ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

UNIT-I

Introduction to Traditional Knowledge

Course Content:

1. Define traditional knowledge,
2. Nature and characteristics,
3. Scope and importance,
4. Kinds of traditional knowledge,
5. The physical and social contexts in which traditional knowledge develop,
6. The historical impact of social change on traditional knowledge systems.
7. Indigenous Knowledge (IK), characteristics,
8. Traditional knowledge vis-à-vis indigenous knowledge,
9. Traditional knowledge Vs western knowledge,
10. Traditional knowledge vis-à-vis formal knowledge

Traditional Knowledge

Since time immemorial, we were put here to take care of the land. Our grandfathers did not abuse the land and it is our turn to pass our knowledge on to our younger generations. What our forefathers kept all this time is very precious. It's now in our hand. Don't you believe that our creator has given us all the resources and knowledge to efficiently use those resources without disturbing the eco-system and environment. Our creator also has given the responsibility for taking very good care of what we have. If we don't take care of it, we will lose every good thing one day. This is all we are talking about is the traditional knowledge that has been transferred through generations.

Traditional Knowledge (TK) is the awareness, experience, expertise, knowledge and applications that are established, continued, performed and passed on from generation to generation within a region or community, often forming a part of its cultural, social or spiritual identity. It can be attributed to in a wide variety of contexts, such as; agricultural, food preparations, art and craft, science, technical, ecological and medicinal knowledge as well as biodiversity-related knowledge.

In other words,

- ***TK in a general sense*** embraces the content of knowledge itself as well as traditional cultural expressions, including distinctive signs and symbols associated with TK.

- ***TK in the narrow sense*** refers to knowledge as such, in particular the knowledge resulting from intellectual activity in a traditional context, and includes know-how, practices, skills, and innovations.

The background of TK and manifestation of TK is quite different; some TK is documented, such as TK concerning traditional medicine. However, the vast majority of TK is NOT documented, perhaps due to custom (for example, the transmission of indigenous medical knowledge by word of mouth from master to disciple, or transmission by movement or performance of a dance, play, or ceremony, etc.). Whether one publishes or records the knowledge makes no difference at all, TK published or not, is still traditional knowledge of the peoples. Traditional Knowledge that are mostly undocumented are typically inherited via word of mouth**.**

Examples are as follows:

- Use of turmeric (*Curcuma Longa*) for medicinal purposes.
- Use of ashwagandha (*Withania Sominifera*) to treat heart related ailments.
- Traditional healing practices such as Yoga and Pranayama.
- Siddha, Unani and Ayurvedic treatment of ailments.

Nature of TK

- Generated, preserved and transmitted in a traditional context;
- distinctively associated with the traditional or indigenous culture or community which preserves and transmits it between generations;
- Linked to a local or indigenous community through a sense of custodianship, guardianship or cultural responsibility, such as a sense of obligation to preserve the knowledge or a sense that to permit misappropriation or demeaning usage would be harmful or offensive;
- 'Knowledge' in the sense that it originates from intellectual activity in a wide range of social, cultural, environmental and technological contexts; and,
- Identified by the source community as being TK.

Characteristics of TK

1. The creation of TK is collective and holistic

Science relies on an abstract conceptual framework to interpret phenomena. The description of phenomena is usually quantifiable by scientific experiments, and follows a step-by-step scientific deductive process. In order to figure out the conceptual relationship of complex phenomena of the world, scientific inquiries always involve reduction process. Cause and effect between certain factors are easier to be found by standardizing and leaving alone, as far as possible, all other factors that the inquirer do not looking for. Even with ecology as a science of complex interactions among living and non-living matters of the whole ecosystem, it is inevitable for the research process to be somewhat reductionistic.

On the other hand, indigenous peoples or local communities live their lives with vast knowledge formed over the centuries during their daily life interacting with the environment. Epistemologically, this type of knowledge is holistic in nature and cannot be dissected. For example, a festival after the taboo month celebrating the beginning of the hunting season should avoid the breeding season of the animal, a form of TK that assures sustainable hunting. TK is an articulation of phenomena. Instead of step-by-step deduction, TK uses the repeated verification of an idea that a person or group of people deduce from facts.

However, TK is not necessarily a collective creation. Individual creation is also possible. On the other hand, modern science and technology do not exclude collective creation for innovations; although usually only one or more trained individuals own the technology as a small, definite group of individuals.

2. Oral transmission of TK from generation to generation

Traditionally indigenous peoples have no writing system. Indigenous people would transmit knowledge by oral language or by body language. On the other hand, the transmission of scientific information relies on written records and publications, and a teacher simply accelerates the transmission of this knowledge orally. However, not all TK lack the written records.

For example, the distribution of classics on Chinese and Indian traditional medicine disseminated TK on Chinese and Indian traditional medicine. WIPO considers both forms of medicine as model forms of TK. Today, indigenous peoples may also use writing to transmit their TK, whether new or old.

3. TK is changeable, and may evolve because of changes in the social environment

“Traditional” does not just mean knowledge of the past, but rather that the method of creation of this knowledge is in the “traditional” way. Since people’s interaction with the environment produces TK, TK is by no means static, but rather dynamic, because of environmental changes. Since, in the past, the environment changed very slowly, TK also changed in a very slow and continuous way.

Science and technology change frequently, and at a rate that is faster than the rate at which TK changes. However, this does not mean that the speed of innovation of modern "TK" is slow. Today, indigenous peoples and tribal inhabitants may exchange new ideas very quickly. Nevertheless, TK changes are not typically revolutionary, unless outside influences affect such TK. Traditional Chinese medicine still maintains the concepts of the five elements and the principles of Yin and Yang from the Chin and Han Dynasty, a good example to illustrate the nature of the TK.

4. The innovator is often unidentifiable

Many peoples accumulate TK as a collective creation without a written record. Therefore, the innovators are often unidentifiable. Modern technology, by contrast, has written records as a rule, and places great emphasis on the importance of determining the original creator.

Nevertheless, since, in modern times, indigenous peoples can invent some TK quickly, their innovator usually is identifiable.

5. Residents of specific areas share TK

Often a closed society creates and preserves its TK. The dissemination of TK is limited and non-systematic. One individual, a small group of individuals, or even an entire community may all share TK. The indigenous peoples usually do not have the same concept of private property as in mainstream society. Modern technology, however, spreads in a broad and systematic manner, and mainstream culture embraces science by granting the specific individuals who create technology individual rights through the IP system.

Scope of TK

The scope of Traditional Knowledge includes

- Technical Knowledge (including agricultural, technical, ecological, medical, and other forms of related technical knowledge),
- General TK (including music, dance, sculpture, weaving, designs, clothing, and other folk custom techniques, and other expression of folklore).

While the first kind of TK concerns knowledge of natural resources or science and technology, the second kind of TK concerns cultural expression of the humanities and the arts (note that many people refer to the second kind of TK as "expression of folklore" or "expressions of traditional culture"). The two types of TK are different, and the types of protection for these two types of TK are naturally different as well.

Importance of TK

For indigenous people and tribal communities, the main focus is to protect their traditional knowledge and focal point on fundamental justice and the propensity to protect and safeguard their traditions. In the globalized world, traditional knowledge somehow gained special importance in the past few years which have seen an outburst in the demand for herbal medicines. These herbals and the traditional method for making these medicine is taking an important part of human health. Traditional knowledge has great importance pertaining to the core of indigenous peoples' identities, cultural heritage and livelihoods. Following are the major importance of the traditional knowledge.

- The transmission of traditional knowledge across generations is fundamental to protecting and promoting indigenous peoples' cultures and identities and as well as the sustainability of livelihoods, resilience to human-made and natural disasters, and sustaining culturally appropriate economic development.
- Traditional knowledge underlines indigenous peoples' holistic approach of life, which is a central element of the world's cultural and biological diversity.
- TK plays a key role in the preservation and sustainability of diversity

- Many activities based on traditional knowledge are important source of income, food and healthcare for the indigenous people.
- The long-term economic development of many indigenous and local communities, depend on their ability to harness their traditional knowledge for commercial benefits.
- Traditional knowledge is being rapidly lost as local ecosystem are degraded and traditional communities are integrated into the wider society.

Kinds of Traditional Knowledge

Traditional knowledge is divided in to the following types

- Cultural Knowledge
- Artistic Knowledge
- Medicinal Knowledge
- Bio-diversity/Natural Resources Knowledge
- Agricultural Knowledge
- Sacred Knowledge

From its domain of application and associated management approaches, traditional knowledge can be categorised as

- Traditional Ecological/environmental Knowledge
- Traditional Technical Knowledge
- Traditional Values and Ethics

Traditional Ecological or Environmental Knowledge (TEK): TEK refers to the evolving knowledge acquired by indigenous and local people over hundreds or thousands of years through direct contact with the environment. This knowledge is specific to a location and includes the relationships between plants, animals, natural phenomena, and the landscape that are used for livelihood and sustenance of life, such as resource gathering through hunting, fishing, agriculture, livestock farming, forestry, agro-forestry, etc.

All these can be categorised as natural resource management, as these practices are linked with management of land, water, flora and fauna. Such practices are linked to prioritization of uses along the line of sustainable harnessing, wise use, equitable sharing of benefits, management of future stocks through conservation, defining threshold limits, etc. There are practices for weather forecasting too. Such TEK considers natural landscape characteristics (topography, slope, soil and rock characteristics), weather and climate as well as types of flora and fauna. The community takes necessary decision

based on abundance/ scarcity and seasonality of biotic and abiotic resources, natural disasters, and associated problems

It is a process of indigenous communities for observation, classification, analysis, interpretation and decision making for daily walk of life along with development of world views

Traditional Technical Knowledge (TTK): TTC represents the knowledge related to design and development of tools, implements and gears for different application in the context of natural resource management by the indigenous communities. Such practices are related to agriculture, fisheries, animal husbandry, forestry, handloom and handicraft etc. Moreover, TTK also represents the knowledge and skill about design and construction like housing, water, harvesting structure, roads and bridges, etc.

Traditional Values and Ethics (TVE): TVE is linked to traditional cultural practices which prioritize dos and don'ts in the aspects in relation to natural resource harvesting, conservation, and equitable sharing etc32. During the process, it evolves the concept of sacred species, space, forests, water bodies, etc. This involves seasonality-based practices like restriction of fishing during breeding season, harvesting forest resources during flowering period, etc. Sometimes institutions are developed to manage human habitation, controlling human practices related to health and sanitation, like restriction of food in different seasons, restriction of waste disposal, norms for location of animal sheds, toilets etc.

Exploration and documentation of such practices in local context will help in understanding these practices, creating a knowledge base and analysis and validation of its scientific base. This will help to identify the prospects for the future adopting lifestyles, habitat management, environment, natural resource management, wildlife protection, etc.

The physical and social contexts in which traditional knowledge develop

Traditional Knowledge System (TKS) is the know-how of the people, gathered through day to- day walk of life, to overcome the hurdles and tap the potentialities from their immediate

neighbourhood. In fact, TKS evolved in a specific location within certain physical and sociocultural environment, where it reflects people's specific knowledge, understanding as well as observational and experimental information about their dwelling environments, along with skill and technology to design a lifestyle in that specific environmental context.

TKS represents information, knowledge, skill and technology along with standard management practices, which are defined through the cultural systems. In the contemporary world when human civilization is facing the challenges of climate change, natural disaster, biodiversity loss, destabilized ecological services, food and nutritional inequality, problems of sanitation and health and many others, there is a need to give emphasis on TKS for searching alternative solutions or ways to face the challenges and design a sustainable lifestyle.

Concurrently, different international forums started to focus on the relevance of TKS. Organizations like World Intellectual Property Organization (WIPO) , the International Labour Organization (ILO), especially its convention 1693 , the Food and Agricultural Organization (FAO), World Health Organization (WHO) , United Nation Educational, Scientific and Cultural Organization (UNESCO) , United Nation Environment Programme (UNEP) , United National Development Programme (UNDP) , United National Commission on Human Right (UNCHR) took initiatives to document the TKS and research for its validation along with developing different protocols for preservation , protection of rights, appropriate application as well as facilitating fair and equitable sharing of the benefits from their applications.

It is noteworthy that the World Conference on Science, organized by UNESCO and the International Council for Science (ICSU), in its Declaration on Science and the Use of Scientific Knowledge, explicitly recognized the importance of TK and the need to respect and encourage its use for various forms of human endeavour (ICSU 2002). Moreover, World Conference on Science (Budapest, June 1999), focussed on TKS, and recommended through 'Science Agenda: Framework for Action' (UNESCO, 2000), that, "*modern scientific knowledge and traditional knowledge should be brought closer together in interdisciplinary projects dealing with the links between culture, environment and development in such areas as the conservation of biological diversity, management of natural resources, understanding of natural hazards and mitigation of their impact. Local communities and other relevant players should be involved in these projects. Individual scientists and the scientific community have a responsibility to communicate in clear language the scientific explanations of these issues and the ways in which science can play a key role in addressing them"*

In India, similar focus is also given on TKS by National Knowledge Commission for proper documentation and protection of Intellectual Property Right. Different organizations and institutions have taken up activities for research and documentation and development of TKS application. It is to be noted that the Indian Journal of Traditional Knowledge was evolved to share such endeavour of research and documentation. Moreover, legal instruments have also been developed like National Biodiversity Act (NBA), 2002. There are many examples of TKS-based practices in the country on natural resource management, agricultural practices, medicine and

health, housing and allied design and construction, which have the potential to act as leverage to sustainable development. In the fifteen different agro-climatic zones of India there is diversity in terms of environmental and cultural practices, which nurture different traditional knowledge-based practices to adjust way of life of the people to their respective environmental set-up. All these practices have some age-old history, progression and empirically tested observation, which essentially need not only documentation but also validation and applicability in contemporary context to meet the requirement for sustainable development.

The historical impact of social change on traditional knowledge systems.

As the society, so the Traditional Knowledge with the change in society there is a change in Traditional Knowledge. Traditional Knowledge is shaped in accordance with the time and need of the society. There is a close relation between Traditional Knowledge and Social Transformation. With the society evolving towards modernization, Traditional Knowledge being a living knowledge which evolves with the society and the people is also evolving towards modern knowledge. The nature can be regarded as a laboratory where the experiment of the Traditional Knowledge takes place. Earlier, Traditional Knowledge was not universal at all, there was traditional system of protection and traditional system for the grant of permission to access it but now due to globalization, there is more chances of misappropriation and Traditional Knowledge is not safe. India is amongst the nations who is very rich in terms of Traditional Knowledge and in India, most of the population still depends on Traditional medicinal system. With the acceptance of globalization, it is high time India should take proper step for the protection of Traditional Knowledge. Traditional Knowledge is categorized under the Intellectual Property Rights, and if it is not provided proper protection then someone else under the Intellectual Property Rights will protect it and the community who owns it will loss the ownership rights.

It is a known fact that one of the concepts of social transformation is globalization and globalization is one of the most dreadful challenge to the TK. There are numerous laws which protect certain aspects of TK but have failed to provide complete protection to it. TK has now become the victim of effects of globalization. Biopiracy and misappropriation are the effect of globalization which has hampered the TK of India and other developing countries severely. Cases regarding Neem, Turmeric, Haldi, Basmati rice, Karela, Indian Gingseng – Ashwagandha, Pudina and Kalamegha, Narcissus tazetta, Bt Brinjal, Jeevani, Asian chick pea, Ginger, Monsanto's wheat patent, Monsanto's biopiracy of Indian Melons, Monsanto's Biopiracy of climate resilience, ConAgra's Biopiracy claim on atta, Phyllanthusniruri, Aloe Vera, Syngenta's attempt at Biopiracy of India's rice diversity are the living example which give a clear cut view that with the social transformation that had taken place and is taking place, the Intellectual Property Rights legislations of India are not strong enough to protect the Traditional Knowledge of its own land and people. These laws are aged old and cannot be regarded as of global standards which has given advantages to the Multi – National Corporations to exploit and misappropriate the Traditional Knowledge.

Social innovations are impossible without the inputs of TK. There is always help taken from the traditional way of life for dealing with the new problems. Likewise, creating new

solutions to problems is embedded in traditional practices. TK has helped in developing new drugs, new technologies, etc. TK based on agriculture has helped the farmers to increase products as well as conserve the soil. The traditional practices had no ill impacts. Apart from agricultural sectors, the role of TK on economic sectors is also being recognized. A whole range of industrial products are dependent on or use of TK in numerous ways. To name few are the pharmaceuticals, house hold goods, cosmetic products etc. The contributions of TK on health care cannot be forgotten.

According to the World Health Organisation (WHO), the majority of the world's population are dependent on medicinal plants that have traditional method of use. There are numerous instances where TK based on medicinal uses have helped in development of new drugs. The WHO estimates that 25% of modern medicines are made from plants that were first used traditionally. Apart from medicinal benefits, traditional knowledge has also helped in dealing with food security during various natural calamities. The indigenous peoples have lived in close with the nature and understand the behavior and changes that takes place in the surroundings. They have acquired unique knowledge about the use of wild flora and fauna and most of which are not known to the people who live away from the natural ecosystem. With recent biotechnological advancement and molecular genetics, particularly in the gene transfer technology have opened new vistas and assumed unlimited power to exploit the genetic resources of the biodiversity. As a result, the potential and actual economic values and genetic materials are increasing rapidly and stimulated international trade in genetic resources commonly known as 'biotrade' which soon led to 'bio-piracy' or 'gene piracy'.

Illustration: Use of traditional herbs in modern cosmetic products

Communities have understood their natural surroundings and hence, adopted agricultural, fishing practices and also the change in the climate etc. TK developed in ancient times can be used to treat various problems that are faced in recent times. The present-day inventions though helpful have various side effects, either to human health or to the environment. But the traditional knowledge has been developed by studying the environment and the needs of various species and hence is more sustainable. Traditional knowledge strives for sustainable development. A society needs development but such development must be a sustainable one. But there is a constant erosion of Traditional knowledge.

Traditional knowledge also plays an important role in preservation of cultural heritage of any community. As the knowledge has been passed through generations, the values as well as the unique characteristics of any culture is also transmitted. The importance of the cultural heritage is also explained by the traditional knowledge. As such knowledge provides an insight to the values and importance of such place or practices.

Similarly, environment is very important to every society, right to live in a clean environment is s right recognized under constitution of various countries. Traditional practices have always taken keen interest in preservation and protection of the environment. With various biotechnological inventions, there is negative impact on the environment and the societies. Hence, the traditional practices for preservation and conservation of environment must be recognized for the betterment of the society because without environment or biological resources life on earth is impossible.

The social transformation that India has under taken demands better protection to the Traditional Knowledge of India and her people, in fact a legislation which shall be enacted keeping in view the present scenario of the world as well as India. Keeping in view the social transformation of India and the world, the Kerala Government has come up with Intellectual Property Rights Policy of Kerala, 2008, vide Government Order (P) No. 4/2008/Law for the protection of Traditional Knowledge of Kerala. This policy is the need of the hour as it covers and protects the whole aspects of the Traditional Knowledge of Kerala and the communities that lives there. The Lok Sabha Member of Parliament from Kerala, Mr. Sashi Tharoor has presented a bill, 'The Protection of Traditional Knowledge Bill 2016' which will provide protection, preservation, promotion and development of the Traditional Knowledge of India and her people. But according to this Bill, either the State or the Central Government shall be the custodian of the whole Traditional Knowledge, even those Traditional Knowledge which are practiced and preserved by specific community or institution or a family which seem to be the biggest flaw of this Bill.

Indigenous Knowledge (IK)

Indigenous Knowledge includes facts, concepts, theories about the characteristics which describe the objects, events, behaviours and interconnection that comprise both the animate and inanimate environments of indigenous peoples. Even though indigenous knowledge is not quantitative in nature, it does not mean that it is not precise.

The relationship between people and the environment forms an important foundation for the organisation of indigenous knowledge, i.e., the categorization of life experiences and the shaping of attitudes and patterns of thinking.

Characteristics:

Following are some important characteristics of indigenous knowledge.

- It is generated with in communities of indigenous people
- It is location and culture specific

- It is the basis for decision making and survival strategies,
- It is not systematically documented
- It concerns critical issues of human and animal life; primary production, human and animal life, natural resources management.
- It is dynamic in nature and based on innovation, adaption, and experimentation
- It is oral and rural in nature.

Indigenous People:

Indigenous people constitute a vulnerable group which has long been neglected. Their social structures and lifestyles have suffered the repercussions of modern development. They have been subject to growing pressure to bring their language, religions, knowledge art, and oral traditions and the other manifestations of their life into conformity with those of the majority of social groups around them.

Indigenous peoples are people who have inhabited all continents since time immemorial. They have lived on their lands, maintained their cultural values, maintained and cultivated their environment and kept their traditions alive over centuries

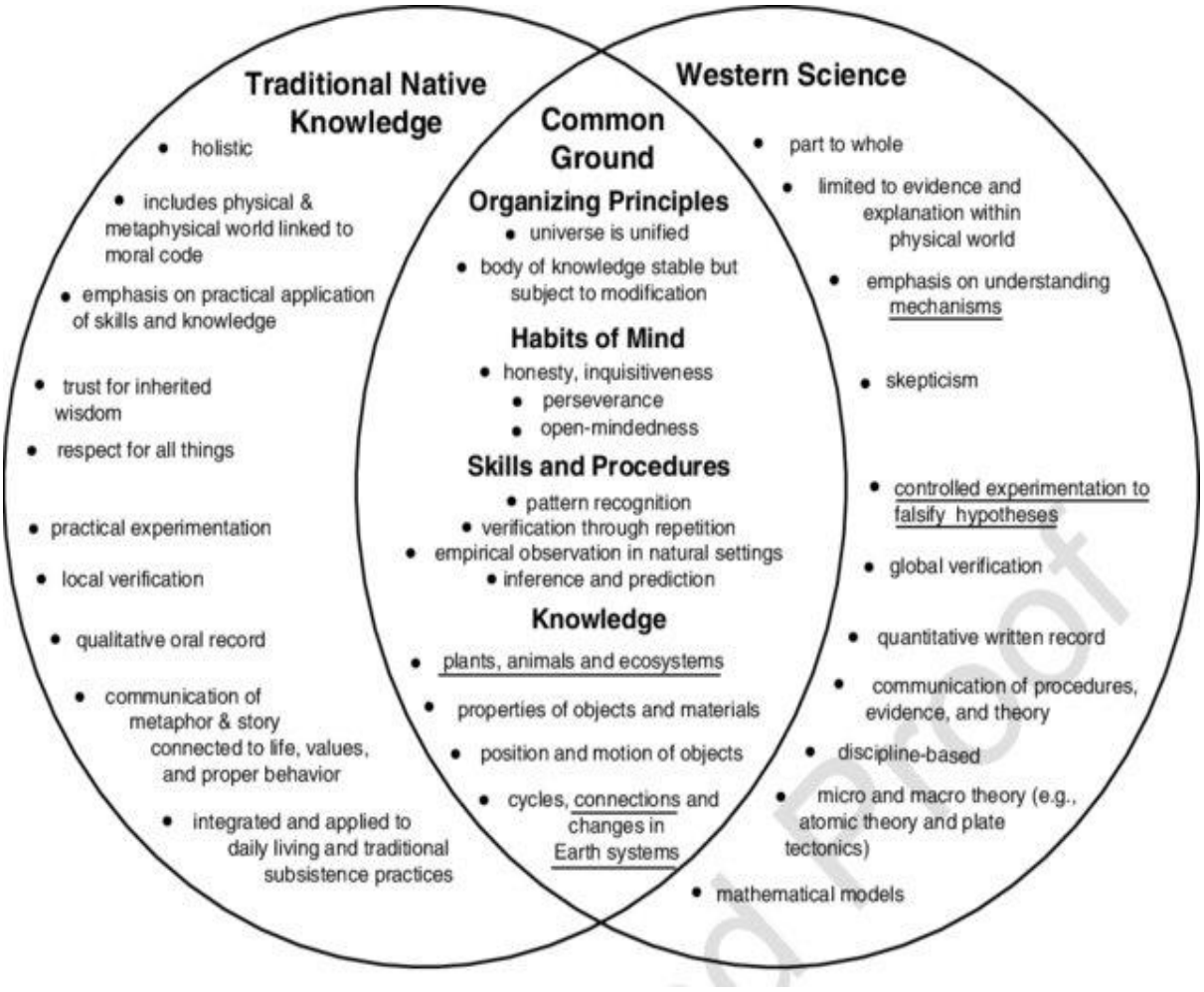
Traditional Knowledge vis-à-vis Indigenous Knowledge

Traditional knowledge	Indigenous knowledge
• Traditional Knowledge (TK) is the awareness, experience, expertise, knowledge and applications that are established, continued, performed and passed on from generation to generation within a region or community, often forming a part of its cultural, social or spiritual identity. • Traditional knowledge is a broader category that includes indigenous knowledge as a type of traditional knowledge held by indigenous communities. • Traditional knowledge typically distinguishes one community from another. • Thus, it is community specific broad in nature. • Some of the traditional knowledge are systematically documented like the Vedas, medicines, treatments, food preparation methods, music, art etc.	• It includes facts, concepts, theories about the characteristics which describe the objects, events, behaviours and interconnection that comprise both the animate and inanimate environments of indigenous peoples. • Indigenous knowledge is a narrow concept which represents the traditional knowledge of the indigenous people. • Indigenous knowledge or techniques (ITKs) are the treasure troves of ancient wisdom and are developed through trial-and-error, experiences gained over the centuries, and are time tested but, generally not substantiated by any scientific evidences. • Even though, they are not quantitative, most of the ITKs were known to be scientifically effective and valid. • It is location and culture specific.

• Traditional knowledge includes types of knowledge about traditional technologies of subsistence (e.g. tools and techniques for hunting or agriculture), midwifery, ethnobotany and ecological knowledge, traditional medicine, celestial navigation, craft skills, ethnoastronomy, climate, and others. • Not all traditional knowledge is indigenous.	• It is not systematically documented. • Indigenous knowledge also includes the knowledge tools and techniques used by indigenous people like the tribals for hunting, agriculture, medicine, navigation, craft etc. they are not spread over as broad as the traditional knowledge. • All of the indigenous knowledge is a subset within traditional knowledge.

Traditional Knowledge vis-à-vis. Western Knowledge

Categories	**Traditional Knowledge**	**Western Knowledge**
Mode of thinking	Intuitive and holistic	Analytical and segmented
Mode of learning	Storytelling and observation	Academic and experimental
Characteristics	Subjective and spiritual	Objective and reductionist
Data creation	Slow and inclusive	Fast and selective
Prediction abilities	Vague and cyclical	Accurate and linear
Classification system	Ecological and interconnected	Genetic and hierarchical
Principle belief	Eco-centric	Anthropo-centric
Management system	Decentralized authority	Centralized authority
Approach and handling	Focus is on understanding the cause of the illness	Focus is on treating symptoms of the illness
Health history	Considers role of community and environment	Patient and family history
Health diagnostics	Intuitive	Intellectual
Health authority	Traditional healer is an advisor with consensus of family and community	Physician is a primary authority



Traditional Knowledge vis-à-vis Formal Knowledge

Categories	Traditional Knowledge	Formal Knowledge
View of knowledge	• Sacred and secular together, includes spiritual aspects. • Holistic and integrated- based on a whole systems view of knowledge • Stored orally and in cultural practices • Powerful predictability in local areas (ecological validity) • Less valued in distant areas.	• Secular only; often excludes the spiritual aspects. • Analytical or reductionist-based on sub-sets of the whole • Stored in books and computers • Powerful predictability in natural principles (rational validity) • Weak in local use of knowledge.
Objectives	• Long-term wisdom • Cultural and ecological sustainability • Practical for use in everyday life	• Short term recall • Economic sustainability • Abstract to pass examination

	• Integration of critical thinking and cultural values in decision making.	• Use of logical and critical thinking in making decisions.
Method of teaching and learning	• Lengthy period of acquisition • Learning through experience • Teaching through example, modeling, ritual and story telling • Tested in practical life situations.	• Rapid acquisition • Learning by formal education • Teaching through abstract concepts and didactic methods • Tested artificially in examinations

Questions

1. What do you mean by traditional knowledge? Explain its characteristics?
2. What is indigenous knowledge? How traditional knowledge is different from indigenous knowledge.
3. What are the different types of traditional knowledge? Explain its scope and importance?
4. Explain the process of change in traditional knowledge due to social changes over years?
5. Explain the development of traditional knowledge under physical and social environments?
6. Explain the difference between traditional knowledge and western knowledge?
7. Outline the differences between traditional knowledge and formal education?