
# St. Albert's College (Autonomous)

An initiative of Archdiocese of Verapoly

Affiliated to Mahatma Gandhi University, Kottayam

(Accredited with "A" Grade by NAAC)

# Programme Outcomes
# Programme Specific Outcomes
# Course Outcomes

Department of Space Science and Technology

## PROGRAMME OUTCOMES (PO)

**Deep Knowledge in the Discipline**: To develop a thorough knowledge about the subject and its allied realms by conscious and continuous process of learning and get informed about the cutting edge research in the frontier areas of the subject.

**Critical Thinking and Problem Solving Skills**: To develop an informed and analytical approach to learning and demonstrate an in-depth knowledge of the subject and to give his/her opinion supported by logical reasoning and problem solving skills.

**Self-Awareness and Emotional Intelligence:** To develop a proper idea about one's own capabilities and potentials and to nurture those attributes towards holistic personality development.

**Teamwork and Effective Communication:** To demonstrate proficiency in communicating competently in groups and organizations, competence in interpersonal communication and to possess skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts.

**Leadership Qualities:** To build essential features of a true leader and to cultivate the character and courage to shoulder responsibilities.

**Social Interaction and Ethical Standards:** To foster the social skills and developing peer interaction and enabling them to make all people feel valued and to respect their differences by being responsible citizens for creating a socially inclusive society. To recognize values such as justice, trust, equity, fairness, kindness and develop a commitment to meeting and upholding standards of ethical behaviour in all walks of life and comprehending the moral dimensions of decisions and actions.

**Environmental Consciousness:** To discern the issues of environmental contexts and engages in promoting values and attitudes that claim coexistence and sustainable living with reduced, minimal, or no harm upon ecosystems.

**Lifelong Learning:** To develop a passion to be an independent lifelong learner by imbibing real-time changes in the socio-technological context, promoting continuous

development and improvement of the knowledge and skills needed for employment and personal fulfillment.

## PROGRAMME SPECIFIC OUTCOMES (PSO)

MSc Space science and Technology is a master's programme specially designed with the guidance of Indian Space Research Organization under University Grants Commission innovative program with the aim of developing research interest in Atmospheric and Astronomical disciplines among students and thereby facilitating them to give back to the society through their research. The major outcomes envisioned through this program are,

To train the students to engage research under inter disciplinary domains- the course is designed in a way so as to impart sound theoretical knowledge in the realms of Physical, Astronomical and Atmospheric sciences along with contemporary practical ,computational and analytical methods.

Enable the students to work under demanding and rigorous nature of research- the course allows the students to carry out their master's thesis work at leading scientific institutions around the country. The project is carried out in three month time and thus preparing them in a time bound manner.

## COURSE OUTCOMES (CO)

### Paper – I: FUNDAMENTALS OF ATMOSPHERIC AND SPACE SCIENCES
### Paper Code: PSP1CRT01
### Course Outcome

- Understand the fundamental concepts of Atmospheric and Space Sciences.
- Interpretation of common atmospheric phenomena with the help of basic Physics principles.

### Paper – II: CLASSICAL MECHANICS
### Paper Code: PSP1CRT02
### Course Outcome

- How to use Newton's laws of motion to solve advanced problems involving the dynamic motion of classical mechanical systems.
- How to use differential equations and other advanced mathematics in the solution of the problems considered in item 1.

- How to use conservation of energy and linear and angular momentum to solve dynamics problems.
- How to represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulations of classical mechanics.

**Paper – III: QUANTUM MECHANICS**

**Paper Code: PSP1CRT03**

**Course Outcome**

- Have a deep understanding of the mathematical foundations of quantum mechanics.
- Be able to solve the Schrödinger equation using various approximation methods.
- Have a basic understanding of relativistic effects in quantum mechanics.

**Paper – IV: MATHEMATICAL AND STATISTICAL METHODS – I**

**Paper Code: PSP1CRT04**

**Course Outcome**

- Be familiar with the main mathematical methods used in physics.

**Paper V: NUMERICAL METHODS AND COMPUTER PROGRAMMING**

**Paper Code: PSP1CRT05**

**Course Outcome**

- Apply Numerical analysis which has enormous application in the field of science and some fields of Engineering.
- Familiar with finite precision computation.
- Familiar with numerical solutions of nonlinear equations in a single variable.
- Familiar with calculation and interpretation of errors in numerical method.
- Familiar with programming with numerical packages like FORTRAN

**Paper I (Lab) – COMPUTER PROGRAMMING – I**

**Paper Code: PSP1CRPP01**

**Course Outcome**

- Solve problems through writing FORTRAN programs.
- Develop FORTRAN programs from specifications and document those programs in a style permitting the maintaining and altering of the programs by a third party.

## Paper – VI: FUNDAMENTALS OF EARTH SCIENCES AND REMOTE SENSING

**Paper Code: PSP2CRT01**

**Course Outcome**

- Understanding of fundamental geologic concepts as it relates to Earth processes and landscape evolution through geologic time. (Critical Thinking, Empirical and Quantitative Skills).
- Knowledge on the interdependence of science and technology and the influences geologic reasoning associated with identifiable and testable hypotheses of geologic processes.
- Students will be able to recognize and explain at a basic level fundamental physical principle of remote sensing, including the electromagnetic spectrum; the emission, scattering, reflection, and absorption of electromagnetic (EM) radiation; how EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and imagery.

## Paper – VII: STATISTICAL MECHANICS

**Paper Code: PSP2CRT02**

**Course Outcome**

- Have a deep understanding of physical statistics and its relation to information theory,
- Be able to solve statistical mechanics problems for simple non-interacting systems
- Have a basic understanding of the phase transitions,
- Be able to use linear response theory and kinetic equation approach.

## Paper – VIII: ELECTRODYNAMICS

**Paper Code: PSP2CRT03**

**Course Outcome**

- Have a deep understanding of the theoretical foundations of electromagnetic phenomena
- Be able to solve the Maxwell equations for simple configurations

## Paper – IX: INTRODUCTION TO PLASMA PHYSICS AND SPACE PHYSICS

**Paper Code: PSP2CRT04**

**Course Outcome**

- Understand and use the basic mathematical formalism needed for describing the dynamics of continuous media.
- Have a very good knowledge on mathematical models for plasma and will be able to distinguish the dynamics of plasmas and neutral fluid media.

- Classify the main domains where space physics applies and enumerate their properties, giving specific details,
- Describe and define the relevant key physical theories (particularly from plasma physics) that control the qualitative properties of different space plasma phenomena,
- Calculate the quantitative behaviour of different space physics phenomena using plasma physics analysis methods,
- Demonstrate an understanding of how space physics has a practical impact on everyday life in the field of space weather,
- Identify ways in which experimental studies of space physics phenomena have advanced our understanding of basic plasma physics.

**Paper – X: ADVANCED COMPUTER PROGRAMMING**

**Paper Code: PSP3CRT05**

**Course Outcome**

- Apply and develop object oriented code.
- Develop software for a variety of architectures (e.g., Windows, UNIX, and Linux).
- Choose an appropriate computer language (e.g., Python, MATLAB, IDL) for a given project.

**Paper II (Lab) – COMPUTER PROGRAMMING – II**

**Paper Code: PSP2CRP01**

**Course Outcome**

- Solve problems through writing Python & MATLAB programs.
- Develop Python & MATLAB programs from specifications and document those programs in a style permitting the maintaining and altering of the programs by a third party.
- Use GIS to present the findings in related areas with clarity.

**Paper – XI: ATMOSPHERIC DYNAMICS**

**Paper Code: PSP3SCRT01**

**Course Outcome**

- Understanding of the use of potential vorticity thinking to diagnose and interpret atmospheric flow and instabilities
- The student has learned the basics of wave-mean-flow interactions, wave breaking, and the Eliassen-Palm flux
- Able to describe and discuss different types of baroclinic instability using quasi-geostrophic theory

## Paper – XII: CLIMATOLOGY – TROPICAL AND GLOBAL
## Paper Code: PSP3CRT02

### Course Outcome

- Critically analyse the interactions between the atmosphere and the surface (topography, vegetation, built structures), and apply this understanding in an environmental decision-making context.
- Apply an understanding of synoptic processes and the ability to interpret a range of graphical and visual data to the explanation of weather events and forecasting.
- Analyse and interpret the relationships between large-scale ocean-atmosphere processes and regional-local climates, using simple statistical techniques.
- Synthesise their understanding of climate processes at a range of scales to explain and critique the applications of climate modelling in research and policy contexts.

## Paper – XIII: SYNOPTIC METEOROLOGY AND SATELLITE METEOROLOGY
## Paper Code: PSP3CRT03

### Course Outcome

- Skills for interpreting and applying atmospheric observations.
- Knowledge of the atmosphere and its evolution.
- Mastery of the fundamental principles governing the atmosphere and the characteristic atmospheric processes across spatial and temporal scales.

## Paper – XIV: ASTRONOMY AND ASTROPHYSICS
## Paper Code: PSP3CRT04
### Course Outcome

- A broad knowledge of fundamental physical laws applying to the world at scales ranging from the nuclear to the cosmological.
- Comprehend, apply, and analyze the most important scientific models governing modern astrophysics and be familiar with the astronomical objects studied by astronomers.

## Paper – XV: ATMOSPHERIC CHEMISTRY AND ATMOSPHERIC ELECTRICITY Paper Code: PSP3CRT05
### Course Outcome

- Predict fate of molecules and radicals under typical atmospheric conditions.
- Explain basic principles of greenhouse effect and compute global warming potentials.

- Qualitatively explain and quantitatively compute trends in photolysis rate constants with altitude, season, and time of day for molecules whose photochemistry is known.
- Appreciation of the elementary quantities of atmospheric electrostatics including fields, currents, conductivity and frequency spectra.
- An understanding of the global electric circuit and the ability to calculate the transfer of charge in both storm time and fair weather conditions.

**Paper II (Lab) ATMOSPHERIC SCIENCES**

**Paper code: PSP3CRP06**

**Course Outcome**

- Skills for interpreting and applying atmospheric observations.
- Describe, analyze and create graphical depictions of meteorological information.
- Access atmosphere science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of meteorological processes identifying areas of congruence and discrepancy.

**Paper XVI: SPACE PLASMA**

**Paper code: PSP4CRT01**

**Course Outcome**

- Calculate fundamental properties of a plasma given appropriate information
- Apply basic electromagnetism to derive the kinetic theory of plasmas
- Use kinetic theory to explain the motions of charged particles in the ionosphere and near-Earth space

**Paper XVII: ELECTIVE PAPER**

**Paper Code PSP4CRT02**

**ELECTIVE I – SOLAR PHYSICS**

**Course Outcome**

- Learn about the history of formation of the Sun and its future evolution.
- Understand the processes of energy production and transfer in the Sun, structure of solar atmosphere, corona and solar wind, generation and evolution of solar magnetic fields, physics behind solar cycle, solar seismology and solar storms
- Learn about current and past solar space missions as well ground observatories and will apply your knowledge to study various aspects of the Sun using real data

ELECTIVE II – SPACE DYNAMICS

Paper Code PSP4CRT02

Course Outcome

- Understand the basics of Orbital Mechanics
- Full understanding of conic sections and fundamental orbit equations of motion
- Understanding of the fundamentals of spacecraft attitude dynamics

Paper IV (Lab) EXPERIMENTS FOR ASTRONOMY AND ASTROPHYSICS

Paper Code PSP4CRP01

Course Outcome

- Plan and execute experimental investigations of physical processes using both standard and advanced bench and astronomical equipment, of complex physical systems or processes, demonstrating logic, initiative, and decision making skills in solving problems encountered.
- Evaluate random and systematic uncertainties inherent in experimental measurements.

Paper V (Lab) LABORATORY FOR PLASMA

Paper code: PSP4CRP02

Course Outcome

- Acquire knowledge of the various plasma diagnostics technique