The Kelkar Education Trust's

Vinayak Ganesh Vaze College of Arts, Science & Commerce

(Autonomous)

Mithaghar Road, Mulund East, Mumbai-400081, India

College with Potential for Excellence

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Syllabus for S.Y.B.A. Programme

Physics Open Elective [OE]

Syllabus as per Choice Based Credit System (NEP-2020)

(June 2025 Onwards)

Submitted by

Department of Physics

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Syllabus as per Choice Based Credit System (NEP 2020)

Syllabus for Approval

Subject: Physics Open Elective

Sr. No.	Heading	Particulars
1	Title of Programme	**Second Year B.A. [Physics OE] : Semester III and IV**
2	Eligibility for Admission	As per university guideline
3	Passing marks	Minimum D Grade or equivalent minimum marks for passing at the Graduation level.
4	Ordinances/Regulations (if any)	---
5	No. of Years/Semesters	One year/ Two semester
6	Level	U.G. Part-I : Level- 5.0
7	Pattern	Semester
8	Status	Revised
9	To be implemented from Academic year	2025-2026

Date: …….. **Signature:**

BOS Chairperson: ……..

The Framework of the Choice-Based Credit System [NEP-2020]

- **Major Subject**:
  A single subject course of study pursued by a student as a mandatory requirement of the programme of study. Indian Knowledge System (IKS) to be included in the core courses.
- **Elective Course**:
  An elective course could be a project designed to acquire skills to supplement the major study.
- **Minor Subject**:
  A second subject of study pursued by a student as an additional requirement of the programme of study.
- **OE: Open Elective**
  An elective course chosen generally from an unrelated discipline/subject, to seek multidisciplinary exposure.
- **AEC: Ability Enhancement Course**
  Mandatory Courses on content related to Language, and Literature
  (i) Compulsory – English communication
  (ii) Elective – any Indian language other than English.
- **IKS: Indian Knowledge System (Generic)**
  Mandatory course - an overview of the contribution of India towards multidisciplinary research and development.
- **VSC: Vocational Skill Course**
  Courses aimed at imparting practical skills, hands-on training, and soft skills to increase the employability of students. Specific or supporting the major subject is to be chosen from a basket/pool offered by the college.
- **SEC: Skill Enhancement Course**
  Courses aimed at imparting practical skills, hands-on training, and soft skills to increase students' employability. It could be chosen from a basket/pool offered by the college or a MOOC on Swayam or NPTEL platforms.
- **On-Job Training (OJT)/Internship/Field Project (FP)/Community Engagement Programme (CEP)/Research Project (RP)**
  Application of knowledge/concepts in solving or analysing a real-life problem. All these are related to the major subject.
- **CC: Co-curricular Course**
  For the holistic development of students through Cultural activities such as performing art, visual art, NCC, NSS, Yoga, etc.
- **VEC: Value Education Course**
  Compulsory courses on
  (i) The Constitution of India
  (ii) Environmental Education

Programme Educational Objectives

PEO1	Introduce basic concepts of physics in a relatable manner to students from non-science backgrounds.
PEO2	Enable learners to appreciate the scientific basis of everyday experiences and common technologies.
PEO3	Equip students with practical skills for measuring physical quantities using basic instruments.
PEO4	Encourage scientific thinking in analyzing personal health, environment, and household decisions.
PEO5	Foster social and ethical responsibility by understanding the implications of using physical technologies.
PEO6	Promote interdisciplinary interest and further curiosity about science in arts, commerce, and life contexts.

Programme Outcomes

Upon successful completion of the B.Sc. (Physics) course from Vaze College affiliated to Mumbai University, graduates can expect the following outcomes:

PO1	Understand and explain fundamental physical concepts and their relevance to everyday life and health.
PO2	Apply physics principles to observe, describe, and interpret real-life situations and technological devices.
PO3	Perform basic physical measurements using common instruments and interpret the outcomes appropriately.
PO4	Communicate physics-related observations and ideas effectively using simple scientific language.
PO5	Demonstrate awareness of the impact of physics-based technologies on health, environment, and safety.
PO6	Develop curiosity, critical thinking, and a habit of lifelong learning through interdisciplinary exploration.

Programme Specific Outcomes

PSO1	Demonstrate an understanding of the historical development of mathematical and astronomical knowledge in ancient India and its practical applications.
PSO2	Analyze the evolution of scientific thinking and philosophical perspectives on the structure and constituents of matter in ancient and medieval India.
PSO3	Evaluate the contributions of medieval Indian astronomers and their role in the development of scientific instruments, observatories, and scholarly translations.
PSO4	Assess the growth of scientific institutions in colonial India, their response to modern scientific knowledge, and the impact of British rule on Indian scientific advancements.
PSO5	Identify key achievements in Indian space research and nuclear programs, focusing on organizations like ISRO, DRDO, and BARC, and their contributions to national development.
PSO6	Critically examine India's international collaborations in scientific research, particularly in the fields of space exploration, nuclear energy, and advanced physics, and their role in global scientific progress.

The Detailed Semester and Course Wise Syllabus as follows:

SEMESTER III						
	Code	**Course of Study**	**Cr.**	**L**	**T**	**P**
OE	VSPH208	History of Physical Sciences in India	2	2	-	-
Total			**2**	**2**	**-**	**-**

SEMESTER IV						
	Code	**Course of Study**	**Cr.**	**L**	**T**	**P**
OE	VSPH258	Scientific Advances of Modern India	2	2	-	-
Total			**2**	**2**	**-**	**-**

L = Lecture hours per week
T = Tutorial hours per week
P = Practical hours per week

- **1 Credit = 15 Hours Lecture**
- **1 Credit = 30 Hours Practical**

Semester – III

Open Elective [For Arts Students]
Course Code: VSPH208
Credits: 2

Physical Sciences in India

Course Learning Objective

Upon Completion of the course the student will be able to

LO 1	To introduce students to the early Indian contributions in mathematics and astronomy, including ideas of time, seasons, and celestial observations.
LO 2	To explore ancient Indian philosophical ideas regarding the structure and constituents of matter.
LO 3	To highlight developments in astronomy during medieval India, including observatories, instruments, and scholarly translations.
LO 4	To analyse the scientific institutions and the Indian response to modern scientific knowledge during colonial times.

Course Code VSPH208	**Physical Sciences in India**	**Credits 2**	**Lectures 30**
Course Outcomes : Upon Completion of the course the student will be able to			
CO 1	Describe key developments in mathematics and astronomy in ancient India and their practical applications.		
CO 2	Compare philosophical approaches to matter and identify their relevance in historical and scientific contexts.		
CO 3	Summarize scientific advances and royal patronage in medieval India, including the role of observatories and instruments.		
CO 4	Evaluate the growth of scientific institutions in colonial India and the Indian engagement with global scientific knowledge.		
Unit	**Content**		**No. of Lectures**
Unit 1	**1. Ancient India in Astronomy and Mathematics** 1.1. Work in Mathematics, Geometry 1.2. Idea of Universe, Observation Methods 1.3. Calculation of Seasons, Equation of Time **2. Ancient India in the Understanding of Matter** 2.1. Different Philosophies on Constituents of Matter		**10**
Unit 2	**3. Medieval India in Astronomy** 3.1. Intellectual Curiosity and Patronage of Rulers 3.2. Astronomical Observatories		**10**

	3.3. Scientific Instruments 3.4. Scientific Literature and Its Translation	
Unit 3	**III. Colonial India and Scientific Progress: Indian Response to New Scientific Knowledge** 4.1. Indian Association for Cultivation of Sciences 4.2. Bombay Astrophysical Observatory 4.3. Trigonometrical Society of India 4.4. Astronomical Observatory of Madras 4.5. Indian Institute of Science 4.6. Overview of Space Research in Colonial India	**10**

Reference Books :

1. The History of Mathematics: A Brief Course – Roger Cooke, Wiley - Interscience
2. In pursuit of excellence: A history of the Indian Institute of Science - B.V. Subbarayappa, Tata Mcgraw-hill
3. Nuclear India - J. P. Jain. India Quarterly, Radiant Publishers
4. Science and Empire – Deepak Kumar; Anamika, New Delhi
5. Science, Technology and Colonization – Satpal Sangwan; Anamika, New Delhi
6. The colonial model and the emergence of national science in India – V. V. Krishna
7. Life and times of Sawai Jai Singh – V. S. Bhatnagar
8. Cosmic Architecture of India, Astronomical Monuments of Jai Singh - Andreas Volwahsen
9. Science and Technology in Medieval India – O. P. Jaggi
10. Science in British India – R. Kocchar
11. ISRO: Institutions that shaped modern India – Ajay Lele
12. https://www.ino.tifr.res.in/ino/

Semester – IV

Open Elective [For Arts Students]

Course Code: VSPH258

Credits: 2

Scientific Advances of Modern India

Course Learning Objective

Upon Completion of the course the student will be able to

LO 1	Understand the key milestones in India's space research, including the establishment of ISRO, the INSAT system, and significant space missions.
LO 2	Analyse the evolution of India's nuclear program, including the establishment of the Department of Atomic Energy (DAE) and the BARC's contributions.
LO 3	Evaluate the contributions of notable Indian scientific organizations like CSIR, TIFR, and the Institute for Plasma Research in advancing scientific research.
LO 4	Examine India's international collaborations in scientific research and their impact, focusing on organizations like CERN, ITER, LIGO, and INO.

Course Code VSPH258	**Scientific Advances of Modern India**	**Credits 2**	**Lectures 30**
Course Outcomes : Upon Completion of the course the student will be able to			
CO 1	Describe the major achievements in Indian space research, including key missions, and the role of ISRO and DRDO in shaping India's space capabilities.		
CO 2	Assess the progress of India's nuclear program and the role of scientific institutions like BARC in the development of nuclear energy.		
CO 3	Discuss the contributions of scientific organizations such as CSIR, TIFR, and Institute for Plasma Research to India's scientific advancements.		
CO 4	Evaluate the significance of India's participation in global scientific collaborations such as CERN, ITER, and LIGO, and their impact on research.		
Unit	**Content**		**No. of Lectures**
Unit 1	**1. Modern India in Space** 1.1. Defense Research and Development Organization (DRDO) 1.2. Indian Space Research: Establishment of ISRO, Indian National Satellite (INSAT) System 1.3. Indian Space Policy and Laws 1.4. Overview of Achievements in Indian Space Research and Missions 1.5. Notable Indian Scientists in Astronomy, Astrophysics, Space Research **2. Evolution of the Indian Nuclear Program** 2.1. Establishment of Department of Atomic Energy (DAE), Atomic Energy Commission 2.2. India's Three-Stage Nuclear Power Program, BARC 2.3. Notable Indian Scientists in the Field		**10**

Unit 2	**3. Other Notable Scientific Organizations and Their Contributions** 3.1. Council of Scientific and Industrial Research (CSIR) 3.2. Tata Institute of Fundamental Research (TIFR) 3.3. Institute for Plasma Research 3.4. Notable Indian Scientists in the Field	**10**
Unit 3	**4. India's International Collaboration** 4.1. CERN-Large Hadron Collider 4.2. Facility for Antiproton and Ion Research (FAIR) 4.3. India-Based Neutrino Observatory (INO) 4.4. International Thermonuclear Experimental Reactor (ITER) 4.5. Laser Interferometer Gravitational-Wave Observatory (LIGO) 4.6. Thirty Meter Telescope (TMT) 4.7. A Large Ion Collider Experiment (ALICE) 4.8. Notable International Scientists of Indian Origin	**10**

Reference Books :

1. The History of Mathematics: A Brief Course – Roger Cooke, Wiley-Interscience
2. In pursuit of excellence: A history of the Indian Institute of Science - B.V. Subbarayappa, Tata McGraw-Hill
3. Nuclear India - J. P. Jain. India Quarterly, Radiant Publishers
4. Science and Empire – Deepak Kumar; Anamika, New Delhi
5. Science, Technology and Colonization – Satpal Sangwan; Anamika, New Delhi
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10. Science in British India – R. Kocchar
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Theory Examination Pattern for

(Open Elective)

➢ Internal Assessment – Theory Paper (Total: 40 Marks)

Sr. No.	Component	Nature of Assessment	Marks
1.	**CIA-1** **Class Test** (Short Answers / MCQs / Objective Questions)	Written test conducted in class	**15**
2.	**CIA-2** **Assignment / Project / Presentation / Book Review / Research Review**	Individual or group work submitted as report or presented orally	**15**
3.	**CIA-3** **Participation, Performance & Attendance**	Based on engagement, attentiveness, regularity	**10**
Total			**40**

➢ External Assessment – Semester End Theory Paper (Total: 60 Marks)

Paper Name		
Duration : 2 Hours		**Marks : 60**
Q. 1	Questions Based on Unit 1	15
Q. 2	Questions Based on Unit 2	15
Q. 3	Questions Based on Unit 3	15
Q. 4	Questions Based on Unit 1, 2, 3	15