COURSE –V (1.1.5.)

UNDERSTANDING DISCIPLINE AND SUBJECTS

UNIT-IV – MATHEMATICS AS A SUBJECT AND DISCIPLINE:

- **Nature and history of mathematics:-**

Definition of Mathematics:-

- ✖ According to various definitions, mathematics is the science of measurement, quality and magnitude. It has also been defined as the science of number and space. Its Hindi or Punjabi name is 'Ganita', which means the science of calculation.
- ✖ The mathematics is the numerical and calculation part of man`s life and knowledge. It helps the man to give exact interpretation to his ideas and conclusions.
- ✖ Mathematics may also be defined as the science of the abstract form.
- ✖ Mathematics is also called the science of logical reasoning. The reasoning in mathematics is of peculiar kind and possesses a number of characteristics such as simplicity, accuracy, certainty of results, originality, similarity, to the reasoning of life and verification.

  Nature of Mathematics:-
- ✖ Mathematical language and symbolism:-The most important characteristics of mathematics, which distinguishes it from many other subjects, are its peculiar language and symbolism.
- ✖ Lindsay says- "Mathematics is the language of physical sciences and certainly no more marvellous language was ever created by the mind of man".
- ✖ Example-the square of sum of two terms is equal to the sum of square of first term, square of the second term and double the product of the terms.
- ✖ Symbols are - +,-, x, |, , α, %, <, >
- ✖ As a Science of Numbers: - As we know already, that Mathematics began with the invension of numbers to count. Usually the written symbols for numbers which we use today= 1,2,3,4,5,6,7,8,and 9 , the way we put these number s together seems simple easy,

but it is in fact the cumulative product of centuries of development. Here the positions each digit in a sequence of numeral deeds its value.

- **As an Interpreter of Physical Phenomenon:-**

  We know that Mathematics is an integral part of the universe whose every aspect is quantitative. So quantitative science soon becomes quantitative with phenomenal advancement. It gives shape, form and definiteness to the properties of matter. Mathematics gives a workable symbolism for the brief and precise experience of ideas of all science. The quantitative can be expressed in mathematics form i.e., if we answer for how many? In addition, how much? So mathematics not only provides the means of measuring and calculating what the scientists wants, but also helps him to decide what he should measure and what he should calculate. Hence mathematics is called as interpreter of physical phenomenon.

- As an Abstract Science:-

  Abstraction is the art of perceiving an amount of qualities in different things and forming a general idea. We abstract, for instance, when we see cartwheel, automobile tyres as circle; we see cows, cats, and dogs as animal etc.

Historical perspective:-

1. **Value of history of mathematics**:- A teacher can be summarized the utility of history of mathematics :-

   (A) It shows the correlation of mathematics with other branches of knowledge.

   (B) It makes clear the fact that mathematics is a man-made science.

   (C) It makes the teaching of mathematics interesting.

   (D) It gives better understanding of the subject.

   (E) Etc.

   2. **The ancient civilizations and mathematics:-**

   (A) The Babylonians- The study of mathematics being with the notation of numbers. That number is called wedge shaped symbol.

   Exam- one was represent by v, ten was represent by < and Hundred by v <.

   (B) Roman System-the roman system is based on the idea of counting figure or line.

   Exam- I, II, III , IV etc.

Some great mathematician in the world

Name of Mathematician	period
Pythagoras	569 B.C ?.-500 B.C. ?
Plato	429 B.C.-348 B.C.
Euclid	330 B.C.-275 B.C.
AryaBhatta	ABOUT 350
Galileo	1563 A.D.-1642 A.D.
Cauchy	1759-1827
Ramanujan	1887-1920

Mathematics as a school subject:-

- **Mathematics as a compulsory subject in school:** - mathematics is like a back bone for science and technology subject. Hence it forms a compulsory component of any school curriculum.
- ***Importance:-*** Starting from the earliest time of human history till today mathematics has been playing an important role in human life. It is important in the life of every human being. Every educated man has to count numbers, add, subtract, multiply and divide numbers, to understand concepts of member and quantity, volume, mass, time, distance and all other physical attributes. So, we want to basic knowledge of numbers, measurement units of measurement, process of measurement and basic mathematical operation.
- **Need:-** we need to learn mathematics compulsory for the following reasons:-
    1. We need basic knowledge of mathematical skills to carry out several activities in life like counting, calculating, buying, selling etc.
    2. Mathematics disciplines the mind. Its help us to think precisely, accurately and logically.
    3. It helps us to draw calculations, to arrive at generalizations based on firm ground.

4. Knowledge of mathematics is required for higher learning in science and social science subject.

✖ **Branches to be taught at different levels:-**

The mathematics curriculum to be taught at different levels depends upon several factors-

1. The age and intellectual of learner.
2. The cognitive development level of children.
3. The entry behaviour of students, that is, the knowledge of basic concepts and mastery of skills, which are fundamental to learn higher-level content, has to be ascertained.
4. The needs of mathematics operations which are essential to every child in day to day activities.

Branches to be taught at different levels:-

Following these analyze the branches of mathematics that are taught to children at different levels of school education under the guidance of WBBPE & WBBSE.

1. Lower Primary Level (one to four):-
2. Higher primary level (five to seven):-
3. Secondary Level (VIII TO X):-

MATHEMATICS IN DAILY LIFE:-

1. When we get up we see the time of waking to verify whether we have enough time to attend to various responsibilities. **(Awareness of time, reading a clock / watch, planningone's routine.)**

2. When we brush our teeth the life of the brush, its cost, the paste, its available quantity to get new one come to one's mind. **(Cost accounting!)**

3. In this connection, use of water, its availability, conservation, proper use of waste water are relevant to think. **(Awareness of environment, nature, preservation of the same)**

4. Drinking coffee, tea, milk- the quantity, the temperature balance not affecting the tongue, quantity consumable, proportion of mixes constituting milk, coffee powder or decoction, boiling stage, filtering mechanism, washed cups / glasses ensuring health and a host of things require analysis, reasoning and attention. **(Practical knowledge of ratio andproportion in domestic life also)**

5. Same is the case with bathing. **(Water use and conservation)**

6. When it comes to wearing of dresses, the size, the make, its durability, its condition washed and ironed with creases etc., need knowledge of proportion, geometry.

(Measurement of length, skill in transformation of cloth into clothe and other ideas indicated)

7. Taking food as breakfast needs clear knowledge of proportion for preparation to have good taste- more salt, chilly etc., besides spoiling the taste will affect health too as proper balance has to be maintained. In that connection procurement of raw materials for preparation of food needs mention which involves calculation, commercial mathematics to study how a dealer measures, calculates and gives change! **(Practical study of commercial mathematics can be used as project at various levels.)**

8. Attending to one's place of study or work, duty involves transport, punctuality, comfort proportionate to one's means, time management and such other skills borrowed from mathematics! **(This study is interesting in itself with shades of time and work, time and distance with more in depth analysis as below)**

9. Fees / salary got calculated suitably for the person, post, work ethics, work involvement daily, weekly, monthly compared with the international or national or state standardization involves a good deal of mathematics though it may require some units of management and accounting which can be done effectively by a student of mathematics!

10. Leisure management requires a study of total time available, money available, types of entertainments available and taste of individuals to be observed, cultivated and practiced involving units of skills needed for each shade of the work**. (Ah! Entertainment industry gaining ground in the global economy also needs mathematical knowledge!)**

11. Planning for social accountability again requires commitment, universal love; money, mind and man management skills that are something like a corollary for the main theorem of life lived by a human individual. It will add luster to one's life to make one enjoy it to the full. In fact such tastes cultivated lead one to realize one's aesthetic potential to be of enjoyment to oneself as also to others around- near and far by this approach. The subject mathematics offers innumerable opportunities for a discerning person with a good background in mathematics to create new knowledge, to refine existing ones and to enjoy repeating certain structures exclusively for their aesthetic value which is a higher order personality trait. (Solving puzzles, riddles, construction of

magic squares in general, date magic squares studied by Ramanujan, construction of problems of this type are all possible if, taste in mathematics is cultivated and practiced.)Mathematics in everyday life 1. On a basic level you need to be able to count, multiply, subtract and divide. Mathematics is around us. It is present in different forms whenever we pick up the phone, manage the money, travel to some place, play soccer, meet new friends; unintentionally in all these things mathematics is involved. 2. There are huge illustrations that testify the presence of mathematics in everything that we are doing. We hope you will enjoy the following slides that illustrate mathematics in everyday life. Enjoy

Correlation in mathematics

INTRODUCTION: CORRELATION: -

"No subject is ever well understood and no art is intelligently practiced, if the light which the other studies are able to throw upon it is deliberately shut out."

Education is a co-ordinated process and the major aim of education is the 'unification of knowledge' existing in the different branches of learning.

Teaching of various subjects is hence correlated. Conscious effort is made to integrate various subjects to treat the subject as a synthetic whole. Herbert first conceived the idea of correlating the teaching of various subjects. 'All knowledge is one unit'.

"The power of the mind does not depend upon the amount of information accumulated in pieces, not related to one another, but is rather on well-organised system on which all these pieces of knowledge are taught, showing their relationship with one another. This is known as the principle of Correlation."

Later on Zillar made this theory of correlation more elaborate. Then De Garmo and John Dewey laid stress on the integration in the teaching of various subjects. Today, correlating of teaching of different subjects is considered highly essential.

CORRELATION MEANING:-

What is correlation?

The term 'correlation' in its simplest form means "connect or to be connected". To be more precise, 'Correlation' mean mutual relations of two or more things/persons. But , Correlation in

teaching indicates a technique which shows the reciprocal relationship between various subjects of the curriculum for making the knowledge concrete and permanent". It is the conscious effort made by teachers teaching various subjects, to show similarities or dependence of one subject on another".

DEFINITION: CORRELATION:-

SIMPSON and KAFKA: "Correlation analysis deals with the association between two or more variables."

FERGUSON: "Correlation is concerned with describing the degree of relation between variables.

A.M. TAULE: "Correlation is an analysis of co-variation between two or more variables".

Thus 'correlation' is just a mutual relationship between various variables, i.e., subjects of school/college curriculum.

- SIGNIFICANCE OF CORRELATION

The most significant development of the 21th century education is the emphasis on imparting unified, integrated and meaningful knowledge of the pupils. Imparting of knowledge in the isolated facts of History, Geography, Science, and Economics etc. has become obsolete. A child's mind is an integrated whole which wants to receive experiences in an integrated manner

Uses of Correlation are as follows:

1. Mind perceives knowledge as a whole.

Earlier: Assumed Human Minds consists of so many mental faculties and each faculty like faculty of reasoning, thinking, memorization etc, were supposed to be developed through the study of a specific subject. So each subject had an independent function. But Education Psychologists have disregarded this study.

Now: Mind consists as a whole and so receives knowledge as a whole.

2. All the subjects aim to develop the intellectual power of the students as a whole.

Therefore it becomes necessary to correlate one subject with another. No subject can be taught in isolation.

PRINCIPLES OF CORRELATION:-

- It should be simple, natural, suited to the nature of the subject and the stage of the pupil's mental development.

- It should be adequate and judicious.
- Main topic or main subject should be the main focus. Other topics/subjects should be linked to it and then revert again to the main topic.
- When doing systematic correlation, teachers could sit together and discuss how to correlate.
- It should involve the previous knowledge of the students.
- It should be done only where it is possible, else it leads to superficial correlation. Eg. The study of voyage of Columbus cannot lead to ocean currents, invasion of Alexander to the calculation of its expenses. The secondary topics do not help in understanding the primary ones.

TYPES OF CORRELATION:

1. **Correlation with Practical Life:** correlation of the given subject with daily activities.
   - According to Herbert Spencer, the main aim of education is to prepare students for future life. This aim can be achieved only if education is correlated with life. Therefore, teaching of various subjects should be correlated with various aspects of life.
   - A subject is best understood when it is applicable to daily life.
   - Correlation of a subject with daily life is of the utmost importance in order to create interest in the subject.
   - Correlation with daily life makes the subject relevant instead of being only theory with no practical applications.
   - Maths: Apply the formulas to calculate areas of rectangle or square to calculate area of classroom area or home.
   - Science: give evidences of the scientific phenomena. E.g. give the eg of the droplets formed in an AC car. Or Use of Al foil to pack foods, to explain it's oxide forming property.
   - Vertical / Internal Correlation: correlation between the different branches of a given subject.
   - Horizontal / External Correlation: correlation between the given subject and other subjects.

2. Vertical / Internal Correlation :

- This type of correlation indicates the relationship between different branches (or various divisions)of a given subject.
- It also includes correlation of different topics in the same branch of a given subject.(correlation of old knowledge with new knowledge)
- Branches of a subject many a times are taught by different teachers, such that each branch is treated as a different entity.
- Internal correlation is necessary for continuity of knowledge and understanding of the subject.
- A commerce teacher can take help of vertical correlation to make his students understand about trade, internal trade, external trade and export-import procedures etc.
- An economics teacher can take help of vertical correlation to correlate production, consumption, distribution, exchange, etc.
- Science teacher uses vertical correlation to correlate physics and chemistry or chemistry and biology and physics, or biology and physics etc.
- A mathematics teacher would use vertical correlation to correlate Arithmetic and Algebra or Algebra and Geometry etc.
- A History teacher would use vertical correlation to correlate history of early age to ancient or medieval or modern or to correlate political history to economic history or social history or to correlate ancient history to economic history or world history to local history etc.
- A Geography teacher would use vertical correlation to correlate physical geography with human geography or economic geography with political geography or physical geography with historical geography.
- A language teacher would use vertical correlation to correlate poetry, prose, grammar, composition.

3. Horizontal/External Correlation:

- This type of correlation is between different school subjects and a given school subject.

- All subjects of the school curriculum contribute towards the realization of the aims of education.
- Since they have the same purpose, study of one subject helps in the study of other subjects.
- In horizontal correlation an attempt is made to co-ordinate the teaching of various subjects. This is done by three methods - Casual and Systematic and Concentric.

- **CORRELATION OF MATH WITH OTHERS SUBJECT:**

MATHS AND SCIENCE:-

- The math teacher can teach students about exponential notation. Once students become proficient in reading and writing numbers in exponential form, and in converting numbers between exponential form, factor form, and standard form, they can apply this knowledge to topics in science. For example, they can write the distance between the sun and each planet using scientific notation.
- Exponential Form 22 Standard Form2 x 2 AND Factor Form 4

MATHEMATICS AND PHYSICS:-

- Mathematics gives final shape to the rules of physics, it presents them in workable form.
- Mathematical calculations occur at every step in physics.

MATHEMATICS AND CHEMISTRY:-

- For estimation of element in organic compounds, the use of percentage and ratio has to be made.
- Molecular weights of organic compounds are calculated mathematically.
- Balancing equations

MATHEMATICS AND BIOLOGY:-

- First paper that Mendel wrote on his discovery of Mendelian laws was called "Mathematics of Peas"
- Rate of respiration, transpiration

- Normal weight calculation
- Caloric and nutritive value of food is calculated using math's
- The growth in weight of infants up to nine months.

MATHS AND SOCIAL SCIENCES:-

- After teaching a unit on how to read, interpret, and draw graphs, you can have your students apply these skills to topics in Social Studies. For example, they can draw bar graphs to compare the Population, Per Capita Income, and Population Density of various countries.

MATHEMATICS AND GEOGRAPHY:-

- From the globe to the map
- Distances on the earth and distances on maps: what the scale is, why and how one has to preserve the proportion.
- Various methods of mapping the earth: what happens to the distances? Mapping to globe versus mappings to plane maps.
- Formation of days and nights
- Lunar and solar eclipse
- Latitude longitude
- Height above sea level
- Calculation of international, local , standard time
maximum and minimum temperature
- Barometric pressure.
- Surveying instruments in math's have to be mathematically accurate.

MATHEMATICS AND ECONOMICS:-

- Statistical methods are applied to economic forecasts
- Trade cycles
- Volume of trade
- Trend of exports and imports
- Public money

- Theory of probability is the basis of insurance

MATHEMATICS AND FINE ARTS:-

- Arts uses the mathematical ideas of ratio and proportion, including similarity and scale
- Appreciation of rhythm in music, proportion, balance and symmetry postulates a mathematical mind.

MATHEMATICS AND HISTORY:-

- Math's helps history in calculation of dates.
- Alexander invaded India in 327 BC tell, how many years have passes the occurrence of the said event?

MATHEMATICS AND LANGUAGE:-

- Math and writing
- A math's teacher teaches about drawing a pie chart and asks them to write a interpretation in their own words.
- Math and reading
- Students read about the work of great mathematicians
- Students make poems on numbers.