EDU104.17 UNDERSTANDING THE DISCIPLINE OF PHYSICAL SCIENCE

Module 2

Conceptual Background of Science

2.1 Nature of Science

What Is Science?

Origin of the Word Science

- **Latin Word- ‘Scientia’**
- **Meaning – Knowledge**

Meaning Of Science

Literal Meaning-

- **Pursuit of knowledge**
- **Heap of truth**
- **Systematised body of knowledge**
- **An interpretation of the natural phenomenon**
- **Way of investigation**

Definition

Fitzpatrick: Science is a cumulative and endless series of empirical observations which results in the formation of concepts and theories with both concepts and theories being subject to modification in the light of further empirical observations Science is both a body of knowledge and the process of acquiring it .

The Editors of Encyclopaedia Britannica

Science: any system of knowledge that is concerned with the physical world and its phenomena and that entails unbiased observations and systematic experimentation. In general, a science involves a pursuit of knowledge covering general truths or the operations of fundamental laws.

Nature of Science

- **Science is a Noun as well as a Verb**
- **Science is tentative (subject to change).**
- **Science is empirically based (based on or derived from observation of the natural world).**
- **Science is inferential, imaginative and creative.**

Nature of Science

- **Science is a blend of logic and imagination**
- **Science demands evidence**
- **Science cannot provide complete answers to all questions**
- **Science is subjective and theory laden.**
- **Science is socially and culturally embedded**

- **Scientific Knowledge Is Durable**

Although scientists reject the notion of attaining absolute truth and accept some uncertainty as part of nature, most scientific knowledge is durable. The modification of ideas, rather than their outright rejection, is the norm in science, as powerful constructs tend to survive and grow more precise and to become widely accepted.

For example, in formulating the theory of relativity, Albert Einstein did not discard the Newtonian laws of motion but rather showed them to be only an approximation of limited application within a more general concept. (The National Aeronautics and Space Administration uses Newtonian mechanics, for instance, in calculating satellite trajectories.)

Science Cannot Provide Complete Answers to All Questions

There are many matters that cannot usefully be examined in a scientific way. There are, for instance, beliefs that—by their very nature—cannot be proved or disproved (such as the existence of supernatural powers and beings, or the true purposes of life).

In other cases, a scientific approach that may be valid is likely to be rejected as irrelevant by people who hold to certain beliefs (such as in miracles, fortune-telling, astrology, and superstition). Nor do scientists have the means to settle issues concerning good and evil, although they can sometimes contribute to the discussion of such issues by identifying the likely consequences of particular actions, which may be helpful in weighing alternatives.

Scientific Ideas Are Subject To Change

Science is a process for producing knowledge. The process depends both on making careful observations of phenomena and on inventing theories for making sense out of those observations. Change in knowledge is inevitable because new observations may challenge prevailing theories.

No matter how well one theory explains a set of observations, it is possible that another theory may fit just as well or better, or may fit a still wider range of observations. In science, the testing and improving and occasional discarding of theories, whether new or old, go on all the time.

Science is socially and culturally embedded

- Scientific ideas are affected by the social and historical setting.
- Science is part of social and cultural traditions.
- People from all cultures contribute to science.

Characteristics of Science

The nine main characteristics of science are as follows:

1. **Objectivity**
2. **Verifiability**
3. **Ethical Neutrality**

4. **Systematic Exploration**
5. **Reliability**
6. **Precision**
7. **Accuracy**
8. **Abstractness**
9. **Predictability**.

1. Objectivity:

Scientific knowledge is objective. Objectivity simply means the ability to see and accept facts as they are, not as one might wish them to be. To be objective, one has to guard against his own biases, beliefs, wishes, values and preferences. Objectivity demands that one must set aside all sorts of the subjective considerations and prejudices.

2.Verifiability:

Science rests upon sense data, i.e., data gathered through our senses—eye, ear, nose, tongue and touch. Scientific knowledge is based on verifiable evidence (concrete factual observations) so that other observers can observe, weigh or measure the same phenomena and check out observation for accuracy.

3. Ethical Neutrality:

Science is ethically neutral. It only seeks knowledge. How this knowledge is to be used, is determined by societal values. Knowledge can be put to differing uses. Knowledge about atomic energy can be used to cure diseases or to wage atomic warfare. Ethical neutrality does not mean that the scientist has no values. It here only means that he must not allow his values to distort the design and conduct of his research. Thus, scientific knowledge is value-neutral or value-free.

4. Systematic Exploration:

A scientific research adopts a certain sequential procedure, an organised plan or design of research for collecting and analysis of facts about the problem under study. Generally, this plan includes a few scientific steps—formulation of hypothesis, collection of facts, analysis of facts (classification, coding and tabulation) and scientific generalisation and predication.

5. Reliability:

Scientific knowledge must occur under the prescribed circumstances not once but repeatedly. It is reproducible under the circumstances stated anywhere and anytime. Conclusions based on casual recollections are not very reliable.

6. Precision:

Scientific knowledge is precise. It is not vague like some literary writing. Precision requires giving exact number or measurement.

7. **Accuracy:**

Scientific knowledge is accurate. Accuracy simply means truth or correctness of a statement or describing things in exact words as they are without jumping to unwarranted conclusions.

8. Abstractness:

Science proceeds on a plane of abstraction. A general scientific principle is highly abstract. It is not interested in giving a realistic picture.

9. Predictability:

Scientists do not merely describe the phenomena being studied, but also attempt to explain and predict as well.