

**VALUE ADDITION COURSES (VAC)**

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**DEPARTMENT OF ZOOLOGY**

**B.Sc. (Hons.) Zoology**

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## Value Addition Course

### Science and Society

Course Title and Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisite of the Course
		Lecture	Tutorial	Practical/Practice		
Science and Society	02	1	0	1	Pass in Class 12th	NIL

#### Course Objectives and Learning Outcomes:

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. The primary objective of this course is to instill 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. 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.

#### Pedagogy:

- 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 instill 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.
- The faculty may refer to books/ articles/ reviews/ documentaries/ films etc. from academic institutions or other reliable sources. A few suggestive links are provided in the Suggested Reading/Resources Section below.
- In the spirit of exposition of popular science, Subject/Domain experts may also be invited for lectures and interactions with students.

#### Course Outline:

The course is divided into three major sections:

1. **Science and Technology – from Ancient to Modern Times**
2. **Scientific Principles and Concepts in Daily Life**
3. **Contemporary Developments**

#### 1. Science and Technology – from Ancient to Modern Times

- (i) Philosophy of science, the scientific method, importance of observation, questions and experimental design, rational thinking, myths vs. facts

(ii) 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

(iii) Science and Technology in Modern Times: Suggestive areas include:

- Public Health: Nutrition, Hygiene, Physical and Mental Health, Vaccines and Antibiotics, Anti-microbial resistance
- Food Security: Green Revolution, White Revolution
- IT Revolution, eGovernance
- Clean Energy, Renewable Energy
- Space Science and Exploration
- Evolution, Ecology and Environment

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.

## 2. Scientific Principles and Concepts in Daily Life

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:

### 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:

- 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

## 3. Contemporary Developments:

This section would focus on current topics of major interest. Suggestive areas include:

- Climate change and global warming
  - Threats to biodiversity and habitat degradation
  - Genomics and modern medicine
  - Genetically engineered crops
  - Artificial intelligence and robotics
  - Big Data Analytics
  - Citizen science and science communication
  - Science of natural disasters and their management
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- Any other Practical/Practice as decided from time to time

**Suggested Books / Resources:**

The list given below comprises only suggestive references. Faculty members conducting this course are encouraged to explore and use other resources subject to the condition that these are updated, authentic and are derived from sources with strong academic credentials or expertise and are supported by strong evidence.

**Suggested Books:**

- 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 (licensed under a Creative Commons Attribution 4.0 International License)
- John Avery (2005). Science and Society, 2<sup>nd</sup> Edition,
- Dharampal (2000). Indian Science and Technology in the Eighteenth Century,

### **Suggested Online Resources:**

#### **Section 1:**

##### **(i) Philosophy of science:**

<https://blogs.scientificamerican.com/doing-good-science/what-is-philosophy-of-science-and-should-scientists-care/>

[http://abyss.uoregon.edu/~js/21st\\_century\\_science/lectures/lec01.html](http://abyss.uoregon.edu/~js/21st_century_science/lectures/lec01.html)

[https://wps.ablongman.com/wps/media/objects/1449/1483820/18\\_2.pdf](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-modern-age/>

##### **Water harvesting:**

<https://worldwaterreserve.com/introduction-to-rainwater-harvesting/>

##### **Public Health :**

[https://www.ajpmonline.org/article/S0749-3797\(11\)00514-9/fulltext](https://www.ajpmonline.org/article/S0749-3797(11)00514-9/fulltext)

<https://study.com/academy/lesson/public-health-vs-medicine-differences-similarities.html>

<https://www.deepc.org.in/video-tutorials/public-health-workshop>

##### **Food Security:**

<https://www.concern.net/news/what-food-security>

**IT Revolution, eGovernance:**

**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/>

**Section 2:**

**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-dna-extraction/?irclickid=2hh2pqRY8xyLTbawUx0Mo3ENUkBwIX3pGQDJSc0&utm\\_source=impact&irpid=2201352&irmpname=Science%20Journal%20for%20Kids&irgwc=1](https://melscience.com/US-en/articles/home-dna-extraction/?irclickid=2hh2pqRY8xyLTbawUx0Mo3ENUkBwIX3pGQDJSc0&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](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-earth-magnetic-field.html>

**Section 3:**

**Climate change and global warming**

<https://letstalkscience.ca/educational-resources/backgrounders/introduction-climate-change>

**Biodiversity**

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

**Genomics and Modern Medicine**

<https://www.nationalgeographic.com/science/article/partner-content-genomics-health-care>

<https://www.mja.com.au/journal/2014/201/1/impact-genomics-future-medicine-and-health>

<https://www.nature.com/scitable/topicpage/pharmacogenomics-and-personalized-medicine-643/>

**Genetically modified crops**

<https://www.nature.com/scitable/topicpage/genetically-modified-organisms-gmos-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-impact-our-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](https://www.researchgate.net/publication/328783489_Big_Data_and_Big_Data_Analytics_Concepts_Types_and_Technologies)

### **Citizen Science**

<https://www.nationalgeographic.org/idea/citizen-science-projects/?page=1>  
<https://blogs.scientificamerican.com/guest-blog/effective-communication-better-science/>

<http://www.dialogue.ias.ac.in/article/30161/citizen-science-in-india-introduction-challenges-and-way-forward>  
<https://www.societyforscience.org/research-at-home/citizen-science/>

### **Suggested Weekly Plan:**

Weeks 1-4: Section 1

Weeks 5-8: Section 2

Weeks 9-12: Section 3

Weeks 13-14: Presentations

### **Assessment Methods\***

Internal Assessment: 25%

End Semester Theory Exam: 25%

Practical: 50%

\*Subject to directions from the Examination Branch/University of Delhi from time to time

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## Value Addition Course

### Ayurveda and Nutrition

Course Title and Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Prerequisite of the Course
		Lecture	Tutorial	Practical/Practice		
Ayurveda and Nutrition	02	1	0	1	Pass in Class 12th	NIL

#### **COURSE OBJECTIVES:**

- To introduce the basic principles of nutrition in Ayurveda
- To link the Ayurvedic nutrition with modern dietary practices for health
- To analyse basic tenets of traditional diets and health recipes
- To understand the contemporary food habits in everyday life

#### **LEARNING OUTCOMES:**

- Awareness of traditional food cultures of India
- Evaluate changing food patterns and lifestyle over the years
- Understand Indian Knowledge Systems (IKS) and key Vedic principles with respect to Food and Nutrition
- Apply basic tenets of traditional diets for health and disease
- Prepare selected healthy recipes based on Ayurvedic principles

#### **Syllabus of *Ayurveda and Nutrition***

Unit 1: Introduction to Ayurvedic Nutrition	Lectures
<ul style="list-style-type: none"> <li>● Ayurveda and Indian food cultures</li> <li>● Nutrition and lifestyle transition over the years</li> <li>● Regional Food Traditions of India</li> </ul>	4
Unit II: Basic principles of Food and Nutrition and Ayurveda	6

<ul style="list-style-type: none"> <li>Understanding rich sources of nutrients</li> <li>Concept of <i>Doshas</i> &amp; assessment</li> <li>Ayurvedic Principles of food habits and factors determining quality of food (<i>Ahara vidhi visheshaayatana</i>)</li> <li>FSSAI regulations on Ayurvedic Aahar</li> </ul>	
<b>Unit III: Ayurvedic Diets</b>	<b>5</b>
<ul style="list-style-type: none"> <li>Principles of Diet: <i>Aharavidhi vidhan</i>, <i>Sattvic</i>, <i>Rajasi</i>, <i>Tamasic</i> foods</li> <li>Incompatible food (<i>Viruddha Ahara</i>), <i>Pathya</i>; <i>Apathya</i>; <i>Viprita Ahaar</i></li> <li>Lifestyle Management with <i>Dincharya</i> and <i>Ritucharya</i></li> <li>Application of Ayurvedic diets to stress linked food behaviour</li> </ul>	

**Practical/ Practice Component****(15 sessions of 2 hours each= 30 hours)**

- Visit your local market and classify the available food items according to *Sattvic*, *Rajasi*, *Tamasic* foods
- Conduct a survey of 10-15 households in your locality:
  - to study food behaviour and analyse them in light of Ayurvedic dietary principles of *Sattvic*, *Rajasi*, *Tamasic*
  - to study the food consumption patterns and intake of incompatible food: *Viruddha Ahara*, *Pathya*; *Apathya*; *Viprita Ahaar*
  - To know about their adopted lifestyle *Dincharya* and *Ritucharya*
- Students are required to visit available e-resources of University of Delhi, Ministry of Ayush with regard to Ayurveda and Nutrition.
- If required, students can share their experiences in the form of a Project Report.
- The students may share their experiences in the form of audio-visual presentations of 15-30 minutes.
- Any other Practical/Practice as decided from time to time

**Essential Readings**

- Rastogi S (2014) Ayurvedic Science of Food and Nutrition. ASIN: BOOHWMV094, Springer: ISBN-13:978-1461496274
- Rastogi S (2010) Building bridges between Ayurveda and modern science. Int J Ayurveda Res. 1(1):41-46.
- FSSAI regulations on Ayurveda Aahar Regulations 2022. Gazette of India CG-DL-E-07052022-235642. New Delhi, Friday, May 6, 2022/ Vaisakha 16, 1944.
- Frawley D (2012) Ayurvedic healing: A comprehensive guide. Lotus Press, India.
- <https://iksindia.org/>: Indian Knowledge Systems

**Suggested Readings**

- Charaka Samhita, Charaka (1998) In: Tripathi BN (ed) Sutra Stahan Maharashtra Adhyay. Chaukhamba Orientalia, Varanasi.

- Kapoor Kapil & Singh AK Indian Knowledge Systems Volume – 1. Indian Institute of Advanced Study Shimla. Published by DK Printworld (P) Ltd, N.Delhi.  
<https://www.lkouniv.ac.in>.

**Assessment Methods\***

Internal Assessment: 25%

End Semester Theory Exam: 25%

Practical: 50%

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