basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

2014

These guidelines consist of 23 pages.

TABLE OF CONTENTS

INTRODUCTION

The seventeen CAPS subjects which contain a practical component all include a Practical Assessment Task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- HSS: Life Orientation
- SCIENCES: Computer Applications Technology, Information Technology
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, Engineering Graphics and Design, **Mechanical Technology**

A PAT allows the teacher to directly and systematically observe applied competence. The PAT comprises the application of knowledge and values and the demonstration and performance of skills particular to that subject and counts 25% (i.e. 100 marks) of the total National Senior Certificate (NSC) mark out of 400.

The Grade 12 PAT is implemented across the first three terms of the school year and should be undertaken as one extended task, which is broken down into different phases or a series of smaller activities that make up the PAT. The planning and execution of the PAT differ from subject to subject.

SECTION A contains the guidelines to the teacher, describing the structure and the administration of the PAT, while SECTION B contains the tasks and the assessment tools for both the learner and the teacher.

Any profession requires of its members a thorough grounding in both practice and theory, and **MECHANICAL TECHNOLOGY** is no exception. It is emphasized that the goal of the Performance Assessment Task is not to produce a skilled craftsperson but a mechanical technology learner in the broadest sense. A nation's true wealth is in its manpower and education should aim to develop the talents of the learner so that he/she can contribute to the well-being of society by using scientific and technological resources with the greatest efficiency and by continuing to develop them.

To prepare a learner in **MECHANICAL TECHNOLOGY** for one or more of these activities his/her education should develop in him/her:

- A mentality which can selectively assimilate ideas, evidence and facts, and by drawing logical conclusions put them to good use creatively and with imagination;
- A capability to express ideas and information clearly by speech, writing, sketching or drawing;
- A willingness and capability to accept and exercise responsibility, to make decisions, and to learn by experience.

Attributes such as these cannot all be achieved in the classroom alone. A sound knowledge of engineering science is essential to the **MECHANICAL TECHNOLOGY** learner, so too is the close practical acquaintance with the processes. There is no substitute for acquiring the feel and demonstrating skills of physically making projects/tasks on the workshop floor. This will enable learners to bridge the gap between trade theory and trade practice in this subject.

Practical application in the workshop must therefore be made an interesting and challenging experience, mentally and physically, with encouragement to the learner to use his/her initiative, curiosity and persistence in finding things out for himself/herself. Learning by watching should be kept to the bare minimum. The giving of some degree of responsibility during practical application is very important as a stimulus and to develop self-confidence.

PAT phases 1 – 3 (phase task/skills task/resource task/enabling task) must not be confused with the practical application of the subject (phase 4 – capability task) during workshop practice sessions.

2. The structure of the PAT for Mechanical Technology

A Practical Assessment Task is designed and developed for a learner to use and demonstrate the various skills he/she acquired during workshop practice to manufacture a project of high quality. The PAT is made up of an integration (or a combination) of various topics as is found in the CAPS document. Safety and tools will always form an integral part of the PAT.

NOTE: The technological process does NOT form part of the Practical Assessment Task.

The focus and emphasis will be on a learner's ability to read and follow instructions in order to produce accurate, quality projects and tasks. Each learner must complete the four phases of the PAT under controlled conditions and with the supervision of the teacher. No group work is allowed.

The Practical Assessment Task consists of **FOUR** phases that the learner must complete as set out in the table on the next page. Phase four will be a combination of skills that have been shown in phase 1 - 3.

STRUCTURE OF THE PAT

PROCESS		TOPIC	MARKS
TERM 1	Phase 1 (task)	Terminology/Manufacturing	**50**
	Phase 4	Teacher to plan and prepare (material and equipment)	
TERM 2	Phase 2 (task)	Joining	**50**
	Phase 4	Final task under construction	
TERM 3	Phase 3 (task)	Maintenance/Experimentation/Simulation	**50**
	Phase 4	Complete Task	**100**
		TOTAL	***250 Convert to 100***

The teacher must in his preparation attend to the following:

- The safety and environmental aspects considered;
- The planning process;
- The knowledge and skills to be achieved;
- The calculations used – if applicable, sketches or diagrams;
- The starting time and ending time – how long it took to complete from start to finish;
- Bill of materials;
- List of tools needed; and
- Any other information that is relevant to the project.

3. Administration of the PAT

Teachers must assign due dates for the different phases of the PAT task (refer to the CAPS document). In this manner, learners can easily assess their progress. In instances where formal assessments take place, it is the responsibility of the teacher to administer assessment.

The PAT (all phases) should be completed in the first three terms. The PAT should be completed under controlled conditions. (Refer to the Mechanical Technology CAPS Grade 10 - 12).

Educators are requested to make copies of **Section B** and distribute to learners at the beginning of the year. Learners should receive the assessment criteria of the PAT at the beginning of the year when the PAT is distributed to them.

4. Assessment and moderation of the PAT

The Practical Assessment Task for Grade 12 is externally set and moderated, but internally assessed.

4.1 Assessment

Frequent developmental feedback is needed to guide and give support to the learner to ensure that the learner is on the right track.

Both formal and informal assessment should be conducted on the different phases that constitute the PAT. Informal assessment can be conducted by the learner himself or herself, by a peer group, or by the teacher. Formal assessment must be conducted by the teacher and marks recorded.

4.2 Moderation

During moderation of the PAT, the phase tasks (phase 1 – 2) and the project (phase 4), must be presented to the moderator with the assessment criteria and marks obtained. For phase task 3 on Maintenance/Experimentation/Simulation, the assessment criteria, spreadsheet of marks obtained and the work book must be presented.

Where required the moderator should be able to call on the learner to explain the function, principles of operation and also request the learner to exhibit the skills acquired through the capability tasks for moderation purposes.

4.3 Time planning

The suggested time planning below is highly recommended to ensure compliance and completion in time for moderation at the end of the third school term.

January:	Phase 1:	Start the manufacturing task (terminology)
	Phase 4:	Start planning, preparation and construction of the project
March:	Phase 1:	Complete the manufacturing task at the end of first term
April:	Phase 2:	Start the welding task (joining)
	Phase 4:	Project under construction
June:	Phase 2:	Complete the welding task at the end of second term
July:	Phase 3:	Start the maintenance task
	Phase 4:	Project under construction
August:	Phase 3:	Complete the maintenance task at the end of third term
	Phase 4:	Complete at the end of third term

SECTION B: THE PRACTICAL ASSESSMENT TASK

The Practical Assessment Task (PAT) consists of 4 Phases, one per term over terms 1 to 3. Phase 4 must be started in the first term and completed in the third term.

PHASE 1: TERMINOLOGY/MANUFACTURING

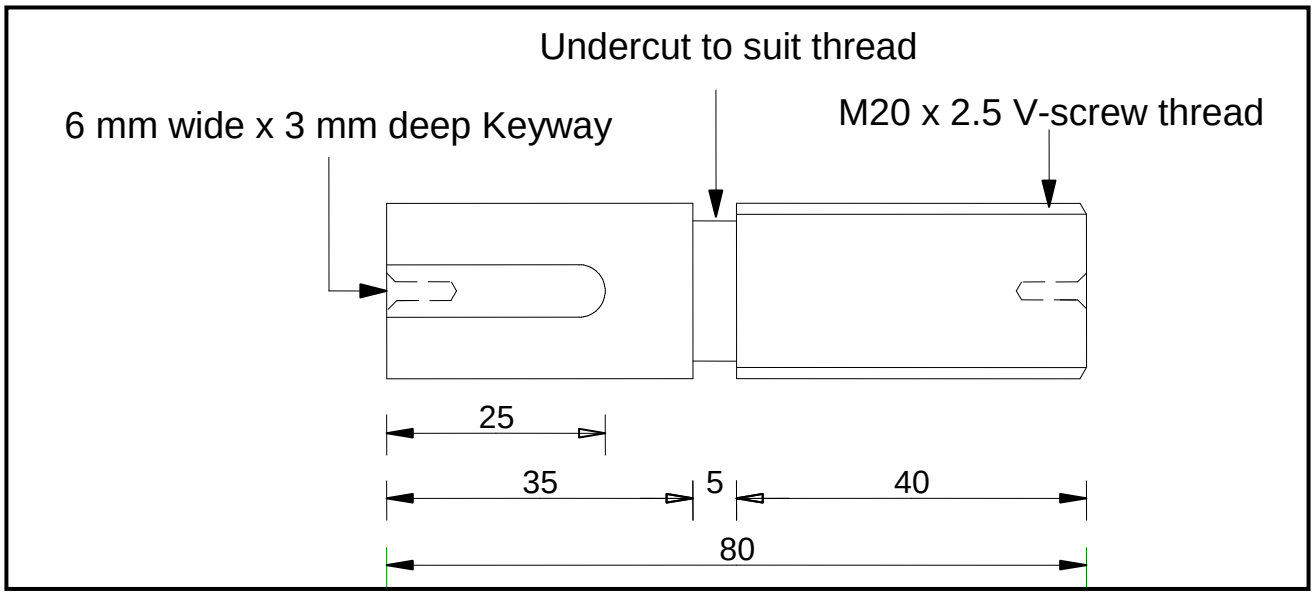

FIGURE 1: Term 1: Skills Task

Instructions:

- Use a piece of diameter 20 mm *mild steel* or *aluminium* or *nylon* (no wood) material for turning. If larger diameter material is available, it must be turned down to diameter 20 mm.
- Face and centre drill both ends of the work piece.
- Set-up the work piece in the milling machine and mill the keyway as indicated on the sketch.
- Set-up the work piece in the centre lathe and chamfer the front of the part (45° x 3 mm) where the screw thread must be cut. Machine an under-cut at the end of the thread to the thread depth.
- Set up the lathe to cut a M20 x 2.5 V-thread referring to:
  - Change gears
  - Rotation speed
  - Setting over of the compound slide
  - Dial indicator
- Cut the thread
- Use a M20 x 2.5 nut to test the thread
- Remove all sharp edges
- Adhere to safety measures during manufacturing.

Processes:

- Manufacturing processes:
  - Turning;
  - Milling
  - Thread cutting
- Manufacturing competency (Addressing the requirements)
- Fitness for purpose
- Finishing
- Quality
- Time

GRADE: 12	YEAR: 2014	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: MECHANICAL TECHNOLOGY		EDUCATOR:
PROJECT: PHASE 1		NUMBER OF LEARNERS:

		NAMES OF LEARNERS														
FACETS / PHASE 1	MARKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FACING	5															
SET-UP IN MILLING MACH	10															
CUT OF KEYWAY	5															
SET CHANGE GEARS TO CUT M20 x 2.5 V-THREAD	10															
CUT OF THREAD	10															
FINISHING OF KEYWAY	5															
FINISHING OF THREAD	5															
TIME (-1 FOR EVERY DAY LATE)																
TOTAL	50															

EDUCATOR:	
HEAD OF DEPARTMENT:	
PRINCIPAL:	
SUBJECT ADVISOR:	

PHASE 2: JOINING

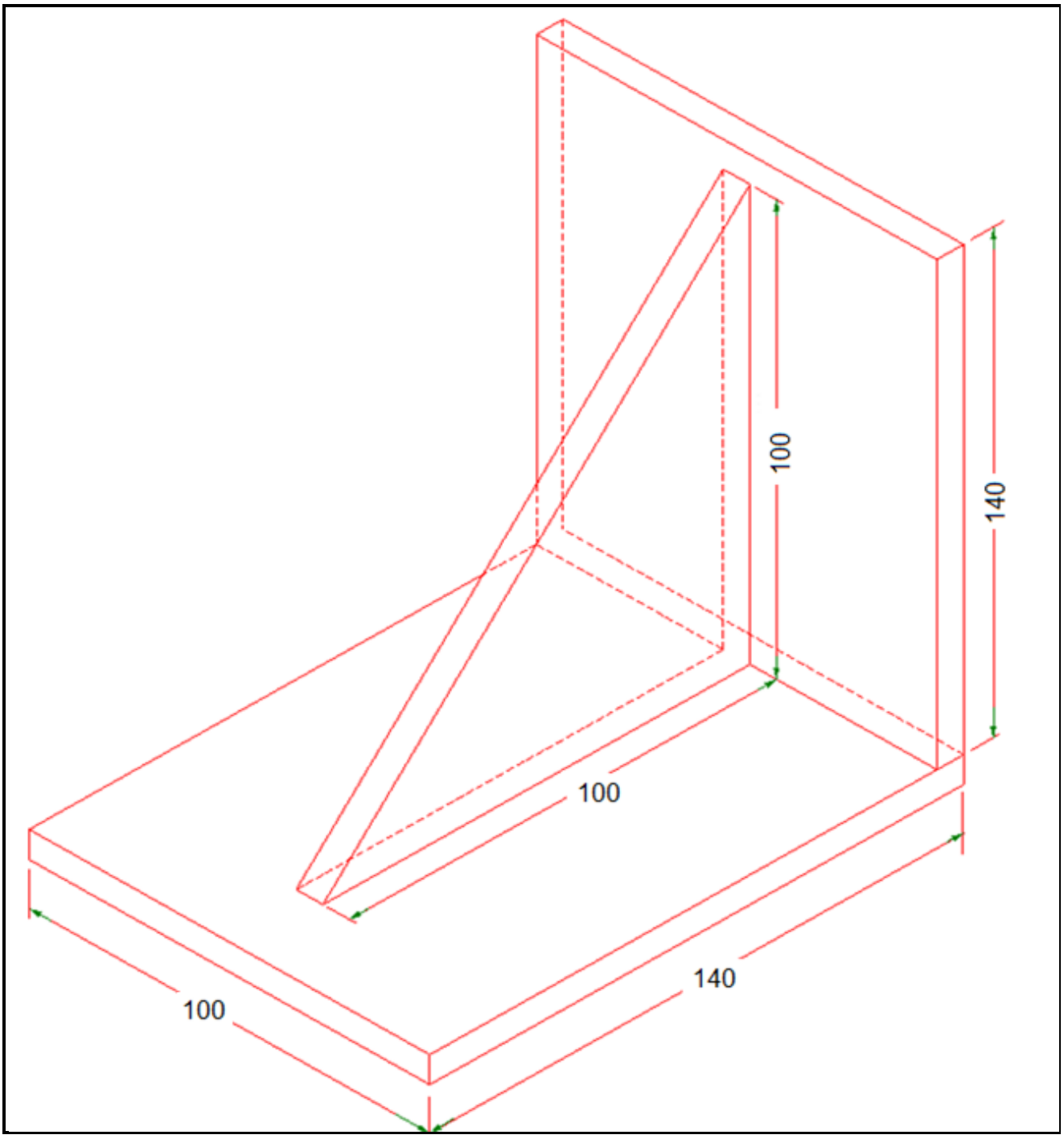

FIGURE 2: Term 2: Skills Task

Material:
- 100 mm x 5 mm flat bar

Instructions:
Safety precautions must be adhered to at all times.

Preparing:
- Marking off
- Cutting to size
- Chamfering

Tack welding:
- Vertical plate front side
- Web plate on side

Welding work:
- Front fillet weld (base and vertical plates).
- Back fillet weld (base and vertical plates).
- Side 1: Staggered Welding: 30 mm weld; 40 mm gap; 30 mm weld (web plate).
- Side 2: Staggered Welding: 30 mm gap; 40 mm weld; 30 mm gap (web plate).
- Work piece can be positioned in an easy manageable position for welding.

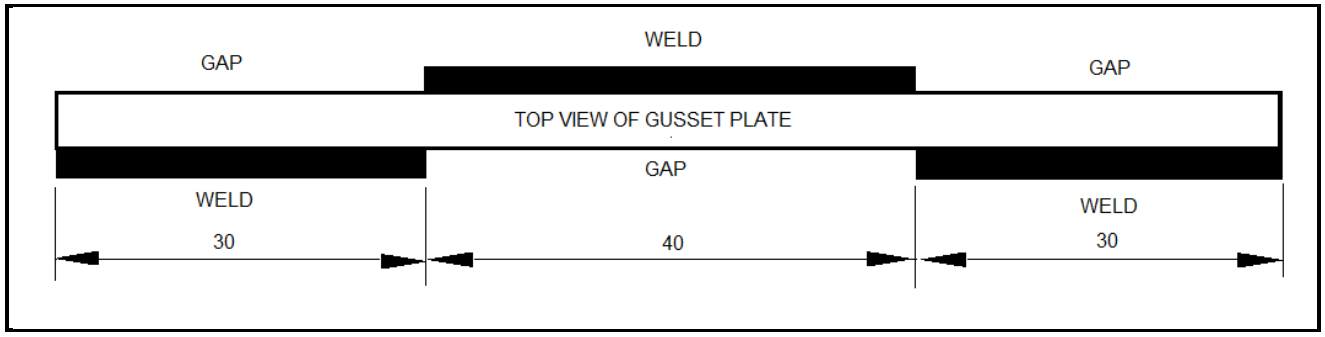

FIGURE 3: Top view of welding on gusset plate

Root run – between vertical and base plate

Visual Inspection:
- Slag inclusion
- Undercutting
- Cracks

Accuracy:

- Base plate and vertical plate be at 90°
- Web plate be at 90° to both plates

Tools and equipment needed:

- MIG/MAG machine
- Engineering square
- Chipping hammer
- Steel rule
- Scriber
- Marking blue
- Grinder
- Guillotine
- Safety accessories

Processes:

- Joining methods
  - Permanent joining (welding) on base and back plate – fillet weld
  - Staggered welding only on gusset plate (web plate).
- Manufacturing competency (Addressing the requirements)
- Fitness for purpose
- Finishing
- Quality
- Time

GRADE: 12	YEAR: 2014	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: MECHANICAL TECHNOLOGY		EDUCATOR:
PROJECT: PHASE 2		NUMBER OF LEARNERS:

		NAMES OF LEARNERS														
FACETS / PHASE 2	MARKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Preparation of plates	5															
Demarcation lines	5															
Tack welds (2)	5															
1st Filler Run	5															
2nd Filler Run	5															
3rd Filler Run	5															
Staggering of welds	5															
Visual inspection for under cutting and slag inclusion	5															
Accuracy – back plate and gusset plate at 90°	5															
Finishing	5															
TOTAL	50															

EDUCATOR:	
HEAD OF DEPARTMENT:	
PRINCIPAL:	
SUBJECT ADVISOR:	

PHASE 3: MAINTENANCE/EXPERIMENTATION/SIMULATION

Teacher must explain to the learners which knowledge and skills are being assessed during the phase as well as the duration of the completion of the phase.

Activity outcomes:

- Learners apply theoretical knowledge into practice
- Safety, tools, maintenance and systems and control
- Correct use of tools and equipment
- Use of equipment to diagnose low compression or other faults in the engine cylinder

NOTE:

- These tasks must be done under supervision of the teacher and learner to be marked while performing the tasks. (The learner can be called upon to perform tasks during moderation.)
- The learner must record all his findings in a work book.

Tasks:

Carry out all simulations below and record the findings.

1. Compression test

Do a dry compression test on a four-cylinder four-stroke petrol engine.

2. Cylinder leakage test

Perform a cylinder leakage test on the cylinder which gave the lowest reading when the compression test was done. Diagnose possible leakages.

3. Ignition timing

Test ignition timing according to manufacturer's specifications during:

- Idling
- High revolutions(± 3 000 r/min)

4. Multimeter

- Test the voltage of a fully charged, disconnected 12 V battery, and record the reading.
- Test the voltage drop of a battery during starting.
- Test the continuity on a simple 12 volt light circuit.

Tools and equipment needed:

- Hand tools
- Four-cylinder four-stroke petrol engine
- Compression tester
- Cylinder leakage tester
- Timing light
- Multimeter
- Manufacturers specifications for the engine

MARKING GUIDE

NOTE: Learner must record and give reasons for actions when completing this task.

1. Compression test

Procedure	Reason	Mark	Total
Get engine to running temperature			**2**
Crack spark plugs			**2**
Remove spark plugs (*What action should take place before spark plugs are removed?)*			**2**
Remove air filter			**2**
Remove HT lead from coil			**2**
Open accelerator fully			**2**
Do compression test on each cylinder and record reading			**4**
Compare to manufacturers specifications			**4**
TOTAL			**20**

2. Cylinder leakage test

Procedure	Reason	Mark	Total
Turn engine to TDC, no 1 cylinder firing			**2**
Connect leakage tester pipe to cylinder			**2**
Open compressed air			**2**
Take reading from gauges			**2**
Listen at air intake			**2**
Listen at exhaust			**2**
Listen at oil filler hole			**2**
TOTAL			**14**

3. Checking of ignition timing

Procedure	Reason	Mark	Total
Connection of timing light *(explain how timing light is connected)*			**2**
Cleaning of timing marks on pulley			**2**
Checking of ignition timing at idling			**2**
Checking of ignition at high revolutions			**2**
Adjust if needed			**2**
TOTAL			**10**

4. Multimeter

Procedure	Reason	Mark	Total
Test battery voltage			**2**
Test voltage drop during starting			**2**
Test continuity in a simple 12 V electrical circuit			**2**
TOTAL			**6**

TOTAL: 50

PHASE 4: THE LAMP STAND

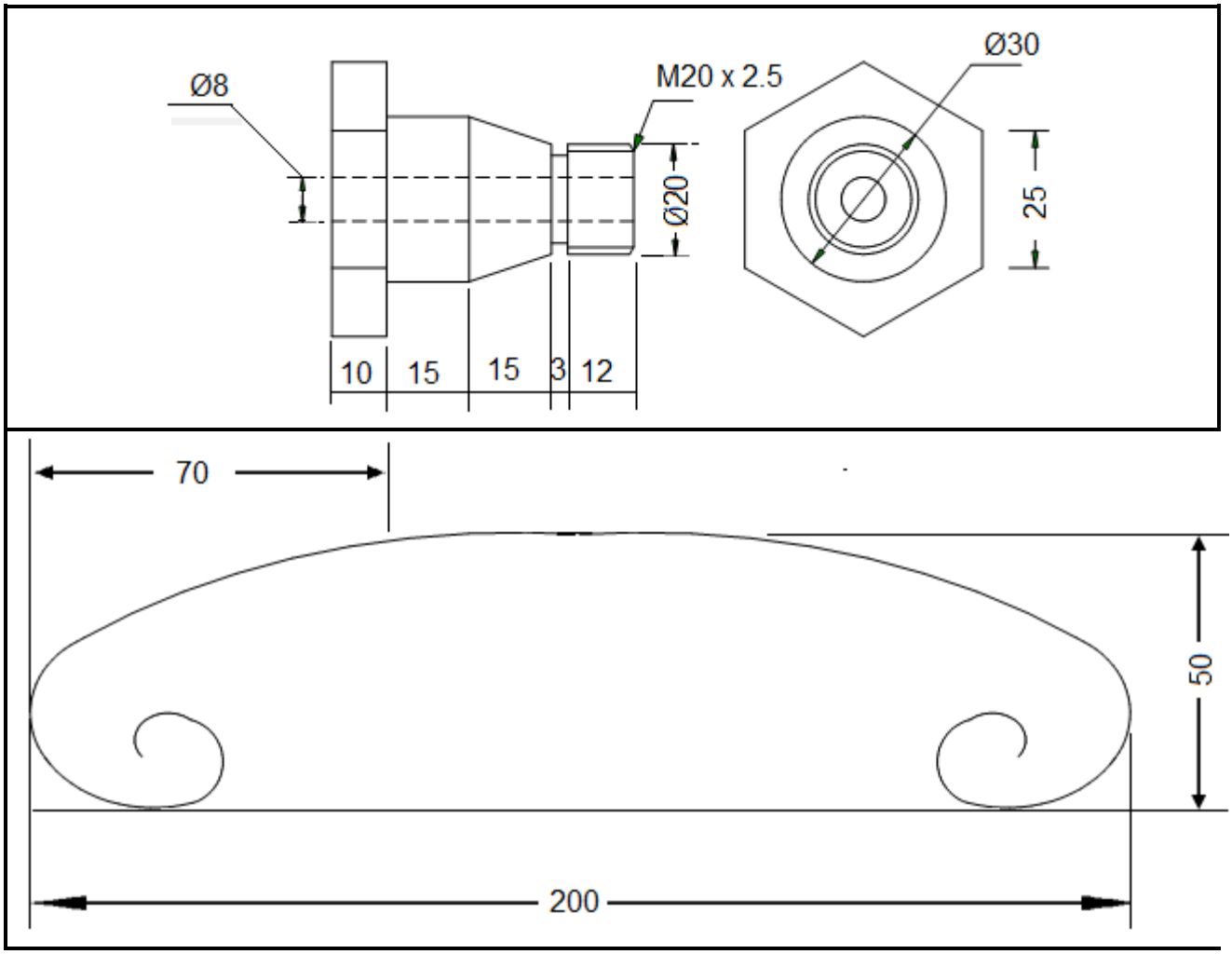

FIGURE 4: The Lamp stand

Resources:

- Ø50 mm mild steel, aluminium or nylon
- M20 x 2,5 nut
- 2 mm mild steel sheet
- Electrical wire
- Mini-switch
- Light bulb
- Light bulb fitting

Instructions:

Turning Piece:

- Cut off a 60 mm length of 50 mm diameter material (nylon, aluminium or mild steel)
- Face and centre drill both sides of the work piece to the final length of 55 mm in the lathe. Work to tolerances as designed.
- Turn the work piece to the required diameters as per drawing.
- Calculate the setting over of the compound slide and turn the taper.
- Calculate the depth of the M20 x 2,5 screw thread. Set up the lathe i.e. the change gears, lathe rotation speed, compound slide angle and dial indicator for the correct pitch. Cut the first thread and check with the screw thread gauge. Continue and check with a M20 x 2,5 nut.
- Calculate the depth of the cut for the hexagon.
- Set-up the work piece in the dividing head.
- Cut the hexagon.
- Drill a 8 mm diameter hole through the centre of the work piece and remove all sharp edges.

Scrolls:

- Cut 3 sheet metal strips of 20 x 2 x 360 mm and remove all sharp edges.
- Bend three identical scrolls as per drawing and mark-off 70 mm from the top curve.
- Space the three scrolls evenly on alternative flats of the M20 nut and secure with soft binding wire (70 mm mark) and tack in place
- Weld scrolls to nut.
- Finish off and paint.
- Assemble parts.
- Safety measures must be adhered to during manufacturing.

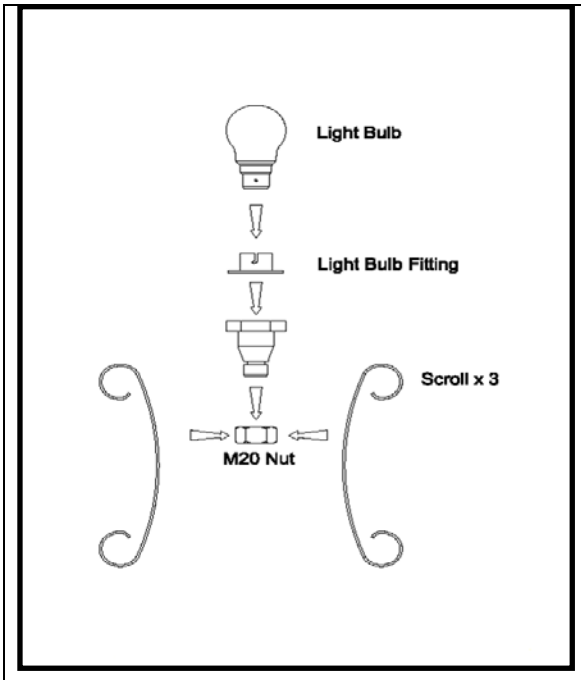

FIGURE 5: Exploded view Lamp stand

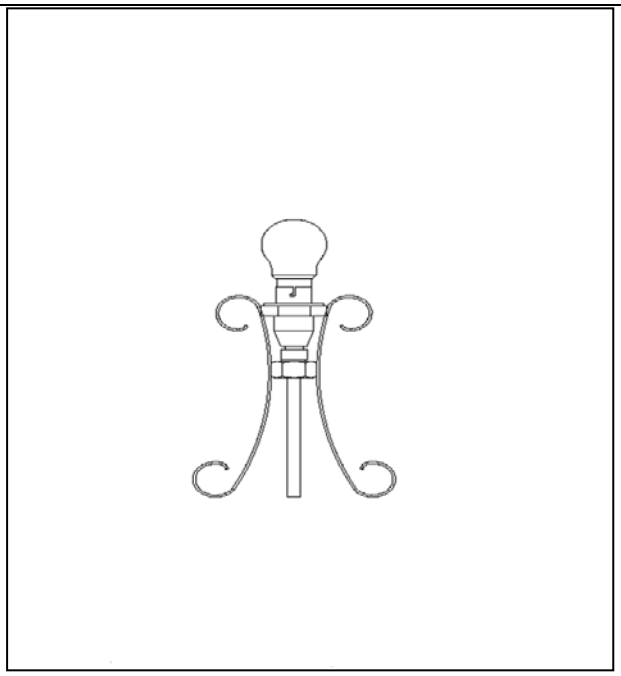

FIGURE 6: Assembly of Lamp stand

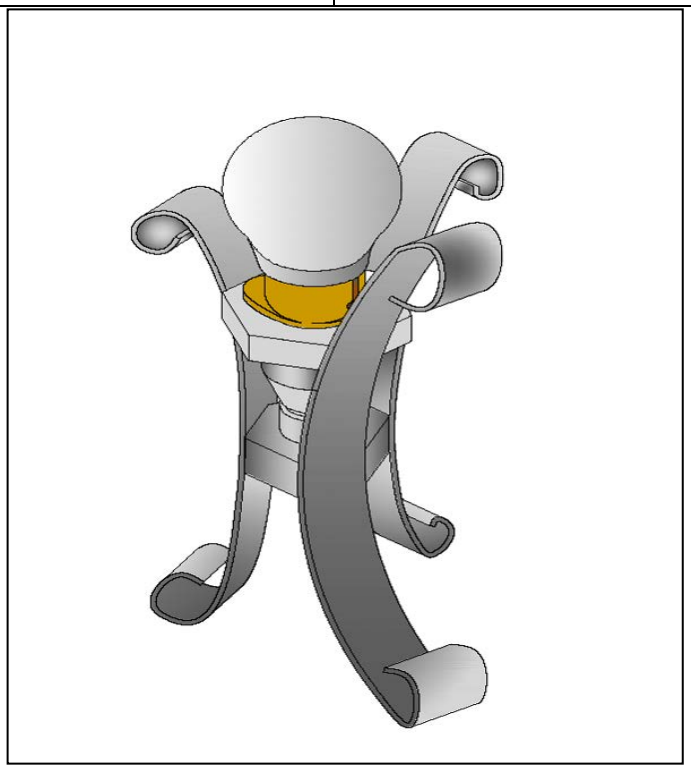

FIGURE 7: Shaded Isometric view of Lamp stand

Processes:

- Joining methods
  - Semi-permanent joining
  - Permanent joining
- Manufacturing processes
  - Turning
  - Milling
  - Thread cutting
- Manufacturing competency (Addressing the requirements)
- Fitness for purpose
- Finishing
- Quality
- Time

GRADE : 12	YEAR: 2014	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: MECHANICAL TECHNOLOGY		EDUCATOR:
PROJECT: PHASE 4		NUMBER OF LEARNERS:

		NAMES OF LEARNERS														
FACETS / **PHASE 4**	**MARKS**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Facing and centre drill	5															
Turn ø20	5															
Turn ø30	5															
Calculate taper	5															
Turn taper	5															
Calculate thread depth M20 x 2.5	5															
Cut M20 x 2.5 thread on centre lathe	10															
Calculate indexing	5															
Calculate depth of cut	5															
Cut hexagon	10															
Drill ø8mm hole & remove sharp edges.	2															
Cut and bend three of 20x2x360 scrolls	10															
Secure scrolls to M20 x 2.5 nut	10															
Finish and paint	3															
Secure lamp holder/fitting to turning piece	5															
Connect electrical parts and lamp shade	5															
Test for electrical continuity	5															
TOTAL	**100**															

EDUCATOR:	
HEAD OF DEPARTMENT:	
PRINCIPAL:	
SUBJECT ADVISOR:	

ANNEXURE A

DECLARATION OF AUTHENTICITY

NAME OF THE SCHOOL: ……..

NAME OF LEARNER: ……..

(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER: ……

NAME OF TEACHER: ……

SCHOOL STAMP

I hereby declare that the project submitted for assessment is my own, original work and has not been previously submitted for moderation.

_____ _____
SIGNATURE OF CANDIDATE **DATE**

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his or her own.

_____ _____
SIGNATURE OF TEACHER **DATE**

ANNEXURE B

TOLERANCE		TURNING		FILING Measured at 4 places	MILLING Measured at 4 places for flat surfaces
		DIAMETER	LENGTH		
		+ 0,03	+ 0,09	+ 0,09	+ 0,09
		- 0,03	- 0,09	- 0,09	- 0,09
DEVIATION	7	0,03 = 100%	0,09 = 100%	0,09 = 100%	0,09 = 100%
	6	0,06 = 80%	0,18 = 80%	0,18 = 80%	0,18 = 80%
	5	0,09 = 70%	0,22 = 70%	0,22 = 70%	0,22 = 70%
	4	0,12 = 60%	0,27 = 60%	0,27 = 60%	0,27 = 60%
	3	0,18 = 40%	0,36 = 40%	0,36 = 40%	0,36 = 40%
	2	0,21 = 20%	0,45 = 20%	0,45 = 20%	0,45 = 20%
	1	0,24 = 0%	0,54 = 0%	0,54 = 0%	0,54 = 0%