



labour

Department:
Labour
REPUBLIC OF SOUTH AFRICA

OHS 3/1/4/6

DEPARTMENT OF LABOUR

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 EXAMINATIONS FOR THE MECHANICAL AND ELECTRICAL ENGINEERS CERTIFICATES OF COMPETENCY (FACTORIES)

Revised January 2007

INFORMATION BROCHURE

1. INTRODUCTION

- 1.1 The following instructions, rules and syllabi for the examinations set by the Commission of Examiners are constituted in terms of the Occupational Health and Safety Act, 1993 and the Regulations concerning the Certificate of Competency, 1990.
- 1.2 The following Certificates of Competency are issued by the Department of Labour:
 - (a) Certificate of Competency as Mechanical Engineer (Factories).
 - (b) Certificate of Competency as Electrical Engineer (Factories).
- 1.3 Written examinations for each of these certificates are held in June and November by the Department of Education in collaboration with the Commission of Examiners appointed by the Chief Inspector.
- 1.4 The procedure to be followed in order to acquire a Certificate of Competency is summarised in paragraph 3.

2. QUALIFYING EXAMINATIONS

- 2.1 To qualify for a Certificate of Competency as Mechanical or Electrical Engineer, the following subjects must be passed by persons accepted as candidates:
- (a) Plant Engineering (Factories)
 - (b) Occupational Health and Safety Act, 1993, and the regulations promulgated thereunder.
- 2.2 To qualify for a Certificate of Competency, candidates must obtain at least 50% of the full marks in each subject stipulated at least in 2.1. Candidates need not pass both subjects at the same examination sitting, but the second subject must be passed within 3 years of passing the first, otherwise both subjects must be re-written. However, if a candidate obtains 75% or more of the full marks in either subject, he will be permanently exempt from re-writing that subject. An appropriate certificate of competency will be issued to candidates who have passed both subjects.

3. ACCEPTANCE OF CANDIDATES

- 3.1 No person shall be allowed to write the qualifying examinations unless accepted as a candidate by the Commission of Examiners. **No credit will be given for a pass in the subjects mentioned in 2.1 before acceptance.**
- 3.2 An applicant shall not be accepted as a candidate by the Commission of Examiners unless he has submitted proof that he has reached the age of 23 years, of his sobriety and general good conduct and that he is in possession of one of the following qualifications with appropriate experience in engineering:
- 3.2.1 A B.Sc. degree in mechanical or electrical engineering recognised by the Commission of Examiners and at least 2 years post graduate experience in the maintenance and operation of mechanical or electrical machinery, as the case may be, which is to the satisfaction of the Commission of Examiners.
- 3.2.2 A National Higher Diploma (T4) or National Diploma (S4) in mechanical or electrical engineering, (Technikon course) plus at least 2 years subsequent experience in the maintenance and operation of mechanical or electrical machinery, as the case may be, which is to the satisfaction of the Commission of Examiners, and of which at least one year has been at a factory. The completion of such course shall include passing all the subjects with a mark of at least 50%.

Individual Technikons will structure a curriculum to cover the electrical and mechanical courses according to the requirements of the Plant Engineering Syllabus (Annexure IV (a).

The Technikon will subsequently certify that a candidate for the Government Certificate of Competency having followed the Technikon route, has

- (i) completed a curriculum which covers the syllabus for Plant Engineering
- (ii) acquired a National Higher Diploma (T4) or National Diploma (S4) with a mark per subject of at least 50%; and

(iii) received the necessary practical training, to obtain the National Higher Diploma (T4) or National Diploma (S4).

3.2.3 A National Technical N6 diploma in mechanical or electrical engineering (Technical College Course). The completion of such a course will include passing all the subjects with a mark of at least 50%. A person will also have served an apprenticeship in an appropriate trade and gained experience in the maintenance and operation of mechanical or electrical machinery, as listed in Annexure I. Such experience, of which at least one year has been at a factory, shall be to the satisfaction of the Commission of Examiners.

The Department of Education will structure a curriculum to cover the electrical and mechanical course according to the requirements of the Plant Engineering Syllabus Annexure IV (a) and as set out in Annexure III. After completion of the prescribed courses the candidate should have:

- (i) completed the curriculum which covers the syllabus for Plant Engineering; and
- (ii) acquired a National Technical Certificate with a mark of at least 50% in all the subjects.

A candidate who is in possession of the necessary qualifications as listed in Annexure III will be evaluated and accepted accordingly.

3.4 Other qualifications and experience will be considered on merit by the Commission of Examiners

Persons who wish to be accepted as candidates and who are in possession of a foreign degree, diploma or certificate in engineering, or who are in possession of engineering qualification other than those mentioned in 3.2, must have such a degree, diploma, certificate or engineering qualification evaluated by the Department of Education, Engineering Field of Study, Private Bag X110, Pretoria, 0001, or who will indicate what additional subjects, if any, must be passed in order to comply with the requirements for acceptance. A request for evaluation must indicate that it is for the Certificate of Competency (M) or (E), and must include a list of the subjects, including marks obtained, which led to the obtaining of the degree, diploma, or certificate. A copy of the evaluation and a certified copy of the degree, diploma or certificate must accompany the application for acceptance as a candidate.

NOTE: An evaluation by the Human Science Research Council or South African Qualifications Authority on its own is NOT sufficient.

3.5 A person who has been accepted by the Commission of Examiners as a candidate and did not obtain a Certificate of Competency within seven (7) years from the date of his/her acceptance must re-apply to the Commission for acceptance.

4. SYLLABI AND EXAMINATION RULES

- 4.1 The syllabi for the subjects mentioned in 2.1 are given in Annexure IV and V.
- 4.2 Plant Engineering is a “closed book” examination. It will consist of both mechanical and electrical questions, with a limited choice of questions. The time allowed for the examination will be 3 hours. Candidates may not use programmable calculators in the examination room.
- 4.3 The question paper on the Occupational Health and Safety Act and Regulations is a “closed book” examination. There is no choice of questions and all questions must be answered. The time allocated for the examination is 3 hours.

5. ALTERNATIVE CERTIFICATES AND EXEMPTIONS

- 5.1 The holder of a Certificate of Competency issued in terms of the Minerals Act of 1991, who wishes to qualify for the equivalent certificate for Factories, shall re-apply for acceptance as a candidate together with proof of at least one year’s appropriate experience in the maintenance and operation of machinery at a factory to the satisfaction of the Commission of Examiners. After acceptance the subject Legal Knowledge (Factories) must be passed.
- 5.2 The holder of a Certificate of Competency as Mechanical Engineer who wishes to qualify for a certificate as an Electrical Engineer shall re-apply. He/she shall produce proof of appropriate experience, which shall be to the satisfaction of the Commission of Examiners. Such experience shall consist of at least 2 years experience in the maintenance and operation of electrical machinery or at least 4 years “mixed” experience the maintenance and operation of both electrical and mechanical machinery, which was gained after the acquisition of the mechanical certificate. The applicant will also be required to produce proof of passing the conversion subjects required to cover the syllabus for the Certificate of Competency as Electrical Engineer, with a mark of at least 50%.
- 5.3 The holder of a Certificate of Competency as an Electrical Engineer who wishes to qualify for a certificate as Mechanical Engineer shall re-apply. He shall produce proof of appropriate experience, which shall be to the satisfaction of the Commission of Examiners. Such experience shall consist of at least 2 years experience in the maintenance and operation of mechanical machinery or at least 4 years “mixed” experience in the maintenance and operation of both mechanical and electrical machinery, which was gained after the acquisition of the electrical certificate. The applicant will also be required to produce proof of passing the conversion subjects required to cover the syllabus for the Certificate of Competency as Mechanical Engineer, with a mark of at least 50%.

6. SUMMARISED PROCEDURE

6.1 Application forms for acceptance are obtainable from:

The Secretary
Commission of Examiners
Department of Labour
Private bag X117
Pretoria
0001

Tel.: (012) 309 4111 or Website: www.labour.gov.za

6.2 Completed forms to be returned to the above-mentioned postal address together with:

- (a) Receipt of R130-00 payable at any Labour Centre or bank
 - o Account holder: Department of Labour
 - o Bank: First National Bank
 - o Account number: 62025135577
 - o Branch code: 253145
 - Reference: OHS: GCC – (your surname and initials).
- (b) Certified copies of degrees, diplomas, or certificates, Technikon syllabus certification (see par. 3.2.2) and if applicable a copy of the evaluation certificate for foreign qualifications. (see par. 3.2.4).
- (c) Proof of appropriate practical experience on company letter head and verified by signature of the employer.
- (d) A testimonial of sobriety and conduct signed by an employer.
- (e) Proof of age, name and identification number, i.e. certified copy of ID document or a copy of birth certificate.
- (f) A letter from the Resident Engineer, where possible indicating that the applicant is considered to be a suitable candidate.

NOTE: Facsimile copies of the above-mentioned will not be accepted.

6.3 The Commission of Examiners will inform the candidate by letter of acceptance for the examinations.

6.4 The letter of acceptance must be submitted when entering for the qualifying subjects (2.1) at any Technical College or the Department of Education where the examination fees must be paid. The examinations are held in June and November and the closing dates for entry are set by the Department of Education.

6.4.1 The Commission of Examiners will not entertain applications for acceptance to the examinations later than 10 working days before the examination closing date set by the Department of Education.

6.4.2 To confirm the closing dates for entry to the qualifying examinations, consult with the Department of Education on the number: (012) 312 – 5755/6.

6.5 Candidates, who have passed the qualifying subjects must forward certified proof of having passed the prescribed subjects to the Commission of Examiners at the above-mentioned

address. Candidates who have passed by means of a remark must notify the Commission of Examiners accordingly.

6.6 The Commission will forward the appropriate certificate of competency to successful candidates.

7. “MINES” CERTIFICATES

Persons who which to qualify for a certificate of competency for Mines must apply to:

The Secretary
Commission of Examiners
Department of Minerals and Energy
Private bag X59
PRETORIA
0001

Tel.: (012) 317 9079

ANNEXURE I

ACCEPTABLE TRADES AND EXPERIENCE

Trade in which the apprenticeship has been served.	<u>Minimum appropriate post apprenticeship experience in the general maintenance and operation of machinery</u>	
TRADE	YEARS	
Aero engine fitter, ground engineer or equivalent	2	
Armature winder	3	On general electrical maintenance
Blacksmith	3	Not as a blacksmith
Boilermaker	3	Not as a Boilermaker
Diesel Mechanic	3	Not as a diesel mechanic
Electrician	2	
Engine-room artificer	2	
Fitter	2	
Fitter and armourer	3	
Fitter and rigger (Air Force)	2	
Fitter and Turner	2	
Instrument mechanic or instrument maker	2	Not as an instrument mechanic
Instrument technician (ISCOR, SASOL, AECI)	2	
Lift mechanic	2	
Millwright	2	
Motor mechanic	3	Not as a motor mechanic
Refrigeration mechanic	3	
Tool and die maker	2	
Turner	3	As a fitter
Welder	4	Not as a welder

ANNEXURE II
PREVIOUS TECHNIKON COURSE
MECHANICAL AND ELECTRICAL ENGINEERING

T1 (S1)	Electrical Engineering	(M) (E)	T1 (S1)
	Engineering Mathematics	(M) (E)	T1 (S1)
	Engineering Mechanics	(M) (E)	T1 (S1)
	Machine Drawings	(M) (E)	T1 (S1)
T2 (S2)	Electronics	(E)	T2 (S2)
T3 (S3)	Electro-technology	(M)	T3 (S3)
	Mechanical Technology	(E)	T3 (S3)
	Industrial Electronics	(E)	T3 (S3)
T4 (S4)	Applied Thermodynamics	(M)	T4 (S4)
	Fluid Mechanics	(M)	T4 (S4)
	Mechanics of Machines	(M)	T4 (S4)
	Strength of Materials	(M) (E)	T4 (S4)
	Electrical Engineering (h.c. or p.e.)	(E)	T4 (S4)
	Electrical Machines	(E)	T4 (S4)

CONVERSION COURSE

To enable holders of the Mechanical Certificate of Competency to qualify for the Electrical Certificate or vice versa:

Electrical Engineering (h.c. or p.e.)	(M)	T4 (S4)
Electrical Machines	(M)	T4 (S4)
Applied Thermodynamics	(E)	T4 (S4)
Fluid Mechanics	(E)	T4 (S4)

(M) – Mechanical Engineering

(E) – Electrical Engineering

(h.c.) – Heavy Current

(p.e.) – Power Engineering

The subjects shown are only the highest levels to be attained. All the grades leading to that level must also be attained with a 50% pass mark (e.g. Strength of Materials T4 (S4) includes a pass in this subject on T2 (S2) and T3 (S3) levels).

Note: Each candidate following this route to obtain a Certificate of Competency must provide documentation to prove that:

- I. He has followed a “sandwich” course (i.e. one semester practical training – one semester classes, alternating at a Technikon), and
- II. That the syllabus in Annexure 4 is included in the extended Technikon curriculum.

ANNEXURE III
TECHNICAL COLLEGE COURSE
MECHANICAL AND ELECTRICAL ENGINEERING

N3	Engineering Drawing	(M) (E)	N3
N4	Engineering Science	(M) (E)	N4
	Industrial Electronics	(M)	N4
	Mathematics	(M) (E)	N4
N5	Fluid Mechanics	(M)	N5
	Strength of Materials	(E)	N5
	Electrotechnics	(M)	N5
N6	Control Systems	(M) (E)	N6
	Mechanotechnics	(M) (E)	N6
	Power Machines	(M) (E)	N6
	Strength of Materials	(M)	N6
	Fluid Mechanics	(M)	N6
	Industrial Electronics	(E)	N6
	Electrotechnics	(E)	N6
	Supervisory Management	(M) (E)	N6

CONVERSION COURSE

To enable holders of the Mechanical Certificate of Competency or vice versa:

Electrotechnics	(M)	N6
Industrial Electronics	(M)	N6
Strength of Materials	(E)	N6
Fluid Mechanics	(E)	N6

(M) – Mechanical Engineering

(E) – Electrical Engineering

The subjects shown are only the highest levels to be attained. All the grades leading to that level must also be attained with a 50% pass mark (e.g. Electrotechnics N6 includes a pass in this subject on the N3, N4 and N5 levels).

ANNEXURE IV (a)
SYLLABUS FOR PLANT ENGINEERING

THE THEORETICAL SECTION OF THE SUBJECT PLANT ENGINEERING TO BE COVERED BY UNIVERSITIES AND TECHNIKONS

Questions will be framed on all aspects of the theory and the practical application of such theory in its widest sense as would be expected of a certificated engineer while performing his normal duties. Emphasis is placed on his competency in the execution, control and supervision of the safe installation, maintenance and operation of machinery.

SYLLABUS FOR PLANT ENGINEERING

Mechanical Students

Electrical Students

SAFETY AND MANAGEMENT	
Accident prevention	Accident prevention
Fire protection	Fire protection
Risk control	Risk control
Project management	Project management
Financial management	Financial management
Loss control	Loss control
ELECTRICAL TECHNOLOGY	
Direct current machines	Direct current machines
Direct current generators	Direct current generators
Direct current motors	Direct current motors
Efficiency of d. c. machines	Efficiency of d. c. machines
Alternating voltage and current	Alternating voltage and current
Single and three phase circuits	Single and three phase circuits
Transformers	Transformers
	Alternator windings
Production of a rotating magnetic field	Production of a rotating magnetic field
Characteristics of synchronous generators and motors	Characteristics of synchronous generators and motors
Three phase induction motors	Three phase induction motors
Semi-conductor devices	Semi-conductor devices
Electric lamps and illumination	Electric lamps and illumination
Electric power transmission and distribution	Electric power transmission and distribution
Short circuit conditions	Short circuit conditions
Circuit breakers	Circuit breakers
Underground cables	Underground cables
Insulators	Insulators
Overhead lines	Overhead lines
Economics of power supply	Economics of power supply
Maximum demand	Maximum demand
Power factor correction	Power factor correction
	High frequency transients
	Method of earthing Protection
	Rectification
	Storage of energy

Fault discrimination (basics) (Symmetrical faults only)	Fault discrimination
	Communication
Explosion proof equipment	Explosion proof equipment
Lightning protection	Lightning protection
	Basics of data transmission
3. APPLIED THERMODYNAMICS	
Air- and gas compressors and blowers	Air- and gas compressors and blowers (rotary compressors only)
Air motor (applications)	
Compressed air columns	Compressed air columns
Compressed air receivers	
Refrigeration and properties of refrigerants	Refrigeration and properties of refrigerants
Psychometry	
Steam generators (boilers & ancillary equipment)	Steam generators (boilers & Ancillary equipment)
Properties of steam	Properties of steam
Heat balance	
Condensers	
Steam and gas turbines	
Fans	Fans (classification)
Internal combustion engines	Internal combustion engines
Fuels and combustion	
4. STRUCTURES AND STRENGTH OF MATERIALS	
Simple stresses	Simple stresses
Simple stresses and Strain	Simple stresses and Strain
Thin-walled pressure vessels	Thin-walled pressure vessels
Torsion of circular shafts	Torsion of circular shafts
Close coiled helical springs	
Shear force and bending moments	Shear force and bending moments
Temperature stresses	Temperature stresses
Stain energy due to direct stresses	
Second moment of area	Second moment of area
Bending stresses	Bending stresses
Shear stresses in beams	
Struts and buckling	
Catenaries	Catenaries
Foundations	
Fatigue failure	
Mechanical and chemical properties of metals	Mechanical and chemical properties of metals
Testing of materials	Testing of materials
Twisting of shafts	
Ropes	Ropes
Properties of different types of ropes	
Reinforced concrete	
Retaining walls	
Fastening	Fastening

5. THEORY OF MACHINES	
Conveyors	Conveyors
Winding plant	Winding plant
Lifts and Elevators	Lifts and Elevators
Traction	Traction
Motion and inertia	Motion and inertia
Displacement, velocity and acceleration	Displacement, velocity and acceleration
Static and dynamic balancing	Static and dynamic balancing
Belt and chain drives	Belt and chain drives
Brakes and dynamometers	Brakes and dynamometers
Toothed gearing Gear trains	
Lubrication	Lubrication
Clutches	Clutches
Knowledge of machine tools	Knowledge of machine tools
Cranes	Cranes
Lifting equipment	Lifting equipment
Bearings	Bearings
Vibrations	Vibrations
6. FLUID MECHANICS	
Hydrostatic transmission	Hydrostatic transmission
Pumps	Pumps
Flow-through pipe-lines	Flow-through pipe-lines
Friction losses	Friction losses
Characteristics curves (pumps and systems)	Characteristics curves (pumps and systems)
Material transmission by pipe lines	Material transmission by pipe lines
Measurement of flow rates	Measurement of flow rates
Orifices	Orifices
Pelton wheel	Pelton wheel
Flow in launders	
Hydraulic machines, circuits and components	
7. ENVIRONMENTAL	
Characteristics of airflow and measurement	Characteristics of airflow and measurement
Properties and effects of dust (health)	Properties and effects of dust (health)
Water purification	Water purification
Waste disposal	Waste disposal
Pollution	Pollution
Noise	Noise
Illumination	Illumination

ANNEXURE IV (b)

PRACTICAL KNOWLEDGE (FACTORIES)

Candidates must be conversant with the following plant, equipment, practices and processes at factories with emphasis on the general design, lay out, production capacity, reticulation, energy requirements, motion characteristics, economic operation, efficiency testing, commissioning, maintenance, safety precautions and safety devices. This section is complimentary to and additional to the theoretical curriculum taught at Universities, Technikons or Technical Colleges.

1. Project Engineering including planning (Gantt Charts), management (critical path scheduling), commissioning and development of a planned maintenance scheme; Loss control management, incident investigations and corrective actions;
2. Electrical Plant and Equipment including generation, transforming, rectification, control and measurement; Testing and repairing of electric motors; Phasing and synchronizing a.c. motors operating in tandem; Fault detection in electric systems; Emergency electric plant; Explosion- proof equipment.
3. Hydraulics including hydrostatic drives-classification and characteristics, hydraulic pumps, actuators and circuits for sequence operation; General properties of lubricants and additives to lubricants (oil and grease).
4. Pressure equipment and plant including boiler, super heater and economizer efficiencies, vessels under pressure inspection and testing, steam ancillary equipment and pipe systems; Maintenance and fault diagnosis of compressors, refrigeration compressor and systems; Pumps, pump stations and fluid mechanics; Gas fuel system maintenance and safety;
5. Factory equipment and plant including lifting and conveying machinery, ie lifts, belt conveyors, aerial ropeways, lift trucks, steel rope, chains and connections, welders, heat treatment plant, lathes, drills, the maintenance, inspection and testing and repairs of all typical machinery used in factories; Flammable and hazardous substance environments, machinery and equipment.
6. Strengths and structures of plant including steel structures (stresses), beams, mechanical properties of fabrication materials, heat treatment and application of steel alloys and man made products (ie nylons), abrasion and protection of structures (steel and other materials). Utilization of concrete, reinforcement, composite beams, curing, chemical protection and wear.
7. Environmental engineering including ventilation systems, air-conditioning systems, dust suppression, emission control of diesel engines, occupational noise originated by machines and hearing protection, illumination types, effects and efficiencies.
8. Safety equipment and systems includes machine guarding, automatic control systems, detection systems, safety precautions and safety devices as found and used on all types of machines; Fire prevention equipment and systems, flammable and hazardous substance plants and continuous plant.

ANNEXURE V
SYLLABUS FOR OCCUPATIONAL HEALTH AND SAFETY ACT, 1993
AND REGULATIONS

1. The Occupational Health and Safety Act, 1993 (No. 85 of 1993) any subsequent amendments including the definitions.
2. Regulations promulgated in terms of section 43 of the Act including all amendments to the Regulations
 - (a) The “General Administrative Regulations” (Notice No. R. 929 of 25 June 2003).
 - (b) The “Electrical Installation Regulations” (Notice No. R. 2920 of 23 October 1992).
 - (c) The “General Safety Regulations” (Notice No. R. 1031 of 30 May 1986).
 - (d) The “Asbestos Regulations” (Notice No. R. 155 of 10 February 2002).
 - (e) The “Environment Regulations for Workplaces” (Notice No. R. 2281 of 16 October 1987).
 - (f) The “Driven Machinery Regulations” (Notice No. R. 295 of 26 February 1988).
 - (g) The “General Machinery Regulations” (Notice No. R. 1521 of 5 August 1998).
 - (h) The “Electrical Machinery Regulations” (Notice No. R. 1593 of 12 August 1988).
 - (i) The “Facility Regulations” (Notice No. R. 2362 of 5 October 1990).
 - (j) The “Lead Regulations” (Notice No. R. 236 of 28 February 2002).
 - (k) The “Vessels Under Pressure Regulations” (Notice No. R. 1591 of 4 October 1996).
 - (l) The “Lift, Escalators and Passenger Conveyor Regulations” (Notice No. R. 797 of 29 April 1994).
 - (m) The “Hazardous Chemical Substances Regulations” (Notice No. R. 1179 of 25 August 1995).
 - (n) The “Major Hazard Installation Regulations” (Notice No. R. 692 of 30 July 2001)
 - (o) The “Regulations for Hazardous Biological Agents” (Notice No. R.1390 of 27 December 2001).
 - (p) The “Explosive Regulations” (Notice No. R.109 of 17 February 2003).
 - (q) The “Construction Regulations” (Notice No. 1010 of 18 July 2003).
 - (r) The “Diving Regulations” (Notice No. 10 of 11 January 2002).
 - (s) The “Noise-Induced Hearing Loss Regulations” (Notice No. 307 of 7 March 2003)