

1. Objectives:

Mathematics is considered as a base of human civilisation and Practical is an inseparable part of Mathematics Curriculum at School level. Participation in Mathematics practical leads to problem solving skills, reduced fear of Mathematics and raised interest in learning Mathematics among the learners. The main objective of doing practical in Mathematics is to develop Mathematical skills among the learners so that they understand the mathematical tools such as Models, Scales, Graphs, and techniques like- Paper folding, Paper cutting and verification.

The purpose of introducing Formative and Summative assessments in Practical PCP is to ensure learners' involvement and active participation in PCP classes as well as continuous assessment which leads to learning.

2. Implementation:

There are 30 activities listed in the Practical Manual of Secondary Course in Mathematics (211). These activities are to be conducted in 5 PCPs as given below. These will be assessed through Formative (Continuous) assessment at the Study Centre. The Sixth PCP is reserved for final examination that will be assessed through summative (Final) assessment at the Study Centre. The dates for the practical examination (Final) will be notified by NIOS in the examination date sheet. 50% weightage is for each of Formative (Continuous) and Summative (Final) assessments. The maximum mark for Practical in Mathematics is 15. The *distribution of* activities in 05 PCPs is as follows:

First PCP Practical:

- (i) Orientation of the learners about distribution of activities to be performed and allocation of Marks for both the Formative (Continuous) and Summative (Final) assessments.
- (ii) Orientation of learners about different algebraic identities, equivalent fractions and concept of linear equations
- (iii) Learners have to choose **any two activities** to be performed from Algebra part (S. No. 1 to 4 and 28 of the Practical Manual) as:

- Verification of the Identify $(a+b)^2 = a^2+2ab+b^2$
- Verification of the identify $(a-b)^2 = a^2-2ab+b^2$
- Verification of the identify $a^2-b^2 = (a+b) (a-b)$
- Verification of the identify $(a+b)^3 = a^3 + 3a^2 + 3ab^2 + b^3$
- Verify the identify $a^3-b^3 = (a-b)(a^2+ab+b^2)$

Second PCP Practical:

- i. Orientation of learners about Fractions and concept of Linear and Quadratic equations.
- ii. Learners have to choose **any two activities** to be performed from Algebra part (S. No. 5 to 9 of Practical Manual) as:
 - To find H.C.F of two given numbers by division method
 - Demonstration of the concept of Equivalent Fractions
 - To verify that a linear equation in two variables has infinite number of solutions
 - To find the condition for consistency of a system of linear equations in two variables
 - To verify the relation between roots and coefficients of a quadratic equation

Third PCP Practical:

- i. Orientation of learners about Polynomial and Arithmetic Progressions (A.P)
- ii. Learners have to choose **any two activities** to be performed from Algebra part (S.No. 10 to 14 of Practical Manual) as:
 - To verify graphically that a quadratic polynomial can have at most two zeroes
 - To verify that a given sequence is an A.P.
 - To find the sum of first n odd natural numbers
 - To find the sum of first n natural numbers
 - To find the sum of first n terms of an Arithmetic Progression

Fourth PCP Practical:

- i. Orientation of learners about concept and properties of a triangle, Cyclic Quadrilateral and Circle.
- ii. Learners have to choose **any two activities** to be performed from Geometry part (S.No. 15 to 21 of Practical Manual) as:
 - To verify that the sum of the angles of a triangle is 180°
 - ✤ To verify that the angles opposite to equal sides of a triangle are equal
 - ✤ To verify the Mid-Point theorem
 - ✤ To verify basic proportionality theorem
 - ✤ To verify Pythagoras theorem
 - ◆ To verify the relation between the ratio of areas of two similar triangles and their sides

- ✤ To find the area of a circle
- ✤ To demonstrate that the opposite angles of a cyclic quadrilateral are supplementary
- ✤ To verify that equal chords of congruent circles subtend equal angles at the centre

Fifth PCP Practical:

- i. Orientation of learners about concept of Cube, Cuboid, Cylinder, Cone, Parallelogram and Trapezium
- ii. Learners have to choose **any two activities** to be performed from Mensuration part (S.No. 24 to 27 and 29-30 of Practical Manual) as:
 - To find the area of a trapezium
 - To find the total surface area of a cube
 - To find the formula for the curved surface area of a cone
 - To find the relationship among the volumes of a right circular cylinder, right circular cone and a hemisphere of same radius and same heights
 - To draw a triangle equal in area to a parallelogram
 - To find the in centre of different types of triangles

3. Scheme of Practical Examination:

The following scheme of practical examinations to be followed is as per the details given below:

- The conduct of practical examinations is mainly linked with practical PCP. There are 06 practical sessions which are compulsory.
- The initial five (05) PCP practicals have to be assessed through Formative (Continuous) Assessment and will be utilized for learning.
- The final (6th PCP) practicals will be utilized for Summative (Final) Assessment for practical examination.
- A weightage of 50% of the marks will be awarded for Formative (05 practical classes) Assessment and 50% marks for the 6th practical classes for Summative Assessment.

S. No.	Criteria for Assessment	Marks	<u>Remarks</u>
1.	Regular Participation in 05 PCP Classes	11/2	The five boxes under formative assessment in the award list will be filled up based on these 05 criteria.
2.	Activities Performed in 05 PCP Classes	11/2	
3.	Practical Record maintained in 05 PCP Classes	11/2	
4.	Use of practical instruments/equipments	11/2	
5.	Participation with Peer-Group and Tutor	11/2	
Total		71⁄2	

I. Marks Distribution in Formative Assessment (05 PCP Sessions):

II. Marks Distribution in Summative Assessment (6th Final PCP Class):

S. No.	Criteria for Assessment	Marks	<u>Remarks</u>
1.	Assessment of activity performed (Two activities out of given three activities)	$2 \ge 2\frac{1}{2}$ = 5	Time of 2½ hours will be allowed for final examination.
2.	Viva-Voce based on the activities	21/2	
	Total	7½	

Note: The total (Formative and Summative Assessment) weightage is 15 marks. In award list the marks obtained by the learner, both in Formative and Summative Assessment are to be mentioned clearly and the final figure is the sum of the marks of Formative and Summative assessment.

4. Preparations for PCP Practical Sessions:

- i. The Centre Superintendent and Tutor must read the instructions mentioned in the Guidelines for practical PCPs.
- ii. Check and arrange the materials, tools, equipments, etc. that will be needed in the Practical PCP sessions in advance.
- iii. Learners are informed about the schedule of Practical PCP sessions. Practicals may be arranged in groups of learners.
- iv. The attendance sheet must be properly maintained in each Practical PCP class.
- v. The award list must be filled up, as per the given assessment criteria.
- vi. The techniques of group work may be followed in Practical PCP sessions.
- vii. Learner shall be asked to bring the practical record books in each class. Each learner is expected to maintain it as per the instructions given in the practical manual.

5. Precautions (DO's and DONT's)

Discuss the following points with learners, regarding preparing the practical record book:

(i) Throughout the practical note book, the learner should follow the same style. Ask them to use a good fountain pen and a sharp black pencil. It is recommended that the right hand page should be written in blue ink and the left hand page with a black pencil.

Left hand page	Right hand page
Scale, Projections, Calculations	Title of the exercise, Date
Graph, Diagram and Figures,	Exercise No. Interpretation and conclusion

The recommended style of writing is shown below:

- (ii) Each experiment should start from a new page.
- (iii) A neat and proportionate Scale, Projections, Graph and Diagrams should be used.
- (iv) Mistakes should be crossed out with a single line so that it can still be read, the correct statement rewritten in its place.
- (v) No page should be tornoff from the practical record book.
- (vi) Before going to take the Practical Examination, get all the exercises of Practical Record Book signed by your tutors.

6. List of Activities:

There are 30 activities in the Mathematics Practical Manual. These 30 activities are distributed under three sections as:

6.1 Section-A (Algebra)

- ^{1.} Verification of the Identify $(a+b)^2 = a^2+2ab+b^2$
- 2. Verification of the identify $(a-b)^2 = a^2-2ab+b^2$
- 3. Verification of the identify $a^2-b^2 = (a+b)(a-b)$
- ^{4.} Verification of the identify $(a+b)^3 = a^3 + 3a^2 + 3ab^2 + b^3$
- 5. To verify the identify $a^3-b^3 = (a-b)(a^2+ab+b^2)$
- 6. To find H.C.F of two given numbers by division method.
- 7. Demonstration of the concept of Equivalent Fractions.
- 8. To verify that a linear equation in two variables has infinite number of solutions.
- 9. To find the condition for consistency of a system of linear equations in two variables.
- 10. To verify the relation between roots and coefficients of a quadratic equation.

- 11. To verify graphically that a quadratic polynomial can have at most two zeroes.
- 12. To verify that a given sequence is an A.P.
- 13. To find the sum of first n odd natural numbers.
- 14. To find the sum of first n natural numbers.
- 15. To find the sum of first n terms of an Arithmetic Progression.

6.2 Section-B (Geometry)

- 1. To verify that the sum of the angles of a triangle is 180°
- 2. To verify that the angles opposite to equal sides of a triangle are equal.
- 3. To verify the midpoint theorem.
- 4. To verify basic proportionality theorem.
- 5. To verify Pythagoras theorem.
- 6. To verify the relation between the ratio of areas of two similar triangles and their sides
- 7. To find the area of a circle.
- 8. To demonstrate that the opposite angles of a cyclic quadrilateral are supplementary.
- 9. To verify that equal chords of congruent circles subtend equal angles at the centre.

6.3 Section- C (Mensuration)

- 1. To find the area of a trapezium.
- 2. To find the total surface area of a cube.
- 3. To find the formula for the curved surface area of a cone.
- 4. To find the relationship among the volumes of a right circular cylinder, right circular cone and a hemisphere of same radius and same heights.
- 5. To draw a triangle equal in area to a parallelogram.
- 6. To find the in centre of different types of triangles.

Note: Material for practical examination will be provided by the centre superintendant at the practical examination centre, as per requirement of the activities.