



basic education

Department:
Basic Education
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MECHANICAL TECHNOLOGY

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

2012

These guidelines consist of 21 pages.

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SECTION A (Teacher Guidelines)

1. The structure of the PAT for Mechanical Technology

Practical Assessment Tasks are designed to develop and demonstrate a learner's ability to integrate a variety of skills in order to solve a problem. The PAT also makes use of the technological process outlined in LO2, to guide the learner which steps need to be followed to arrive at a solution for the problem at hand.

The PAT is based on simulations and investigations. The PAT is made up of an integration (or a combination) of two or more areas of specialisation; i.e. motor mechanics, welding and metalwork and fitting and machining.

OPTIONS

The Practical Assessment Task for 2012 consists of three scenarios. Only ONE of the two scenarios should be chosen by the teacher.

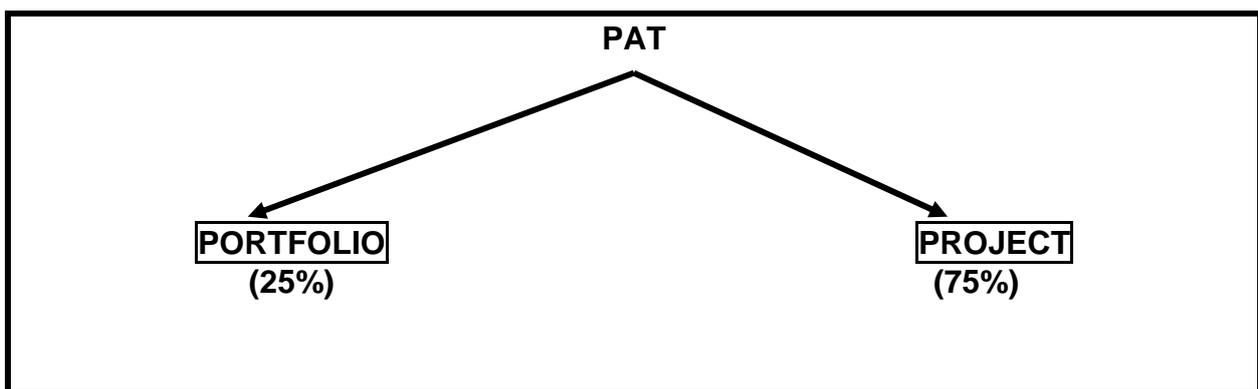


FIGURE 1: ELEMENTS OF PAT PROCESS

The design portfolio of the PAT should include evidence of how the development of the product or artefact was approached, that is:

- The planning process
- The knowledge and skills accumulated in the process
- The technological process followed
- The safety and environmental aspects considered
- The calculations used – if applicable, sketches or diagrams
- The starting time and ending time – how long it took to complete from start to finish
- The investigations undertaken
- User manual of product/artefact
- Bill of materials
- List of tools
- Any other information that is relevant to the project

As part of the design process learners must:

- Identify the problem and investigate means of solving the problem
- Design possible solutions
- Develop the preferred solution
- Evaluate the solution
- State the process followed in the project portfolio
- Construct the technological solution in the form of a product/artefact

In 2012 THREE scenarios (options) are provided.

2. Management of the PAT

The PAT should commence from the first term, as this is a lengthy and drawn out process and **CANNOT** be left to the last minute.

- i. All the components of the PAT (design portfolio, working drawings and model) should be completed and presented for assessment by the end of the third term before the commencement of the preparatory examination to allow sufficient time for the external moderation.
- ii. At this phase the teacher will do any final assessments, which are outstanding, and all learner portfolios and models are kept safely until the moderation process is completed (both Provincial and National moderation).
- iii. **The internal moderator/HOD must conduct moderation of the PAT throughout the year.**
- iv. It is imperative that the criteria are adhered to from the beginning, as this will form the basis for assessment.
- v. Teachers cannot penalise learners on points, which are not included in the initial criteria.
- vi. Upon selection, learners may be required to showcase skills and knowledge during moderation (face moderation).

The communication of the design is a continuous process and the learner will continuously make changes to this part of the portfolio as the PAT progresses.

Every teacher must design a pacesetter to indicate the completion dates for the different stages of the PAT, and manage this process in order to avoid crisis management and unnecessary stress nearer to the completion date of the PAT.

The submission dates for the different sections of the PAT as indicated in the pacesetter should be given to learners in writing.

3. Administration of the PAT

Teachers can attach due dates for the different stages of the PAT in Table 1 on page 10. In this manner, learners can easily assess their progress. In instances where formal assessment takes place, it is the responsibility of the teacher to administer assessment.

The PAT should be completed in the first three terms and handed in at the end of the third term. The PAT should be based on real-life situations and completed under controlled conditions. (Refer to the SAG, Jan 2008.)

Teachers are requested to make copies of **Section B** of this guideline and to distribute it 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 handed out.

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 tasks 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 should always be conducted by the teacher and will be recorded.

Learners must submit the product or artefact for assessment by the end of the third term. The accompanying design portfolio must also be submitted for assessment at this time.

4.2 Moderation

During moderation of the PAT, the design portfolio and the artefact will be presented to the moderator.

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. The sequence of events according to the technological process may also be requested from the learner.

SECTION B: THE PRACTICAL ASSESSMENT TASK (Learner Task)

1. Instructions

The Practical Assessment Task (PAT) consists of a practical task to be completed over three terms. The PAT consists of a design portfolio and a product/artefact and a practical skills assessment task. Learners are expected to **choose ONE** of the three scenarios to complete the Practical Assessment Task.

2. Scenarios

2.1 Scenario 1 (Option 1)

Mr Jones and his wife is an elderly couple and need a product that will fit easily in the boot of a car to be used by them to carry their groceries/goods during and after their visit to town.

Design a product to help Mr and Mrs Jones to transport their groceries/goods from the car to the kitchen or shop to the car with a minimum effort. Take into consideration the weight and size of the product you design. Use the specifications and constraints to guide you with your design.

Show evidence that you gathered information to assist you to design and make a product to address the problem of Mr Jones and his wife.

Specifications and constraints:

- Product should be lightweight and easily handled by one person
- Product must be easy to use
- Product must be rust proof
- Design must include some turning work done on a lathe (thread cutting, taper turning and parallel turning)
- Work to tolerances as designed (within $\pm 0,1$) – refer to Annexure F
- Design could include a milling machine operation
- Product must be stable and safe to use
- Product design must be of such a nature as not to damage the inside of the boot or body of the vehicle
- Product to be foldable to fit into the boot of the car
- The product needs to have at least two wheels
- Safety measures must be adhered to during manufacturing
- Product must be cost effective – inexpensive in relation to current market-related products

Rubrics on processes:

- Joining methods
 - Thread cutting
 - Press fitting
 - Welding
- Manufacturing processes
 - Turning
 - Milling
- Manufacturing competency (addressing the requirements)
- Fitness for purpose
- Finishing
- Quality
- Time

Rubrics on processes:

- Joining methods
 - Thread cutting
 - Press fitting
 - Welding
 - Semi-permanent joining (bolts and nuts)
 - Permanent joining (welding)
- Manufacturing processes
 - Turning
 - Milling
- Manufacturing competency (addressing the requirements)
- Fitness for purpose
- Finishing/Quality
- Time

2.2 Scenario 2 (Option 2)

Many people staying in flats and town houses in high-density areas would like to beautify their homes with different products but find that living space is generally a problem.

Design and make a decorative multipurpose product that does not take up a lot of space and can be used in your dwelling to display flower pots, ornaments, objects and pictures as a combination. The specifications and constraints should guide you with your design.

Specifications and constraints:

- Safety measures must be adhered to during manufacturing.
- Final product must be aesthetically pleasing to the eye.
- Product can be free standing or wall mounted or movable.
- If the final product is free standing it must stand very firm and be stable.
- Any decorations to give product an aesthetically pleasing finish must be made by the learner as **no ready-made** decorations may be used.
- Must be cost effective – inexpensive in relation to current market-related products.
- Must be treated against corrosion.
- At least two types of permanent joining methods must be used during manufacturing.
- If handles form part of the product semi-permanent joining methods may be used.
- Because the product is decorative finishing must be of a high standard.

Rubrics on processes:

- Joining methods
 - Semi-permanent joining (bolts and nuts)
 - Permanent joining (welding)
- Manufacturing processes
 - Turning
 - Milling
- Manufacturing competency (addressing the requirements)
- Fitness for purpose
- Finishing/Quality
- Time

2.3 Scenario 3 (Option 3)

Workshops need to be cleaned on a regular basis and this is very time consuming. The owner of a manufacturing firm requested you to design a hand held mechanical product that can clean the floor from dust and rubbish to save time and be safe to use. The product must be able to pick up the dust and rubbish by the forward/backward movement of it.

Show evidence that appropriate information has been gathered to assist you to design and make a product to address the problem of cleaning the workshop quicker and safer without injury to yourself when collecting rubbish. Take the specifications and constraints into consideration when doing your design.

Specifications and constraints:

- Design must include advance turning (thread cutting, taper turning and parallel turning)
- Work to tolerances as designed (within $\pm 0,1$) – refer to Annexure F
- Design must include at least two milling machine operations
 - One of the milling operations must include indexing
- The product needs to be effective under normal walking speed
- Minimum sweeping width must be 300 mm
- Product must be stable and safe to use
- The product needs to have at least two wheels
- The collecting bin to be cleaned easily
- Safety measures must be adhered to during manufacturing
- Product must be cost effective – inexpensive in relation to current market-related products

Rubrics on processes:

- Joining methods
 - Thread cutting
 - Press fitting
 - Welding
- Manufacturing processes
 - Turning
 - Milling
- Manufacturing competency (addressing the requirements)
- Fitness for purpose
- Finishing
- Quality
- Time

THE TECHNOLOGICAL PROCESS MUST BE EVIDENT

Specifications and constraints

The **cost factor** must be taken into consideration in making the artefact/product affordable. The weight of the /product must also be considered when designing. Use your knowledge of different materials to assist you come up with the best possible solution.

1. Design brief and artefact

The design brief should be clearly written. Design the artefact/product so that it can be stored easily. The artefact/product must also be manufactured to full scale. The artefact/product must be neat and absolutely functional.

2. The Design Portfolio (the documentation you must compile)

The portfolio must contain the following:

- Drawings of the artefact/product
- Pictures of the artefact/product
- Description of its operation
- Freehand sketches of the different ideas
- The original/selected design and a line drawing with all the changes you have made to it
- The portfolio must contain a list of the tools used to build it.
- The portfolio must contain a parts list of the artefact/product.
- The design portfolio must **not be less than four pages** and **not more than eight** pages

The following additional criteria may be considered:

The portfolio includes a marketing strategy which shows:

- The retail price at which the unit can be sold to the public (show your percentage profit margin)
- An advertisement of the artefact/product which can be published in the local community newspaper (not smaller than 15 cm x 15 cm)

Indicate (from your research) who might buy a artefact/product like this (target market).

3. Completing the PAT

In completing the PAT you will have to go through a number of phases. The guideline in TABLE 1 below will assist you in completing the PAT in time for external moderation.

NOTE: The task must also be evaluated at each phase of the technological process.

Phase	Completion date
1. Investigating	February
2. Designing: Research task	March
3. Designing: Portfolio	April
4. Making: Practical skills and Project (artefact)	May to August
5. Evaluating	First week of September
6. Communicating	Second week of September

TABLE 1: DUE DATES FOR THE DIFFERENT STAGES OF PAT

3.1 Phase 1 – Problem statement (Identify/Investigate)

The scenario has been given to you. You must respond by writing a design brief.

Design Brief	<p>Identify the problem you are being faced with. What is it that is asked of you?</p> <p>Write down, in your own words, what the problem is.</p> <hr/> <hr/> <hr/> <hr/> <hr/>
Solution Statement	<p>List not fewer than THREE possible solutions you may consider to solve the problem that you have been tasked to solve.</p> <hr/> <hr/> <hr/> <hr/> <hr/>

Time needed for completion – 1 month. This part of the PAT should be completed by the end of February.

3.2 Phase 2 – The Design (acquisition of information and skills)

3.2.1 Research Task

- Find information on each of the possible solutions you have listed.
- Compile a criteria list to assist you in choosing the best solution. The list must address all the specifications/constraints that must be met and you are allowed to add your own criteria as well.
- Using these criteria, judge/assess the possible solutions and choose the one that best meets these criteria.
- Motivate why you have decided on the chosen solution.
- Plan how long it will take you to complete the project. Set short-term and long-term goals and also set dates by when you plan to reach each phase.
- Place all your research in the Design Portfolio under the heading **Research Task**.

3.2.2 Design Portfolio

- A neatly drawn diagram of the artefact/product with measurements
- List the tools required
- Compile a components list with cost and specifications
- Choose a possible name(s) for your artefact/product/device
- Design a logo for the artefact/product/device
- Compile all your designed material and place it in the design portfolio under the heading **Capability Task**
- Prepare the production procedure and place it in the design portfolio under the heading **Capability Task**

3.3 Phase 3 – The Make (Production and evaluation)

On completion of your design and drawings, proceed to the production of the artefact/product. Consider the following points:

Manufacturing/Modification of the artefact/product:

- Take care that you follow the initial design you made for the artefact/product.
- Should you need to adapt your design at this phase, capture your design changes in a drawing and add that to the initial design. This happens a great deal in industry and is normal.
- Motivate why you changed your initial design.

3.4 Phase 4 – Evaluation

Upon completion of the artefact/product, finalise the Design Portfolio for assessment.

3.5 Phase 5 – Communication

The **Design Portfolio** must contain the following subdivisions:

- **The learner task**
- **Declaration of authenticity by the learner**
- **Summarising record sheet**
- **Research:**
 - Listed information
 - Criteria list
 - Possible solutions
 - Chosen solution
 - Planning and goal setting
- **Design and manufacturing:**
 - Enclosed design
 - Tools list
 - Components list with cost and specifications
 - Artefact/product design
 - Name and logo of the artefact/product
 - Production procedure
 - Evidence of prototyping
 - Tabulated prototyping findings
- **Evaluation and communication**

The artefact/product needs to remain with the design portfolio.

Assessment Criteria

The following assessment tools must be used to assess the PAT:

- The rubric displayed in Annexure A is for assessing the **design portfolio and process**. This mark will contribute **25%** to the final PAT mark.
- The rubric displayed in Annexure B is for assessing the final product/artefact. The following should be assessed: **safe use of tools; correctness of the product/artefact; planning, surface finish and modeling of the product/artefact**. This mark will contribute **75%** to the final PAT mark.

MECHANICAL TECHNOLOGY

PRACTICAL ASSESSMENT TASKS

2012

ASSESSMENT TOOLS

ANNEXURE A: RUBRIC FOR ASSESSMENT OF DESIGN PORTFOLIO

CRITERIA	7	6	5	4	3	2	1	MARK
	80–100%	70–79%	60–69%	50–59%	40–49%	30–39%	0–29%	
10	8–10	7–8	6–7	5–6	4–5	3–4	1–3	
20	16–20	14–16	12–14	10–12	8–10	6–8	1–6	
30	24–30	21–24	18–21	15–18	12–15	9–12	1–9	
40	32–40	28–32	24–28	20–24	16–20	12–16	1–12	
Presentation	Exceeded the required information, extremely neat: Name Register class Year 20... Appropriate cover illustration Appropriate title Index All sections Page numbers	Required information very neat: Name Register class Year 20... Appropriate cover illustration Appropriate title Index All sections Page numbers	Adequate information from list below, neatly presented: Name Register class, Year 20. Appropriate cover illustration Appropriate title Index All sections Page numbers	Necessary information from list below, neatly presented: Name Register class Year 20... Appropriate cover illustration Appropriate title Index All sections Page numbers	Limited information from list below, neatly presented: Name Register class Year 20... Appropriate cover illustration Appropriate title Index All sections Page numbers	Lack of essential information, not very neatly presented	Only name and register class untidily presented	20
Development of a design brief	The design brief is extremely well formulated and defines the need or opportunity. It lists detailed specifications and constraints.	The design brief is very well constructed and defines the need or opportunity. It lists detailed specifications and constraints.	The design brief is well constructed and defines the need or opportunity. It lists detailed specifications and constraints.	The design brief defines the need or opportunity and provides a list of specifications and constraints.	The design brief defines the needs or opportunity and provides limited specifications.	The simple design brief makes little reference to the need or problem.	The design brief is vague and lists no specifications or constraints.	20
Investigation and analyses information	Shows evidence of a variety of strategies *(6) of investigation used to obtain all relevant information to assist in developing innovative design ideas.	Uses a wide range*(5) of appropriate information sources to develop innovative design options.	Uses of a range of information sources*(4) which shows understanding for the problem or need.	Uses adequate sources *(3) to collect relevant information to assist with design ideas.	Uses relevant research *(2) to address the problem or need identified in the design brief.	Uses less than adequate sources* (1) and collects less than adequate information.	Collects very little relevant information *(0).	20

CRITERIA	7	6	5	4	3	2	1	MARK
	80–00%	70–79%	60–69%	50–59%	40–49%	30–39%	0–29%	
10	8–10	7–8	6–7	5–6	4–5	3–4	1–3	
20	16–20	14–16	12–14	10–12	8–10	6–8	1–6	
30	24–30	21–24	18–21	15–18	12–15	9–12	1–9	
40	32–40	28–32	24–28	20–24	16–20	12–16	1–12	
Generation of design ideas	Generates an excellent variety of alternative and innovative ideas with different approaches to address the problem or need. Justifies the preferred option with clear links to the design brief.	Shows evidence of a wide range of communication methods used to develop original and creative design options. Substantiates well choice of final design.	Shows evidence of a range of communication methods used to develop original and creative design options including modelling design ideas. Explains well reasoned choice of final design.	Uses a good variety of alternatives exploring different approaches. Well reasoned choice of final design.	Considers alternatives but lacks in originality and flair. Indicates final design choice.	Offers some alternatives but tends to be a collection of existing products with limited reasoning of choice. Shows limited links with research done.	Shows little or no exploration of alternatives.	20
Communication of ideas	Develops a very interesting solution and communicates it exceptionally well using appropriate techniques and methods. Uses modelling ideas to test and explore design thinking.	Develops a very interesting solution and communicated it very well using appropriate techniques and methods.	Develops an interesting solution and effectively communicates it effectively using appropriate techniques.	Reasons well for choice of solution. Uses good overall communication techniques.	The solution lacks creativity with limited communication techniques used.	The solution lacks creativity with inappropriate communication techniques used.	The solution lacks detail, making interpretation difficult. Scant attention is given to communication techniques.	10
Evaluation of product or artefact	Comprehensively evaluates the product against the design brief taking account of the user and cost-effectiveness. Evaluates procedures, techniques and processes and indicates possible improvements. Evaluates the appropriateness of the materials used.	Evaluates the product against the design brief taking account of the user and cost-effectiveness. Evaluates procedures, techniques and processes and indicates possible improvements. Evaluates the appropriateness of the materials used.	Evaluates the product against the design brief. Present suggestions to improve on function. Evaluates the appropriateness of the materials used with limited suggestions for improvement.	Evaluates the product against the design brief. Evaluates the appropriateness of the materials used.	Superficially evaluates the product against the design brief. Makes recommendations to improve its functionality.	Very superficially evaluates with limited recommendations.	Shows little or no evidence of an evaluation of the project.	10

ANNEXURE B: RUBRIC FOR ASSESSMENT OF FINAL PRODUCT/ARTEFACT

CRITERIA	7	6	5	4	3	2	1	MARK
	80–100%	70–79%	60–69%	50–59%	40–49%	30–39%	0–29%	
10	8–10	7–8	6–7	5–6	4–5	3–4	1–3	
20	16–20	14–16	12–14	10–12	8–10	6–8	1–6	
30	24–30	21–24	18–21	15–18	12–15	9–12	1–9	
40	32–40	28–32	24–28	20–24	16–20	12–16	1–12	
FITNESS FOR PURPOSE	This product has an outstanding level of functionality. It shows a very high level of innovation that is appropriate to the design brief.	The product demonstrates a high level of functionality. It shows a high level of innovation that is appropriate to the design brief.	The product fulfills adequately the purpose for which it was designed. It shows some innovation that is appropriate to the design brief.	The product fulfills satisfactorily the purpose for which it was designed. It shows limited innovation for the identified need/problem.	The product fulfills its functional requirements. No evidence of innovation in the solution to the identified need/problem.	The product barely fulfills functional requirements but lacks any refinement/innovation.	The project is incomplete and does not fulfil the identified need/problem.	20
MANUFACTURING COMPETENCY	Demonstration of an outstanding level of skill/competence in the correct and safe use of a wide range of materials, tools, equipment and machines under teacher supervision.	Demonstrates a very high level of skill/competence in the correct and safe use of a wide range of materials, tools, equipment and machines under teacher supervision.	Demonstrates a high level of skill/competence in the correct and safe use of a range of materials, tools, equipment and machines under teacher supervision.	Demonstrates a satisfactory level of skill/competence in the correct and safe use of appropriate materials, tools, equipment and machines under teacher supervision.	Demonstrates an acceptable level of skill/competence in the correct and safe use of appropriate materials, tools, equipment and machines under teacher supervision.	Demonstrates some regard for accuracy and safety in the use of materials, tools, equipment and machines under teacher supervision.	Demonstrates a lack of skill/competence in the use of appropriate materials, tools, equipment and machines under teacher supervision. Pays little attention to safety.	40

CRITERIA	7	6	5	4	3	2	1	MARK
	80–100%	70–79%	60–69%	50–59%	40–49%	30–39%	0–29%	
10	8–10	7–8	6–7	5–6	4–5	3–4	1–3	
20	16–20	14–16	12–14	10–12	8–10	6–8	1–6	
30	24–30	21–24	18–21	15–18	12–15	9–12	1–9	
40	32–40	28–32	24–28	20–24	16–20	12–16	1–12	
PLANNING	Demonstrates continual review of the making process. Shows outstanding ability to adapt and modify the design when difficulties arise. Adopts procedures to minimise waste, manages time outstandingly well.	Reviews design during the making process, demonstrates resourcefulness and adaptability in making modifications to ensure a high quality product. Excellent waste and time management.	Shows ability to adapt and modify the design when difficulties arise. Adequate planning to minimise waste, manages time well.	Apply knowledge of materials and processes to overcome problems in making when these arise. Demonstrates a good sense of material and time management.	Shows evidence of adopting alternative ways of proceeding when difficulty is experienced. Seeks assistance from educator to proceed. . Demonstrates some sense of material and time management.	Shows little evidence of alternative ways of proceeding when difficulty is experienced. Does not seek assistance from educator and to proceeds regardless of time and material management.	No attempt made to overcome making problems. No proper planning evident resulting in any regard for time and material management.	20
SURFACE FINISHING	An outstanding degree of skill in the surface finishing is demonstrated. The surface finish is of an exceptional quality.	A very high degree of skill in the surface finishing is demonstrated. The surface finish is blemish free.	A high degree of skill in the surface finishing is demonstrated.	A satisfactory level of skill in the surface finish is demonstrated but with some blemishes evident.	A low level of skill in the surface finishing is demonstrated. Blemishes are evident.	A very low level of skill in the surface finishing is demonstrated.	No surface finish evident.	20
MODELLING THE PRODUCT	Exceptionally modelled to illustrate, realistically, function for which it was developed	Specialist modelling techniques used to demonstrate, realistically, the function for which it was developed.	Product is effectively modelled to illustrate the function for which it was developed.	Product is adequately modelled to illustrate the function for which it was developed.	Product is modelled to illustrate the function for which it was developed.	Product barely illustrates the function for which it was developed.	No clarity as to how the product is to function.	20

ANNEXURE C

DECLARATION OF AUTHENTICITY

NAME OF THE SCHOOL:

NAME OF LEARNER:

(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER:

NAME OF TEACHER:



I hereby declare that the portfolio and artifact/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 F: TOLERANCES

TOLERANCE	TURNING		FILING	MILLING
	DIAMETER	LENGTH		
DEVIATION	0,1 = 7	0,1 = 7	0,1 = 7	0,1 = 7
	0,2 = 6	0,2 = 6	0,2 = 6	0,2 = 6
	0,3 = 5	0,3 = 5	0,3 = 5	0,3 = 5
	0,4 = 4	0,4 = 4	0,4 = 4	0,4 = 4
	0,5 = 3	0,5 = 3	0,5 = 3	0,5 = 3
	0,6 = 2	0,6 = 2	0,6 = 2	0,6 = 2
	0,7 = 1	0,7 = 1	0,7 = 1	0,7 = 1