VAC 1: SCIENCE AND SOCIETY

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Science and Society	02	1	0	1	Pass in Class 12th	NIL

Learning Objectives

The Learning Objectives of this course are:

- The primary objective of this course is to instil in students an appreciation for science and a scientific outlook and temper.
- The course further aims to increase awareness about fundamental scientific concepts that play an important role in our daily life using various examples and case studies.
- Pedagogy in this course should largely rely on learning by enquiry, observations, experimentation and group discussions using case studies/examples.
- Efforts should be made to instil an interest in students for science. Students should be encouraged to understand and appreciate scientific concepts and their applications rather than solely memorizing factual information.

Learning outcomes

The Learning Outcomes of this course are:

- This paper is interdisciplinary in nature and would provide students with basic exposure to scientific methods, technologies and developments that have played a significant role in the evolution of human society from ancient to modern times.
- 2. Students would also be made aware of the scientific rationale of technological developments that would enable them to make informed decisions about their potential impact on society.

SYLLABUS OF SCIENCE AND SOCIETY

UNIT – I Science and Technology – from Ancient to Modern Times (10 Weeks)

In this section, students should also be made aware about the contributions of Indian scientists since ancient times and the contributions of women in science.

Subtopics

- Philosophy of science, the scientific method, importance of observation, questions and experimental design, rational thinking, myths vs. Facts

- Science, Technology and Traditional Practices: Suggestive areas include: Water harvesting structures and Practices; Construction, architecture and design – use of natural environment-friendly designs and materials; Agriculture including domestication of plants and animals.
In this section, students should also be made aware about the contributions of Indian scientists since ancient times and the contributions of women in science.

- Science and Technology in Modern Times: Suggestive areas include: PublicHealth:Nutrition,Hygiene,PhysicalandMentalHealth,VaccinesandAntibiotics,Anti-microbial resistance; Food Security: Green Revolution, White Revolution; IT Revolution, E-Governance; Clean Energy, Renewable Energy; Space Science and Exploration; Evolution, Ecology and Environment

UNIT II: Scientific Principles, and Concepts in Daily Life (5 Weeks)

Unit Description:

This section aims to encourage appreciation of the scientific method through observation, experimentation, analysis and discussions. Students are required to participate in activities and experiments. A suggestive list is given below:

Subtopics:

Suggested Activities:

- Observing and documenting flora and fauna of College campus/city.
- Visits to science laboratories in the College or neighbouring College/Institute.
- Visits to science museums, planetarium.
- Visits to biodiversity parks and nature walks.
- Participation in a citizen science project/initiative.

Suggested Experiments (minimum any four):

- Measuring the height of the college building using a stick.
- Measuring the curvature of earth, using distance and shadow length.
- Isolation of DNA (DNA Spooling)
- Observing transpiration and photosynthesis in plants
- The blood typing game (online)
- Are fruit juices, soap, carbonated drinks acidic or alkaline? (using pH strips or developing your own Litmus Test)
- Do plants learn and remember?
- Experiments on how migratory birds find their way. (Online)
- How can a mosquito sit on a water surface or a blade float on water?
- How does a submarine dip or rise in the ocean?
- How and why does the path of the sun in the sky change with the seasons?
- Identification of celestial objects with the naked eye
- Types of clouds
- Science of musical sounds
- Science of splitting of colours from white light: rainbow, CD-rom, prism, oil films.
- Lenses, mirrors and the human eye

Practical/ Practice Component : **Please Refer to Unit II.**

Essential/recommended readings

- Basu and Khan (2001). Marching Ahead with Science. National Book Trust
- Gopalakrishnan (2006). Inventors who Revolutionised our Lives. National Book Trust
- Yash Pal and Rahul Pal (2013) Random Curiosity. National Book Trust
- Hakob Barseghyan, Nicholas Overgaard, and Gregory Rupik (****) Introduction to History and Philosophy of Science
- John Avery (2005). Science and Society, 2nd Edition, H.C. Ørsted Institute, Copenhagen.
- Dharampal (2000). Indian Science and Technology in the Eighteenth Century, OIP.

Suggested Readings:

Section 1. Science and Technology – from Ancient to Modern Times:
Philosophy of science:
https://blogs.scientificamerican.com/doing-good-science/what-is-philosophy-of-scienceand- should-scientists-care/
http://abyss.uoregon.edu/~js/21st_century_science/lectures/lec01.html
https://wps.ablongman.com/wps/media/objects/1449/1483820/18_2.pdf

Myths vs. facts:

https://www.sciencelearn.org.nz/resources/415-myths-of-the-nature-of-science
History of technology:

https://www.visualcapitalist.com/history-of-technology-earliest-tools-modernage/

Water harvesting:

https://worldwaterreserve.com/introduction-to-rainwater-harvesting/
Public Health :

https://www.ajpmonline.org/article/S0749-3797(11)00514-9/fulltext
https://study.com/academy/lesson/public-health-vs-medicinedifferences-similarities.html
https://www.deepc.org.in/video-tutorials/public-health
Food Security:

https://www.concern.net/news/what-food-security
Energy:
https://www.nrdc.org/stories/renewable-energy-clean-facts

Space Science:

https://www.isro.gov.in/spacecraft/space-science-exploration
https://www.isro.gov.in/pslv-c11-chandrayaan-1
https://www.isro.gov.in/chandrayaan2-home-0
https://www.britannica.com/science/space-exploration

Contribution of Indian Scientists & Women Scientists:

https://www.tifr.res.in/~outreach/biographies/scientists.pdf
https://indiabioscience.org/media/articles/ISTI.pdf
https://www.thebetterindia.com/63119/ancient-india-science technology/
https://ncsm.gov.in/indian-women-in-science-technology/

Evolution:

https://www.livescience.com/474-controversy-evolution-works.html
https://www.ibiology.org/evolution/origin-of-life/
Climate change and global warming
https://letstalkscience.ca/educational-resources/backgrounders/introductionclimate-change

Biodiversity

https://india.mongabay.com/2020/09/nature-in-peril-as-biodiversity-lossesmount-alarmingly-states-the-living-planet-report/

Genomics and Modern Medicine

https://www.nationalgeographic.com/science/article/partner-contentgenomics-health-care
https://www.mja.com.au/journal/2014/201/1/impact-genomics-future-medicine-and-health
https://www.nature.com/scitable/topicpage/pharmacogenomics-andpersonalized-medicine-643/

Genetically modified engineered crops

https://www.nature.com/scitable/topicpage/genetically-modified-organismsgmos-transgenic-crops-and-732/
https://factly.in/explainer-what-is-the-status-of-gm-crops-in-india/
https://www.fda.gov/food/agricultural-biotechnology/how-gmo-crops-impactour-world

Artificial Intelligence and Robotics

https://www.ohio.edu/mechanical-faculty/williams/html/PDF/IntroRob.pdf
https://nptel.ac.in/content/storage2/courses/106105078/pdf/Lesson%2001.pdf

Big Data Analytics

https://www.researchgate.net/publication/328783489_Big_Data_and_Big_Data_Analytics_Concepts_Types_and_Technologies

Section 2. Scientific Principles, and Concepts in Daily Life Measuring buildings, earth curvature:

https://www.youtube.com/watch?v=hrwL3u2Z4Kg
https://www.youtube.com/watch?v=khRMzxONpLg
https://www.youtube.com/watch?v=YaPa4esJJx4

Isolation of DNA

https://melscience.com/US-en/articles/home-dnaextraction/?irclickid=2hh2pqRY8xyLTbawUx0Mo3ENUkBwlX3pGQDJSc0&utm_source=impact&irpid=2201352&irmpname=Science%20Journal%20for%20Kids&irgwc=1

Transpiration & Photosynthesis

https://www.youtube.com/watch?v=JQvdXX7hGqI
https://www.youtube.com/watch?v=U4rzLhz4HHk
https://www.youtube.com/watch?v=pFaBpVoQD4E

Online game on blood typing

https://educationalgames.nobelprize.org/educational/medicine/bloodtypinggame/gamev3/1.html

Determination of pH
https://www.youtube.com/watch?v=BEz6t_e6gpc

Plant behaviour
https://youtu.be/KyoeCFTIXKk
https://youtu.be/gBGt5OeAQFk

Migratory Birds

https://www.scienceabc.com/nature/how-migrating-birds-geese-navigate-long-distance-earthmagnetic-field.html