



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

SUBJECT GUIDELINES

ENGINEERING SYSTEMS

NQF LEVEL 2

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INTRODUCTION

A. What is Engineering Systems?

Engineering Systems deals with the mechanical, electrical, electronic, hydraulic and pneumatic aspects of a system (e.g. various systems in a vehicle or machinery), including identifying, selecting and preparing components in terms of their operation, control and pre-operational maintenance. Calculations that are required are also included.

B. Why is Engineering Systems important in the Engineering and Related Design programme?

Engineering Systems links the beginning of an engineering process and products in systems, using routine maintenance systems, decision-making approaches, work planning and priority setting, organisation and administration and condition monitoring.

C. The link between the Engineering Systems Learning Outcomes and the Critical and Developmental Outcomes

Engineering Systems, as a subject:

- Develops students' problem-solving skills by requiring them to continually collect, analyse and evaluate data.
- Allows students to reflect and explore strategies to learn various ways of conducting pre-operational analyses of engineering systems.
- Instils and enhances team spirit by affirming the importance of team work.
- Teaches students effective communication and reporting methods using visual, mathematical, scientific and technological knowledge.
- Creates a sense of respect and responsibility towards the environment and the health and safety of fellow human beings.
- Stimulates students' interest in entrepreneurial careers.

D. Factors that contribute in the Engineering Systems Learning Outcomes

- An effective Simulated Engineering Environment or a real engineering workplace where students can display their competencies
- Qualified and competent lecturers and assessors who not only aid and facilitate teaching, training and learning but who are also readily available to provide moral support
- Patience, self-discipline and the ability to work in a team
- Critical thinking and problem-solving skills to readily evaluate data systems and processes

ENGINEERING SYSTEMS – LEVEL 2

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ANNEXURE A

1 DURATION AND TUITION TIME

This is a one-year instructional programme comprising 200 teaching and learning hours. The subject may be offered on a part-time basis provided the student meets all the assessment requirements.

Students with special education needs (LSEN) must be catered for in a way that eliminates barriers to learning.

2 SUBJECT LEVEL FOCUS

The student should be able to identify and apply applicable methods and processes to various engineering systems.

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment (50 percent)

3.1.1 Theoretical component

The theoretical component forms 40 percent of the internal assessment mark.

Internal assessment of the theoretical component in Engineering Systems Level 2 takes the form of observation, class questions, group work, informal group competitions with rewards, individual discussions with students, class, topic and semester tests and internal examinations. Lecturers can observe students when marking exercises from the previous day and asking class questions.

Assignments, case studies and tests can be completed at the end of a topic. Tests and internal examinations must form part of the internal assessment.

3.1.2 Practical component

The practical component forms 60 percent of the internal assessment mark.

Practical components include applications and exercises. All practical components must be indicated in a Portfolio of Evidence (PoE).

Internal assessment of the practical component in Engineering Systems Level 2 takes the form of assignments, practical exercises, case studies and practical examinations in a workshop environment.

Students may complete practical exercises daily. Assignments and case studies can be completed at the end of a topic. Practical examinations can form part of internal practical assessment.

- **Some examples of practical assessments include, but are not limited to:**

- A. Presentations (lectures, demonstrations, group discussions and activities, practical work, observation, role-play, independent activity, synthesis and evaluation)
- B. Exhibitions by students
- C. Visits undertaken by students based on a structured assignment task
- D. Research
- E. Task performance in a “Structured Environment”

- **Definition of the term “Structured Environment”**

For the purposes of assessment, “Structured Environment” refers to a simulated workplace or workshop environment.

• Evidence in practical assessments

All evidence pertaining to evaluation of practical work must be reflected in the students' Portfolio of Evidence (PoE). The tools and instruments constructed and used to conduct these assessments must be clear from the evidence contained in the Portfolio of Evidence (PoE).

3.1.3 Processing of internal assessment mark for the year

A year mark out of 100 is calculated by adding the marks of the theoretical component (60 percent) and the practical component (40 percent) of the internal continuous assessment (ICASS).

3.1.4 Moderation of internal assessment mark

Internal assessment is subjected to internal and external moderation procedures as set out in the *National Examinations Policy for FET College Programmes*.

3.2 External assessment (50 percent)

A National Examination is conducted annually in October or November by means of a paper(s) set and moderated externally. A practical component will also be assessed.

External assessment details and procedures are set out in the *Assessment Guidelines: Engineering Systems (Level 2)*.

4 WEIGHTED VALUES OF TOPICS

| TOPICS | WEIGHTED VALUES |
|---|-----------------|
| 1. Engineering Systems and Their Applications | 50 |
| 2. Equipment with Simple Control Systems | 25 |
| 3. Routine Maintenance | 25 |
| TOTAL | 100 |

5 CALCULATION OF FINAL MARK

Internal assessment mark: Student's mark/100 x 50 = a mark out of 50 (a)

Examination mark: Student's mark/100 x 50 = a mark out of 50 (b)

Final mark: (a) + (b) = a mark out of 100

All marks are systematically processed and accurately recorded to be available as hard copy evidence for, amongst others, reporting, moderation and verification purposes.

6 PASS REQUIREMENTS

The student must obtain at least fifty (50) percent in ICASS and fifty (50) percent in the examination.

7 SUBJECT AND LEARNING OUTCOMES

On the completion of Engineering Systems Level 2, the students should have covered the following topics:

Topic 1: Engineering Systems and Their Applications

Topic 2: Equipment with Simple Control Systems

Topic 3: Routine Maintenance

7.1 Topic1: Engineering Systems and Their Applications

Subject Outcome 1: Identify various engineering systems.

Learning Outcomes:

The student should be able to:

- Identify and discuss various engineering systems (electrical, electronic, mechanical, hydraulic, pneumatic, etc.).
- Identify and discuss the components of engineering systems and their functions.

Subject Outcome 2: Discuss safety measures relating to different engineering systems.

Learning Outcomes:

The student should be able to:

- Identify safety measures to be observed when dealing different engineering systems.
- Discuss the implications of non-adherence to safety measures as stipulated by the manufacturers.

Subject Outcome 3: Select engineering systems applications.

Learning Outcomes:

The student should be able to:

- Identify a variety of engineering systems applications (e.g. gear trains and brake system).
- Discuss the functions of each system's application.

Subject Outcome 4: Prepare engineering systems for operation.

Learning Outcomes:

The student should be able to:

- Prepare engineering systems applications for operation.
- Set up an engineering systems application for operation.

Subject Outcome 5: Do basic calculation on engineering systems.

Learning Outcomes:

The student should be able to:

- Define a variety of outputs for engineering systems.
- By means of simple calculations, determine a variety of outputs for each engineering system.

Subject Outcome 6: Maintain engineering systems.

Learning Outcomes:

The student should be able to:

- Identify consumables needed to maintain engineering systems applications.
- Care for engineering systems applications.

7.2 Topic 2: Equipment with Simple Control Systems

Subject Outcome 1: Identify equipment using simple control systems.

Learning Outcomes:

The student should be able to:

- Identify equipment with simple control systems.
- List the functions of equipment with simple control systems.

Subject Outcome 2: Discuss safety precautions to be observed when operating equipment with simple control systems.

Learning Outcomes:

The student should be able to:

- Discuss safety precautions to be observed when dealing with equipment with simple control systems.

- Discuss the implications of non-conformance with the manufacturer's specifications when operating equipment with simple control systems.

Subject Outcome 3: Set up and operate equipment with simple control systems.

Learning Outcomes:

The student should be able to:

- Draft a plan of operation.
- Adjust settings of, start and operate equipment.
- Monitor and adjust the process as required.

Subject Outcome 4: Maintain equipment with simple control systems.

Learning Outcomes:

The student should be able to:

- Care for and maintain equipment with simple control systems.
- Start the equipment after maintenance.
- Compile a post-maintenance report and submit it to the supervisor or assessor.

7.3 Topic 3: Routine Maintenance

Subject Outcome 1: Plan and prepare for routine maintenance.

Learning Outcomes:

The student should be able to:

- Plan a routine maintenance programme.
- Perform a pre-operational inspection on machinery or equipment.
- Prepare machinery or equipment for routine maintenance.

Subject Outcome 2: Perform routine maintenance

Learning Outcomes:

The student should be able to:

- Discuss safety precautions with regard to maintenance.
- Isolate machinery or equipment for routine maintenance.
- Perform routine maintenance.
- Start the machine or equipment.
- Write a post-maintenance report.

8 RESOURCE NEEDS FOR THE TEACHING OF ENGINEERING SYSTEMS – LEVEL 2

8.1 Physical resources

Building infrastructure, fixtures, networks, plant and machinery, for example:

- Storeroom
- Tool room
- Lecture room(s)
- Training area or work area
- Ablution facilities

8.2 Human resources

The lecturer for Engineering Fundamentals Level 2 must be:

- a subject matter expert,
- certificated as an assessor with the ETDP SETA,
- registered with an ETQA or SETA,

- a life-long student,
- in possession of an NQF Level 5 teaching qualification,
- conversant with outcomes-based methodologies, and
- skilled in facilitating learning programme development.

Lecturers must attend seminars and upgrading workshops to keep up-to-date with the latest developments in technology.

8.3 Other resources

Consumables, individual tool and equipment requirements and learning materials and resources, for example:

- Literature and learning material which address tasks
- Learning materials on projection equipment
- Educational tours to relevant learning venues
- Educational and motivational talks from industry
- Visual and audio-visual material
- Workshop manuals and documentation for theoretical knowledge
- Models and demonstrations

Funds from the learning provider or funding bodies for the procurement of consumables, tools and equipment must be readily available to ensure the effective operation of a Simulated Environment where students are individually equipped with the necessary tools.

ANNEXURE A: RESOURCE NEEDS FOR ENGINEERING SYSTEMS – LEVEL 2

Per every 20 students:

| DESCRIPTION | TYPE | QUANTITY |
|---------------------------|-----------------------------------|---|
| | | LL = Number of students per machine MM = Number of items per machine |
| Adaptor: | | |
| Head stock – Dashin | Dead centre MT3-2 | 20MM x 20 |
| Reducing sleeve | 40XMT3 X Dia 40 ISO 40 | 3 MM x 3 |
| Reducing plain | 40xMT3 ISO 40 | 3 MM x 3 |
| Reducing plain | 40xMT2 ISO 40 | 3 MM x 3 |
| Arbour: | | |
| Facing – Rose cutter | R8 FMA32 | 2MM x 2 |
| Facing – Rose cutter | R8 Spigot threaded | 2MM x 2 |
| Drill chuck | 3MT-DIN B22 | 2MM x 2 |
| Drill chuck – keyless | 3MT-DIN B16 | 2MM x 2 |
| Drill chuck | 2MT-DIN B22 | 2MM x 2 |
| Drill chuck | B16-R8 | 2MM x 2 |
| Angle plate: | Series: | |
| Eron | E118 305 x 229 | 3MM x 3 |
| Eron | E128 600 x 600 | 2MM x 2 |
| Analyser | Gas | 5LLx4 |
| Anvil-blacksmith | 90kg | 1 |
| Balancing wheel | Hoffman Geodyna | 10LL x 2 |
| Box spanner set | 6mm Drive-Gedore | 4 |
| Box spanner set | 12mm Drive Gedore | 4 |
| Boring: | | |
| Head | Model BC3 | 2MM x 2 |
| Buff-and-polisher machine | DIA 250 Wheel | 1 |
| Bender – pipe | Ram Dia 50mm Stroke length 140 mm | 1 |
| Band saw – vertical | FuHo VBS 16 | 3 |
| Band saw – horizontal | GB 4025 Semi-Automatic | 2 |
| Chuck: | | |
| Drilling | Porta Agip 1/16 -1/2 | 25MM x 25 |
| Drilling | Validus 3-16mm | 3 |
| Drilling | B22 5-20mm | 2 |
| Milling | Clarkson Model SY 3405-R8 | 1MM x 1 |
| Milling | Clarkson Model SY 3407-ISO 40 | 1MM x1 |
| Charger (battery) | Hawkins 6/60G | 10LL x 2 |
| Centre: | | |
| Dead | MT 3-2 | 20MM x 20 |
| Dead | MT 4-3 | 20MM x 20 |
| Clamping: | | |
| Amco kit | M12x1,5 | 6MM x6 |
| “G” | 25mm Groz | 10 |
| “G” | 50mm Groz | 10 |
| “G” | 75mmGroz | 10 |
| “G” | 150mm | 10 |
| Sash | 1m (Heavy Duty) | 8 |
| Sash | 1.5m (Heavy Duty) | 8 |
| Sash | 2m (Heavy Duty) | 4 |
| Carver | 75mm (medium throat) | 10 |
| Carver | 150mm (medium throat) | 6 |
| Carver | 200mm (medium throat) | 6 |
| Collets milling set | Dia 3-20mm R8 | 1MM x 1 |
| Calliper: | | |
| Jenny | 150mm | 10 |

| DESCRIPTION | TYPE | QUANTITY |
|---------------------|------------------------------------|---|
| | | LL = Number of students per machine MM = Number of items per machine |
| Inside | 150mm | 10 |
| Cleaner (engine) | Wap Model DX 8005 | 10LL x2 |
| Crane | Overhead (2 ton) | 1 |
| Compressor: | | |
| Airline | 270 L 5,5 HP 380 Volt 21,8CFM | 2 |
| Coil Spring | (With accessories) | 4 pairs |
| Dividers: | | |
| Spring bow | 50mm | 20 |
| Spring bow | 75mm | 20 |
| Spring bow | 150mm | 20 |
| Drill: | | |
| Sleeves | MT 2-1 | 25MM x 25 |
| Sleeves | MT 3-2 | 25MM x 25 |
| Sleeves | MT 4-3 | 2MM x 1 |
| Sleeves | MT 3-2 R8 | 1MM x 1 |
| Dividing head: | | |
| Semi universal | Homge BS -1 (with accessories) | 1MM x 4 |
| Drilling machine: | | |
| Radial | Mao-Ming Model K.M.R-700 DS | 10LL x 2 |
| Pedestal | Strands S-68 | 10LL x 2 |
| Pedestal | 200F (380 Volt) | 20LL x 1 |
| Hand | Metabo SB 650 / 2S | 7LL x 3 |
| Deburring: | Blade type: | |
| Tool | BS 1010 | 10 |
| Tool | BS 1012 | 10 |
| Tool | BS 2010 | 10 |
| Tool | BS3010 | 10 |
| Tool | BS 6010 | 10 |
| Handel | NB 100 | 10 |
| Electrical: | | |
| Extension | 7,5 Meters | 2 |
| Extension | 15 Meters | 4 |
| Extension | 30 Meters | 20LL x 1 |
| Extractor screw kit | Rigid Set No 10 No 35583 | 7LL x 3 |
| Extractor: | | |
| Tap | M3 | 5LL x 4 |
| Tap | M4 | 5LL x 4 |
| Tap | M5 | 5LL x 4 |
| Tap | M6 | 5LL x 4 |
| Tap | M7-8 | 5LL x 4 |
| Tap | M9-10 | 5LL x 4 |
| Tap | M12 | 5LL x 4 |
| Gauge: | | |
| Thread | Whitworth | 5 |
| Thread | Metric | 5 |
| Feeler | Omni 25 Blade | 5 |
| Slip | Mitutoyo MSG 1120 | 2 |
| Telescopic | Series 155 | 20LL x 2 |
| Surface | Base 82x63x25 | 5 |
| Height | Dial Double Column 600mm | 2 |
| Dial magnetic base | Kanet MB-FX | 4LL x 5 |
| Grinder: | | |
| Pedestal | Dia 250 Wheel Marpol CE 98 | 2 |
| Pedestal | Dia 150 Wheel Marpol (MBG 200/380) | 5 |
| Angle | Metabo W7-115 | 4LL x 5 |
| Angle | Metabo W?-230 | 7LL x 3 |

| DESCRIPTION | TYPE | QUANTITY |
|---------------------|-----------------------------------|---|
| | | LL = Number of students per machine MM = Number of items per machine |
| Orbital (die) | Metabo GE 700 | 7LL x 3 |
| Dresser | Diamond 0,5 Carat | 2 |
| Dresser | No 1 Dia 35 Wheel | 2 |
| Guillotine | Heli CS 7 x 2550 | 1 |
| Gun: | | |
| Grease | Cylinder pump action | 2 |
| Oil | Cylinder pump action | 2 |
| Spray | Devilbus gravity feed | 2 |
| Air | Blow off | 5 |
| Holder: | | |
| Lathe tool | 6x6mm cutter | 2LL x 10 |
| Lathe tool | 8x8mm cutter | 2LL x 10 |
| Lathe tool | 10x10mm cutter | 2LL x 10 |
| Lathe tool | 12x12mm cutter | 2LL x 10 |
| Hammer: | | |
| Dead blow | Dia 54mm Face | 5 |
| Dead blow | Dia 65 mm Face | 5 |
| Ball pein | 500gram | 10 |
| Ball pein | 900 gram | 10 |
| Club | 2kg | 2 |
| Hack saw: | | |
| Hand | 300mm blade capacity | 2LL x 10 |
| Power machine | Model Carif 240 | 1 |
| Hone | Amco Model 500 | 2 |
| Harnesses | Safety | 4 x 5 |
| Helmet arc welding: | | |
| Standard | Gardwell – Tufflite | 5 |
| Electronic | F 11 Protection 0-175 Amp | 2 |
| Inflator (tyre) | Vehicle | 5LL x 4 |
| Jack: | | |
| Trolley | 5 ton | 5LL x 4 |
| Bottle | 3 ton | 10LL x 2 |
| Scissors | 3 ton | 10LL x 2 |
| Pipes | N/A | 10 |
| Stands | 3 ton | 7LL x 3 |
| Stands | 5 ton | 7LL x 3 |
| Jumper cables | Vehicle | 7LL x 3 |
| Key set: | | |
| Allen | Metric 1,5-20mm | 5 |
| Allen | Imperial 1/16"- 1/2" | 2 |
| Torx | Multi Splined T 10-T50 | 2 |
| Knurling tool: | | |
| Revolving head | Type 8143 | 20LL x 10 |
| Swivel head | Type 8140 | 20LL x 10 |
| Lathe: | | |
| Machine | Dashin Prince Swing 160 mm Bed 1m | 20LL x 20 |
| Machine | Tezsan Model Cayirovo/G.E.B.Z.E. | 7LL x 3 |
| CNC lathe | Alpha Plus 400S | 1 |
| Ladder: | | |
| Aluminium | 1,5m | 20LL x 1 |
| Aluminium | 6m | 20LL x 1 |
| Aluminium | 9m | 20LL x 1 |
| Lead (light) | 10 meter cord | 4LL x 5 |
| Line (chalk) | 10 meter | 2 LL x 10 |
| Lifter: | | |

| DESCRIPTION | TYPE | QUANTITY |
|----------------------|--|---|
| | | LL = Number of students per machine MM = Number of items per machine |
| Valve | Medium | 4LL x 5 |
| Valve | Large | 4LL x 5 |
| Lift: | | |
| Car | 4 post | 20LL x 1 |
| Car | 2 post | 10LL x 2 |
| Media components: | | |
| CPU | Diskette and CD writer | |
| | Stored programmes: Word Excel Cad | 1LL x 20 |
| Screen | | 1LL x 20 |
| Keyboard | Colour tone | 1LL x 20 |
| Mouse | | 1LL x 20 |
| Memory stick | | 10LL x 2 |
| Diskette | | 1LL x 40 |
| CD | | 1LL x 20 |
| Printer | | 5LL x 4 |
| Fax | | 7LL x 3 |
| Photocopier | | 20LL x 1 |
| Telephone | | 20LL x 1 |
| Micrometer: | Mitutoyo: | |
| Outside | 0 -25 | 20LL x 20 |
| Outside | 25 -50 | 20LL x 20 |
| Outside | 50-75 | 2LL x 10 |
| Outside | 75-100 | 2LL x 10 |
| Depth | Series 129-111 0-100mm | 4LL x 5 |
| Inside | 50-300 mm | 4LL x 5 |
| Milling machine: | | |
| Pinnacle | Table 920x220 Model PK – 1 1/4M | 10LL x 2 |
| Universal | Table 1100x300 Model X6125 A | 7LL x 3 |
| Power transmissions: | | |
| Clutches: | (Training models) | 5LL x 4 |
| Friction | (Training models) | 5LL x 4 |
| Centrifugal | (Training models) | 5LL x 4 |
| Hydraulic | (Training models) | 5LL x 4 |
| Chain Drives | (Training models) | 5LL x 4 |
| Belt Drives | (Training models) | 5LL x 4 |
| Gear Drives | (Training models) | 5LL x 4 |
| Couplings: | (Training models) | 5LL x 4 |
| Flexible | (Training models) | 5LL x 4 |
| Fixed | (Training models) | 5LL x 4 |
| Self Aligning | (Training models) | 5LL x 4 |
| Punch: | | |
| Centre | 100mm length | 10LL x 20 |
| Pin (set) | Dia 3 – 10mm | 4LL x 5 |
| Letter (set) | 6mm | 10LL x 2 |
| Letter (set) | 10mm | 10LL x 2 |
| Number (set) | 6mm | 10LL x 2 |
| Number (set) | 10mm | 10LL x 2 |
| Pliers: | | |
| Combination | 200mm | 4LL x 5 |
| Long Nose | 200mm | 4LL x 5 |
| Side Cutters | 200mm | 4LL x 5 |
| Circlip Outside | 170mm bend | 4LL x 5 |

| DESCRIPTION | TYPE | QUANTITY |
|--------------------------|---------------------------------|---|
| | | LL = Number of students per machine MM = Number of items per machine |
| Circlip Outside | 170mm Straight | 4LL x 5 |
| Circlip Inside | 170mm Bend | 4LL x 5 |
| Circlip Inside | 170mm Straight | 4LL x 5 |
| Puller Set | Sykes - Piacavant | 7LL x 3 |
| Press: | | |
| Hydraulic | 33 Tone | 2 |
| Eccentric | Dirinler CD/P300 | 1 |
| Break | Heli PT 50 x 2500 + Accessories | 1 |
| Rollers: | | |
| Pinch | Horizontal | 1 |
| Pinch | Vertical | 1 |
| Ruler: | | |
| Steel | 150mm | 20LL x 20 |
| Steel | 300mm | 20LL x 20 |
| Steel | 1000mm | 10LL x 2 |
| Repair kit | Tubeless tyre | 10 |
| Reamer set (adjustable) | Set P-45 B 4412 No 5028 | 10LL x 2 |
| Slotting machine | TS – 200K | 1 |
| Square: | | |
| Combination | Mitutoyo 300mm | 4LLx5 |
| Engineer | 75mm | 4LLx5 |
| Engineer | 180mm | 4LLx5 |
| Stock die and tap set | Metric Course M6-M24 | 2 |
| Stock die and tap set | Metric Fine M6-M24 | 2 |
| Stands | Mitutoyo Magnetic | 4LLx5 |
| Scraper: | | |
| Engineer | 200mm | 10LL x 20 |
| Tape: | | |
| | 5 meter | 20LL x 20 |
| | 10 meter | 5LL x 4 |
| Table: | | |
| Steel | 1220 x 610 | 15 |
| Steel | 1810 x 910 | 4LL x 5 |
| Wood | 750 x 450 | 1MM x34 |
| Marking off | 500400 | 2 |
| Tester: | | |
| Rockwell (hardness) | RHTC | 2 |
| Multi-tester | Fluke | 5LL x 4 |
| Battery | Vehicle | 5LL x 4 |
| Compression | Vehicle | 5LL x 4 |
| Training units: | | |
| Hydraulic | (Standard) | 3 |
| Pneumatic | (Standard) | 3 |
| ART (motor display unit) | (Interior mechanism exposure) | 2 |
| Tool box (complete) | Geodore (Motor mechanics) | 4LL x 5 |
| Tool box (complete) | Boiler maker | 4LL x 5 |
| Tool post: | | |
| Quick change | Type A | 1MM x 20 |
| Quick change | Type B | 1MM x 2 |
| Tyre changer | N/A | 20LL x 1 |
| Tirfors | N/A | 4 |
| Tail stock dial holder | N/A | 4MM x 5 |
| Vice: | | |
| Magnetic | Walker Hagou BV Mod 20 | 1MM x 10 |
| Machine | Swivel - 160 Jaw (6537) | 5 |

| DESCRIPTION | TYPE | QUANTITY |
|-----------------------|----------------------------------|---|
| | | LL = Number of students per machine MM = Number of items per machine |
| Drilling | 150 Jaw GS-106A | 3 |
| Engineer | 105mm | 15 |
| Engineer | 150mm | 5LL x 4 |
| Grip | 250mm | 4LL x 5 |
| Vernier: | | |
| Calliper | 150mm | 4LL x 5 |
| Calliper | 200mm | 4LL x 5 |
| Calliper | 300mm | 4LL x 5 |
| Calliper | Mitutoyo Absolute 500-151 CD-15C | 1 |
| Bevel protractor | BP300 | 10LL x 1 |
| Wrench: | | |
| Tapping | M 2-4.5 | 4LL x 5 |
| Tapping | M 5-10 | 4LL x 5 |
| Torque | 10 -160 nm | 4LL x 5 |
| Welding units: | | |
| Oxygen and Acetylene | Oxygen 9Kg, Acetylene 7Kg | 7LL x 3 |
| Arc | 21-335 amps | 5LL x 4 |
| Profile cutting | N/A | 7LL x 3 |
| Straight line cutting | N/A | 7LL x 3 |
| Plasma cutting | N/A | 7LL x 3 |
| AC/DC | N/A | 10LL x 2 |

CONSUMABLE RESOURCE NEEDS FOR ENGINEERING SYSTEMS – LEVEL 2

Per every 20 students:

| DESCRIPTION | TYPE | QUANTITY |
|--------------------------|-------------------------------|-----------------|
| Bright mild steel: | Diameter: | 6 metrelengths: |
| | 10 mm | 10 |
| | 16 | 10 |
| | 20 | 10 |
| | 32 | 5 |
| | 50 | 5 |
| Blade: | | |
| Bandsaw | M 42 8TPI 3150 x 25x 0.6 | 10 off |
| Hacksaw | Ultra bi hard 300x18 TPI | 1 box (100) |
| Power saw | Starret Red Stripe 400x32x1.6 | 2 box (10) |
| Brush: | | |
| File | Wire | 10 off |
| Cleaning | Wire | 5 off |
| Painting | 15 mm | 20 off |
| Painting | 25 mm | 20 off |
| Painting | 50 mm | 20 off |
| Cutters: Tungsten tipped | Lathe: | |
| TYPE: | 10x10 P30 (B3) | |
| 111 | RH | 30 off |
| 113 | RH | 30 off |
| 115 | RH | 30 off |
| 116 | RH | 30 off |
| 116 | LH | 20 off |
| 117 | RH | 30 off |
| 117 | LH | 20 off |
| 127 | RH | 20 off |
| 136 | RH | 30 off |
| 166 | RH | 30 off |
| Cutters: Tungsten tipped | Lathe: | |
| TYPE: | 20x20 P30 (B3) | |
| 111 | RH | 5 off |
| 113 | RH | 5 off |
| 115 | RH | 5 off |
| 116 | RH | 5 off |
| 116 | LH | 5 off |
| 117 | RH | 5 off |
| 117 | LH | 5 off |
| 127 | RH | 5 off |
| 136 | RH | 5 off |
| 166 | RH | 5 off |
| Cutters: Tungsten tipped | Lathe: | |
| TYPE: | 20x20 K10 (C3) | |
| 111 | RH | 5 off |
| 113 | RH | 5 off |
| 115 | RH | 5 off |
| 116 | RH | 5 off |
| 116 | LH | 5 off |
| 117 | RH | 5 off |
| 117 | LH | 5 off |
| 127 | RH | 5 off |
| 136 | RH | 5 off |
| 166 | RH | 5 off |

| DESCRIPTION | TYPE | QUANTITY |
|-----------------------------|------------------------|----------|
| Cutter: High speed steel | | |
| Diameter: | Code: | |
| 6 mm | 6050070 | 10 off |
| 8 | 6050110 | 10 off |
| 10 | 6050140 | 10 off |
| Cutter: High speed steel | | |
| Square: | Code: | |
| 4 x 63 mm | 6010025 | 20 off |
| 5 x 63 | 6010034 | 20 off |
| 6 x 100 | 6010070 | 20 off |
| 8 x 100 | 6010110 | 20 off |
| 10 x 100 | 6010140 | 20 off |
| 12 x 100 | 6010170 | 20 off |
| 16 x 100 | 6010200 | 20 off |
| 20 x 160 | 6010256 | 20 off |
| Double bevel parting blade: | 6440070 | 40 off |
| Cutter: High speed steel | Milling: 2 flute | |
| Diameter: | Length: Regular (Co8o) | |
| 3 mm | Code: | |
| 4 | 3480300 | 5 off |
| 5 | 3480400 | 5 off |
| 6 | 3480500 | 5 off |
| 7 | 3480600 | 5 off |
| 8 | 3480700 | 5 off |
| 9 | 3480800 | 5 off |
| 10 | 3480900 | 5 off |
| | 3481000 | 5 off |
| Cutter: High speed steel | Milling: 4 flute | |
| Diameter: | Length: Regular (Co8o) | |
| 3 mm | Code: | |
| 4 | 3440300 | 5 off |
| 5 | 3440400 | 5 off |
| 6 | 3440500 | 5 off |
| 7 | 3440600 | 5 off |
| 8 | 3440700 | 5 off |
| 9 | 3440800 | 5 off |
| 10 | 3440900 | 5 off |
| | 3441000 | 5 off |
| Detergent: | | |
| Turpentine | | 5L x 3 |
| Thinners | | 5L x 3 |
| Paraffin | | 20L x 2 |
| Dies tapping: | | |
| Nuts (Coarse) | HSS: | |
| M3 x 0.5 | 5070300 | 6 off |
| M4 x 0.7 | 5070400 | 6 off |
| M5 x 0.8 | 5070500 | 6 off |
| M6 x 1.0 | 5070600 | 6 off |
| M8 x 1.25 | 5070800 | 6 off |
| M10 x 1.5 | 5071000 | 6 off |
| M12 x 1.75 | 5071200 | 6 off |
| Circular solid (Coarse) | | |
| M3 x 0.5 | 5800300 | 4 off |
| M4 x 0.7 | 5800400 | 4 off |
| M5 x 0.8 | 5800500 | 4 off |
| M6 x 1.0 | 5800600 | 4 off |
| M8 x 1.25 | 5800800 | 4 off |

| DESCRIPTION | TYPE | QUANTITY |
|---|---|-------------------|
| M10 x 1.5 | 5801000 | 4 off |
| M12 x 1.75 | 5801200 | 4 off |
| Jobber drills: Diameter range from 2 - 12 mm advancing in 0,1 mm increments | Straight shank Code: 112 HSS Co | 6 sets |
| Drills: Diameter range from 13 - 30 mm advancing in 0,5 mm increments | Morse taper shank Chipbreaker Code: 2A1 HSS | 2 sets |
| Drills: Diameter range from 31 - 50 mm advancing in 0,5 mm increments | Morse taper shank Chipbreaker Code: 2A1 HSS | 1 set |
| Drill centre: Diameter: 2,5 x 6,3 mm | HSS: Code: 1390250 | 30 off |
| 6,3 x 16 mm | 1390630 | 10 off |
| Engineering marking blue | 300 ml | 10 off |
| Brazing flux | Oxygen and Acetylene | 500 ml x 10 off |
| Files: | | |
| Rectangular: | Barsted | 10 off |
| | Medium | 10 off |
| | Smooth | 10 off |
| Square: | Barsted | 10 off |
| | Medium | 10 off |
| | Smooth | 10 off |
| 3 Cornered: | Barsted | 10 off |
| | Medium | 10 off |
| | Smooth | 10 off |
| Round: | Barsted | 10 off |
| | Medium | 10 off |
| | Smooth | 10 off |
| Half round: | Barsted | 10 off |
| | Medium | 10 off |
| | Smooth | 10 off |
| Thread restorer: | Sykes Pickavant 015602 | 5 off |
| Grease | Shell Retinax EP2 | 20 Litre x 1 only |
| Grinding stone: | Diameter: | |
| Wheel (tungsten) | 250 x 32 x 31,75 GC 60 J V | 2 off |
| Wheel (Carborundum) | 250 x 32 x 31,75 A 36 P5 V 13 | 3 off |
| Wheel (Carborundum) | 150 x 32 x 31,75 A 36 P5 V | 10 off |
| Angle (cutting) | 125 x 6,3 x 22,23 | 10 off |
| Angle (grinding) | 125 x 6, 3 x 22,23 | 10 off |
| Loctite | 27 050 grms | 3 off |
| Mutton cloth | 400 grms | 30 off |
| Oil (motor vehicle) | 20W – 50 | 5 Litres x 3 off |
| Tellus (gearbox and feed boxes) | S 68 | 20 Litres x 2 off |
| Tonna (bedways and slides) | T 68 | 20 Litres x 2 off |
| Reamers: | | |
| Hand | | |
| Diameter: | HSS: | |
| 10 mm | H7 – 7011000 | 2 off |
| 12 | H7 – 7011200 | 2 off |
| 14 | H7 – 7011400 | 2 off |
| 15 | H7 – 7011500 | 2 off |
| 16 | H7 – 7011600 | 2 off |

| DESCRIPTION | TYPE | QUANTITY | |
|-----------------------------|--|---------------------------|--------|
| 17 | H7 – 7011700 | 2 off | |
| 18 | H7 – 7011800 | 2 off | |
| 19 | H7 – 7011900 | 2 off | |
| 20 | H7 – 7012000 | 2 off | |
| 21 | H7 – 7012100 | 2 off | |
| 22 | H7 – 7012200 | 2 off | |
| 23 | H7 – 7012300 | 2 off | |
| 24 | H7 – 7012400 | 2 off | |
| Countersinks: Diameter: | Parallel shank 60 Degree HSS Code: | | |
| 6,3 mm | 7610630 | 10 off | |
| 8 | 7610800 | 10 off | |
| 10 | 7611000 | 10 off | |
| 12,5 | 7611250 | 10 off | |
| Steel: | | 6 metre lengths: | |
| Solid square (dimensions): | | | |
| 8 x 8 mm | 0,3 – 0,4% Carbon content | 10 off | |
| 10 x 10 | | 10 off | |
| 12 x 12 | | 10 off | |
| 16 x 16 | | 10 off | |
| Square tubing (dimensions): | | | |
| 12 x 12 mm | 0,3 – 0,4% Carbon content | 10 off | |
| 16 x 16 | | 10 off | |
| 20 x 20 | | 10 off | |
| 24 x 24 | | 10 off | |
| 32 x 32 | | 10 off | |
| 50 x 50 | | 5 off | |
| Rectangular (dimensions): | | | |
| 20 x 5 mm | 0,3 – 0,4% Carbon content | 5 off | |
| 25 x 5 | | 5 off | |
| 30 x 5 | | 5 off | |
| 50 x 5 | | 5 off | |
| 80 x 5 | | 5 off | |
| 100 x 5 | | 5 off | |
| Round bar (diameter): | | | |
| 6 mm | 0,3 – 0,4% Carbon content | 5 off | |
| 8 | | 5 off | |
| 10 | | 5 off | |
| 12 | | 5 off | |
| 16 | | 5 off | |
| 20 | | 5 off | |
| Plate (dimensions): | | | |
| 2,440 x 1,220 x 0,5 | 0,3 – 0,4% Carbon content | 5 off | |
| 2,440 x 1,220 x 1,0 | | 5 off | |
| 2,440 x 1,220 x 1,5 | | 5 off | |
| 2,440 x 1,220 x 2,0 | | 5 off | |
| 2,440 x 1,220 x 3,0 | | 5 off | |
| 2,440 x 1,220 x 5,0 | | 5 off | |
| 2,440 x 1,220 x 8,0 | | 3 off | |
| 2,440 x 1,220 x 10,0 | | 3 off | |
| Scriber (diameter) 3 mm | | De-scaling pin | 30 off |
| Sandpaper (emery tape) | | Grade P100 (50 mm x 50 m) | 2 off |
| Soap (hand) | Bingo 150g | 50 off | |
| Threads: | | | |
| Tapping (Coarse): | HSS: | | |

| DESCRIPTION | TYPE | QUANTITY |
|--------------------|------------------|-----------------|
| M3 x 0,5 | Code: 5010300 | 6 off |
| M4 x 0,7 | 5010400 | 6 off |
| M5 x 0,8 | 5010500 | 6 off |
| M6 x 1,0 | 5010600 | 6 off |
| M8 x 1,25 | 5010800 | 6 off |
| M10 x 1,5 | 5011000 | 6 off |
| M12 x 1,75 | 5011200 | 6 off |
| Tapping lubricant: | | |
| Steel | Dual Action #1 | 10 off |
| Aluminium | Dual Action #2 | 5 off |
| Welding: | | |
| Arc | | |
| Diameter rod: | | |
| 2 mm | General Purpose | 5kg packets x 2 |
| 2,5 | | 5kg packets x 2 |
| 3,125 | | 5kg packets x 2 |
| Gas (Brazing): | | |
| 1,8 mm | | 2kg x 1 |
| 2,8 | | 2kg x 1 |
| Gas (Welding): | | |
| 1,8 mm | 2kg x 1 | |
| 2,8 | 2kg x 1 | |