the Act;
b) Professional Engineering Technologist (PrTechEng) registered in terms of Section 18(1)(a)(ii) of the Act;
c) Professional Engineering Technician (PrTechniEng) registered in terms of Section 18(1)(a)(iv) of the Act;
d) Specified Category Practitioner registered in terms of Section 18(1)(c) of the Act;
e) A candidate registered in terms of Section 18(1)(b) of the Act.

6. INDUSTRIAL ENGINEERING COMPETENCY REQUIREMENTS

6.1 General requirements

(a) All Industrial Engineering Work shall be carried out by a competent Industrial Engineering Registered Person who is qualified by virtue of knowledge, training, experience and applicable qualifications to perform such work.

(b) All Registered Persons shall confine their performance of Industrial Engineering Work to the areas in which they are competent, subject to the provisions of (a) above.

(c) All Registered Persons shall undertake continuing professional development (CPD) or independent learning activities sufficient to maintain and extend their competence in line with current good practice in the industry.

(d) Registered Persons' competence and the nature of the work they are competent to perform should be assessed in terms of the criteria applicable to them.

6.2 Criteria for assessment of competency

The criteria for assessing competency are defined in the ECSA Competency Standard for Registration in Professional Categories as **PE/PT/PN** (**R-02-STA-PE/PT/PN**) and **R-02-STA-SC**.

7. INDUSTRIAL ENGINEERING GOOD PRACTICE

7.1 General good practice

All work carried out or services rendered shall be:

- in accordance with accepted norms and standards of Industrial Engineering
- in an ethical and responsible manner in accordance with the Code of Conduct
- within the area of competency with honesty, fidelity and integrity
- in accordance with the Labour Relations Act (Act 66 of 1995) as amended
- in accordance with the Protection of Personal Information Act (Act 4 of 2013) as amended
- in accordance with any other applicable legislation.

Prior to taking a role in Industrial Engineering, Industrial Engineering Registered Persons shall ensure that they possess the competencies required to undertake the work.

Prior to undertaking any task, Industrial Engineering Registered Persons -shall ascertain and document:

- the purpose of the activities
- the approach to be used in executing the activities
- the performance requirements for the activities
- any statutory, regulatory or other requirements that may pertain to the activities.

The Industrial Engineering Registered Person shall consider the likely variation in input parameters and the accuracy of the models or methods used and shall consider all likely.

All calculations shall be independently checked, either by another suitably qualified registered person or by alternative calculation methods.

Prior to approving any work or signing any completion certificate, Industrial Engineering Registered Persons shall ensure sufficient detailed checks or inspections to warrant such

approval. Where the checks or inspections were limited in any way or carried out by a third party, the approval shall be qualified accordingly.

7.2 Health, safety and environment

All Industrial Engineering Work shall be done in accordance with the following:

- Occupational Health and Saftety Act, as amended
- National Environmental Management Act, as amended
- Any other applicable legislation.

Cognisance should be taken of health and safety requirements from planning to completion of work.

The environmental impact of all Industrial Engineering Work should be assessed and appropriate measures taken to minimise such impacts or to remediate areas so impacted.

Industrial Engineering Registered Person shall involve relevant expertise when identified impacts are outside their area of expertise.

The client shall immediately be notified of any condition that is observed which may compromise the health and safety of persons or the environment.

7.3 Ethical considerations

Registered Persons shall comply with the Code of Conduct.

Cognisance should be taken of any potential social and cultural impacts of the Industrial Engineering Work on the communities within which work is conducted.

The client shall immediately be notified of any condition that is observed which may result in social or cultural impacts.

7.4 Standards and codes of practice

All Industrial Engineering Work shall be done in accordance with accepted norms and standards. Any deviation from such norms and standards shall be clearly stated.

7.5 Industrial Engineering data

Sufficient quantitative or qualitative data is required for all Industrial Engineering tasks. Industrial Engineering Registered Persons should ensure that the data used is adequate for the intended purpose. Where this is not the case, additional data should be obtained, or the work should be based on parameter values selected such that the occurrence of less favourable values is unlikely.

Data analysis should be presented in sufficient detail to allow independent assessment of the data.

7.6 Reporting

During the planning of an activitiy, Industrial Engineering Registered Persons should ascertain the purpose for which the activitiy is required and the nature of the proposed activity. Industrial Engineering Registered Persons shall ensure that the proposed activity is capable of yielding the information required for that purpose.

Industrial Engineering Registered Persons should advise the client of the effect of any restrictions placed on the activity that are likely to adversely affect the accuracy or adequacy of the data obtained. This information may be presented as a single report or in two separate reports: a factual report and an interpretive report. All assumptions shall be clearly documented together with the reason for the specific assumption.

7.7 Quality and risk management

Industrial Engineering Registered Persons shall implement quality and risk management systems covering all aspects of their work, appropriate to the nature and size of the work.

Quality and risk management systems must be reviewed regularly. Compliance with the quality and risk management systems should be audited at least annually. Organisations undertaking Engineering Work should consider external certification, such as ISO 9001 and ISO 14001.

8. ADMINISTRATION

(a) The Council shall be responsible for the administration of this Code, including its publication, maintenance and distribution.

(b) The Council shall ensure that this Code and all amendments thereto are available on the ECSA website and shall upon request, provide a copy thereof.

(c) The Council shall take all reasonable steps to introduce this Code to the general public.

9. INTERPRETATION AND COMPLIANCE

9.1 Interpretation

(a) The word “shall” indicates a peremptory provision.

(b) The word “should” indicates a provision directive or informative in character, requiring substantial compliance only.

9.2 Compliance

Failure to comply with a peremptory provision of this Code constitutes improper conduct in terms of the Act. Failure to comply with a directive or informative provision of this Code may constitute improper conduct in terms of the Act if its consequences are significant.

10. FURTHER INFORMATION

Further insights and information can be found in the following publications:

- Engineering Council of South Africa Code of Conduct
- Engineering Council of South Africa Overarching Code of Practice for the performance of Engineering Work.

REVISION HISTORY

Revision no.	Revision date	Revision details	Approved by
Rev 0	12 November 2021	New Document	
Rev 0 Draft 2	24 November 2021	Comments	Code of Practice Steering Committee
Rev 0 Draft 3	14 December 201	Incorporation of received comments	RPS & Working Group
Rev 0 Draft 4	17 January 2022	Review	ERPS
Rev 0 Draft 5	11 May 2022	Presentation before Steering Commitee	Code of Practice Steering Committee
Rev 0 Draft 6	11 May 2022	Recommendation for approval	Code of Practice Steering Committee
Rev 0	13 July 2022	Approval	RPSC
Rev 0	25 August 2022	Ratification	Council

The Code of Practice for:

Industrial Engineering

Revision 0 dated 25 August 2022 consisting of 19 pages have been reviewed for adequacy by the Business Unit Assistant Manager and is approved by the Acting Executive: Research, Policy and Standards (**RPS**).

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Business Unit Assistant Manager

04 October 2022
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Date

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Acting Executive: RPS

04 October 2022
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Date

This definitive version of this policy is available on our website