

"Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

**Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur (Autonomous)**



DEPARTMENT OF PHYSICS

**B.Sc. Part - II
Semester-III & IV**

SYLLABUS

Under Choice Based Credit System

to be implemented from Academic Year 2022-23



B. Sc. Part – II CBCS
Semester - III Paper- III
Fundamentals of Astronomy and Astrophysics
(DSC -1511 C)

Theory: 60 Hours (75 lectures of 48 minutes)

Credits -4

Course Outcomes: After the completion of the course the student will be able to -

CO₁: understand the basic primary concept of ancient astronomical theories. To understand the knowledge of apparent luminosity of stars

CO₂: demonstrate a proficiency in solving problems in Astronomy and Astrophysics

CO₃: understand the basic concepts of (I) Celestial objects, Celestial Sphere, Celestial Co ordinates .(II) Terrestrial distances , concept of light years, distance of sun, moon and stars. (III) Identification of stars , various constellations and Comets ,Asteroids and Meteors.(IV) Various Spectrums, Different tools of Astronomers, evolutions of stars, H-R diagram. (V) Different theories describing origin of stars

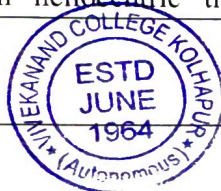
CO₄: develop the critical skill in students to understand Astronomy and Astrophysics.

Section-I: Fundamentals of Astronomy

Unit	Syllabus	Lectures
Unit 1	History of Astronomy and Apparent Luminosity of stars Babylonian astronomy, Greek astronomy, Aristotle work, Ptolemy's astronomical work, Copernican heliocentric theory, Tycho's system, Luminosity of stars, Magnitude scale, expression for luminosity ,flux and magnitude ,Luminosity measurement(1)Visual method (2) Photographic method, and (3) Photoelectric method.	10
Unit 2	The Sky, Calendar, and Celestial coordinates The moon, Sun and stars as calendars, sidereal day, sidereal time, appearance of the celestial sphere and its parts, celestial co-ordinates, longitude, and latitude on the earth celestial co- ordinates	08
Unit 3	The Stellar distances Measurement of terrestrial distances, distance of moon, distance of planets, Astronomical unit aberration of star light, Definition of parallax and Geocentric parallax, Trigonometric parallax of stars, light years and parsec.	10
Unit 4	Constellations, Comets, Asteroids, Meteors of stars, Constellations – Aries, Pisces, Orion, Asterisms – summer triangle and Big Dipper (Saptarishi). Comets, Asteroids, Meteors- Structure, chemical composition, and orbits.	08

Section-I: Fundamentals of Astrophysics

Unit	Syllabus	Lectures
Unit 1	History of Astronomy and Apparent Luminosity of stars Babylonian astronomy, Greek astronomy, Aristotle work, Ptolemy's astronomical work, Copernican heliocentric theory, Tycho's system,	10



	Luminosity of stars, Magnitude scale, expression for luminosity ,flux and magnitude ,Luminosity measurement(1)Visual method (2) Photographic method, and (3) Photoelectric method.	
Unit 2	The Sky, Calendar, and Celestial coordinates The moon, Sun and stars as calendars, sidereal day, sidereal time, appearance of the celestial sphere and its parts, celestial co-ordinates, longitude, and latitude on the earth celestial co- ordinates	08
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Reference Books:

- 1) Astronomy : Fundamentals and Frontiers – Jastrow & Thomson.
- 2) Dynamic Astronomy - Robert T. Dixon.
- 3) Astronomy – Robert H. Baker.
- 4) Fundamental of Astronomy and Astrophysics – Michael Seed.
- 5) Introductory Astronomy and Astrophysics – Zeilik and Greogary.
- 6) Moons and Planets – William K. Hartmann.
- 7) Our Solar System – A. W. Joshi and N. Rana.
- 8) The Structure of Universe – Jayant Naralika.
- 9) Astrophysics (Stars & Galaxies) – K. D. Abhyankar
- 10) Stars, Life, Death and Beyond – A. K. Kimbhavi and Jayant Naralika.
- 11) Fluid Mechanics - L. D. Landau and E. M. Lifshitz.
- 12) Classical Electrodynamics – J. D. Jackson.
- 13) Cosmic Electrodynamics – J. H. Pidington.
- 14) Fluid Dynamics – Rutherford.
- 15) An Introduction to Stellar Structure – S. Chandrasheker.
- 16) Electrodynamics–David Griffiths.
- 17) Elements of plasma physics - S. N. Goswami.
- 18) Astronomy: A Physical Perspective - Marc L. Kutner.
- 19) Exploring the universe-W.M.Protheroe,E.R. Capriotti, G.H. Newsom
- 20) An introduction to Cosmology-Jayant Vishnu Narlikar
- 21) Text book on Spherical Astronomy- W.M.Smart
- 22) Modern Physics (revised edition)- R. Murugesan,Er. Kiruthiga Sivaprasath
- 23) Spherical astronomy-M.L.Khanna
- 1) Introduction to Fluid dynamics Aitchison,
- 2) Plasma Astrophysics, Sturrock,P., Academic Press, 1967.
- 3) Fluid Mechanics, 2nd ed Landau & Lifshitz.,., Butterworth-Heinemann, 1998



B. Sc. Part – II CBCS
Semester - IV Paper- IV
Galaxies, Cosmology and Solar system and Cosmic Electrodynamics
(DSC -1511 D)

Theory: 60 Hours (75 lectures of 48 minutes)

Credits -4

Course Outcomes: After the completion of the course the student will be able to -

CO₁: understand the basic knowledge about galaxies Cosmology, solar system and cosmic electrodynamics.

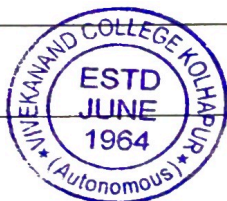
CO₂: demonstrate a proficiency in solving problems in galaxies Cosmology, solar system and cosmic electrodynamics.

CO₃: understand the basic concepts of (I) Cosmological theories , cosmological tests .(II) Milky-way galaxy, position of our solar system in milky way galaxy(III) Details of our solar system , theories of moon (IV) Concepts of fluid, continuity equation, basic equation of fluid dynamics. (V) Equation of electrodynamics and magneto hydro dynamics

CO₄: develop the critical skill in students to understand applied knowledge of Galaxies, Cosmology, solar system, and cosmic electrodynamics.

Section I Galaxies, Cosmology and Solar system

Unit	Syllabus	Lectures
Unit 1	Galaxies Components of the Universe: Introduction of Stars, Planets, Asteroids, Meteors, Comets, Galaxies, Formation of galaxies, visual morphology of galaxy, Types of galaxies-Elliptical, Spiral, Barred spiral, irregular, Hubble tuning fork diagram, Peculiar galaxies, Radio galaxies, Seyfert galaxy, Quasars.[Galaxy : Nomenclature, observation theory, Types and morphology, properties, formation and evolution, large scale structure]	12
Unit 2	Milky Way galaxy Shape of the galaxy, interstellar medium and molecules, Radio emission from interstellar carbon monoxide, clusters of stars, Galactic clusters. [Appearance, size and mass , contents, structure, formation , environment , astronomical history]	06
Unit 3	Cosmology The expanding universe, Big Bang universe , the steady state cosmology and oscillating universe, Hubble law. Hubble constant , cosmological tests .	06
Unit 4	The Solar system Origin of the solar system and planets, Basic structure of Sun -Sun's interior, the photosphere, the solar atmosphere (chromospheres and corona). Sunspots, Sun's rotation and Solar magnetic field, Explanation for observed features of sunspots, Planetary properties and quick facts of Mercury, Venus, and Mars. Moon-different theories of the moon, Structure of the moon and its quick facts	12



Section I Cosmic Electrodynamics

Unit	Syllabus	Lectures
Unit 1	Fluids Perfect Fluid: Assumptions, Equation of state, equation of motion, TOV equation, stars of uniform density, limit of mass to radius ratio. Basic equations of fluid mechanics, Energy equation, continuity equation viscosity, gas dynamics, waves and instabilities, turbulence, orbit theory, properties,	09
Unit 2	Electrodynamics Scalar electric potential (ϕ), Vector magnetic potential(A), Poisson's and Laplace's equation, Maxwell's equation in vacuum, Electromagnetic waves in vacuum- wave equation and wave velocity, scattering of light, scattering cross section, Thomson's and Rayleigh scattering, explanation for blue color of the sky, red color of sunset and sunrise.	09
Unit 3	Magneto hydrodynamics Motion of charged particle in electromagnetic field, Ideal hydro magnetic equation, Characteristics of plasma in magnetic field - Diffusion and freezing effect, Magnetohydrodynamic equation -magnetic pressure and magnetic tension, confinement of plasma	09
Unit 4	Hydrodynamics Equation of continuity - conservation of mass, Ideal fluid and Euler's equation of motion, Navier-Stokes equation for viscous fluid.	09

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25) Plasma Astrophysics, Sturrock,P., Academic Press, 1967.
26) Fluid Mechanics, 2nd ed Landau & Lifshitz., Butterworth-Heinemann, 1998

**Skill Enhancement Course
(SEC) I (Cosmology and
Galaxies)
B.Sc. II
(Credit 2)**

I. Project work regarding cosmological theories and galaxies

- Big-Bang theory
- Oscillatory theory
- Steady state theory
- Types of Galaxies

**Skill Enhancement Course (SEC) II
(Cosmology and Galaxies)
B.Sc. II
(Credit 2)**

I. Project work regarding solar system, solar activities and stellar evolution

- History of planets
- Sun spots, solar magnetic field, rotation of sun, interior of sun
- Protostar, dwarf star, pulsar, super nova black hole etc.

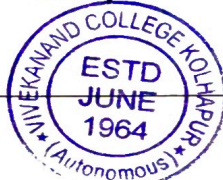
B.Sc. II Astrophysics Lab Work (Practical)

Marks-100 (Credits: 08)

Group I

- 1) Numerical Integration.
- 2) Numerical Differentiation.
- 3) Numerical interpolation.
- 4) Solution of ordinary differential equations.
- 5) Measurement of terrestrial distance using Sextant.
- 6) Total internal reflection in prism.
- 7) Constellation map drawings – a) Orion b) Ursa Major (Big Dipper) c) Auriga d) Taurus.
- 8) To use idea of parallax to determine large distance

Group II



- 1) Lummer Brothum Photometer (comparison of intensities)
- 2) Spherical aberration (caustic curve).
- 3) Resolving power of telescope.
- 4) Magnifying power of telescope.
- 5) Determination of Planck's constant using LED
- 6) Goniometer: Equivalent focal length
- 7) Study of scattering of light (Diameter of Lycopodium powder).
- 8) Verification of Stefan's forth power law.

Group III

- 1) I-V Characteristics of solar cell and verification of inverse square law of intensity.
- 2) Velocity of sound using CRO and microphone.
- 3) Study of Lissageous figures using CRO.
- 4) D.C. Amplifier using Operational amplifier.
- 5) Measurement of Earth's magnetic field using Earth inductor.
- 6) Measurement of wavelength of given LASER source using diffraction grating.
- 7) Phase shift measurement RC network using CRO.
- 8) Study of hysteresis curve using CRO.

Group IV

- 1) Calibration of spectrometer.
- 2) Study of Balmer lines.
- 3) Measurement and identification of spectral lines.
- 4) Measurement of wavelength using F. P. Etalon.
- 5) Band absorption spectrum of liquid (KMnO₄ solution).
- 6) Study of solar spectrum.
- 7) Sunspots activity analysis.
- 8) Study of line absorption spectrum and measurement of temperature of flame.



- There will be internal evaluation of 15 marks for each paper.
- There will be end semester theory examination of 35 marks for each paper.
- The total marks for each paper will be 50.
- There will be separate passing for internal evaluation, end semester theory examination, practical examination and Skill Enhancement Courses

Paper No.	Internal evaluation	End Semester Theory Examination	Total
V	15	35	50
VI	15	35	50
VII	15	35	50
VIII	15	35	50

- There will be practical examination of 100 marks at the end of semester IV
- Distribution of 100 marks of practical is as below

Group I	22
Group II	22
Group III	22
Group IV	22
Journal	12
Total	100

- There will be separate examination of 100 marks for Skill Enhancement Courses (SEC's) of all three subjects together of B.Sc. II at the end of semester IV (Conducted by College Examination Cell)

Nature of Question Paper (End Semester Examination)

Instructions:

- 1) All the questions are **compulsory**.
- 2). Figures to the right indicate **full** marks.
- 3) Draw neat labeled diagrams **wherever** necessary.

Time : 2 hours

Total Marks: 35

Paper V

Q:1] Chose correct alternative

A] **FIVE** Multiple Choice Questions

5 Marks

B] **TWO** fill in the blanks

2 Marks

Q:2] Long Answer questions (Attempt any **TWO** out of three) 16 Marks

- 1.
- 2.
- 3.



Q.3] Short Answer questions (Attempt any **THREE** out of five) 12 Marks

- 1.
- 2.
- 3.
- 4.
- 5.

