

To,

SHIVAJI UNIVERSITY, KOLHAPUR - 416 004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापुर - ४१६ ००४,महाराष्ट्र

दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१ - २६०९०९३/९४



SU/BOS/Science/481

Date: 01/07/2023

The Principal,	The Head/Co-ordinator/Director
All Concerned Affiliated Colleges/Institutions	All Concerned Department (Science)
Shivaji University, Kolhapur	Shivaji University, Kolhapur.

Subject: Regarding syllabi of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

B.Sc. Part-II (Sem III & IV) as per NEP-2020							
1.	Mathematics	8.	Chemistry				
2.	Statistics	9.	Sugar Technology (Entire)				
3.	Physics	10.	Microbiology				
4.	Astrophysics	11.	Industrial Microbiology				
5.	Zoology	12.	Electronics				
6.	Botany	13.	Geology	(÷			
7.	Plant Protection						

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website <u>www.unishivaji.ac.in</u>)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

WRegistrar Dr. S. M. Kubal

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1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

SHIVAJI UNIVERSITY, KOLHAPUR. NEP Syllabus with effect from June, 2023 B. Sc. Part – II Semester-III **DSC-IC39-** Astrophysics Paper-I **Theory: 36 Hours** Marks-50 (Credits: 02) **Paper - I (Fundamentals of Astronomy)**

Course Objectives: -

- To understand the basic concepts of Fundamentals of Astrophysics and Astronomy.
- Elucidate the Nature of Light and Message of the Star Light, basic tools of Astronomers, stellar evaluation, theories of star, galaxies, milky way galaxy, cosmology, the Solar system, Sun, fluids, hydrodynamics , electrodynamics , and magneto hydrodynamics.
- Aim to give the student an in-depth understanding of the principles and methods of astrophysics, and the skills to apply this understanding to a range of theoretical, observational, and practical problems, at a level appropriate for a professional scientist.

UNIT-I: History of Astronomy: -

Ptolemy's astronomical work, Tycho Brahe's observation Copernican heliocentric theory, Kepler's laws, and its explanation.

UNIT-II: The Sky, Calendar and Celestial coordinates

The moon, Sun and stars as calendars, sidereal time, sidereal day, solar day, celestial sphere, explanation of celestial co-ordinates, longitude, and latitude on the earth as a celestial coordinates.

UNIT-III: The Stellar distances and apparent luminosity of stars

Measurement of terrestrial distances, Definition of parallax and Geocentric parallax, distance of moon, distance of planets, Trigonometric parallax of stars, Astronomical unit (light years, and parsec). Luminosity of stars, Magnitude scale, Luminosity measurement (1) Visual method, (2) Photographic method, and (2) Photoelectric method.

UNIT-IV: Constellations, Comets, Asteroids, Meteors:

Identification of stars, Constellations, Asterisms - summer triangle and Big Dipper (Saptarishi), Hunter (Orion), Comets, Asteroids, Meteors- Structure, chemical composition and orbits.

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DSC-IC40- Astrophysics Paper-II Theory: 36 Hours Marks-50 (Credits: 02) Paper - II (Fundamentals of Astrophysics)

UNIT I: The Nature of Light and Message of The Star Light

Light as an electromagnetic wave, Electromagnetic spectrum. Electromagnetic radiation from heated object, Doppler shift and its applications, atomic spectra-emission and absorption spectra (Fraunhofer lines).

UNIT II: Basic Tools of Astronomers

Optical telescopes-Galilean, Newtonian, Cassegrainian, Hubble space telescope, Magnifying power of telescope, Resolving power of telescope, Spectroscope (prism, grating), UV, IR, Radio, X-Ray, and Gravitational waves astronomy, LIGO (qualitative).

UNIT III: Stellar evolution

Life cycle of stars (from protostar to black holes), Hertzsprung-Russell (H-R) diagram- white and red dwarfs, electron degeneracy pressure, Chandrasekhar limit, Neutron stars

UNIT IV: Theories of star

Classification and spectral characteristics of stars (temperature, mass, spectral absorption, stages of evolution), Nuclear Reactions in stars, Photon diffusion time, gravitational binding energy of a star, internal temperature, and pressure of a star. Sun as a 'G' type star.

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B. Sc. Part – II Semester-IV DSC-ID39- Astrophysics Paper-III Theory: 36 Hours Marks-50 (Credits: 02) Paper - III (Galaxies, Cosmology and Solar system)

UNIT I: Galaxies

Components of the Universe: Galaxies, Formation of galaxies, Types of galaxies-Elliptical, Spiral, peculiar, irregular, Hubble tuning fork diagram, Active galaxies: Radio galaxies, Seyfert galaxy, Quasars.

UNIT II: Milky Way galaxy

Shape of the galaxy, characteristics (number of stars, radius, age, angular momentum, declination, rotation period) interstellar medium and molecules, location of our sun and earth in milky way galaxy, clusters of stars, Galactic clusters.

UNIT III: Cosmology

The expanding universe, Big Bang universe, the steady state cosmology and oscillating universe, Hubble law, applications of Hubble's law: 1) Age of the present universe 2) Distance of observable distant galaxy, cosmological tests.

UNIT IV: The Solar system

Origin of the solar system and planets, condensation theory of solar system, Basic structure of Sun - Sun's interior, the photosphere, the solar atmosphere (chromospheres and corona). Sunspots and its characteristic features, Explanation for observed features of sunspots, Planetary properties and quick facts of Mercury, Venus, Mars, Saturn and Jupiter. Moon - different theories of the moon, characteristics (structure of the earth and continental drift),

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B. Sc. Part – II Semester-IV DSC-ID40- Astrophysics Paper-IV Theory: 36 Hours Marks-50 (Credits: 02) Paper - II (Cosmic Electrodynamics)

UNIT-I: 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.

UNIT-II: Hydrodynamics

Equation of continuity - conservation of mass, Ideal fluid and Euler's equation of motion, Navier-Stokes equation for viscous fluid, waves and instabilities in a fluid, turbulence.

UNIT-III: Magneto hydrodynamics

Motion of charged particle in electromagnetic field, Ideal hydro magnetic equation, Characteristics of plasma in magnetic field - Diffusion and frozening effect, Magnetohydrodynamic equation -magnetic pressure and magnetic tension, confinement of plasma

UNIT-IV: Hydrodynamics in gravitational field

Energy-momentum tensor, Pressure less fluid (dust), Equation of state, TOV equation, stars of uniform density, limit of mass to radius ratio.

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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) A revision book of Astronomy and Astrophysics - Rohan Gharate

7) A textbook of Astronomy of astrophysics - Mohit Kumar Sharma and Suresh Chanra

8) Theoretical Astrophysics – T. Padmanabhan

9) Moons and Planets – William K. Hartmann.

10) Our Solar System – A. W. Joshi and N. Rana.

11) The Structure of Universe – Jayant Naralikar.

12) Astrophysics (Stars & Galaxies) - K. D. Abhyankar

13) Stars, Life, Death and Beyond – A. K. Kimbhavi and Jayant Naralikar.

14) Fluid Mechanics - L. D. Landau and E. M. Lifshitz.

15) Classical Electrodynamics – J. D. Jackson.

16) Cosmic Electrodynamics – J. H. Pidington.

17) Fluid Dynamics – Rutherford.

18) An Introduction to Stellar Structure – S. Chandrashekher.

19) Electrodynamics–David Griffiths.

20) Elements of plasma physics - S. N. Goswami.

21) Astronomy: A Physical Perspective - Marc L. Kutner.

22)Exploring the universe-W.M.Protheroe, E.R. Capriotti, G.H. Newsom

23) An introduction to Cosmology-Jayant Vishnu Narlikar

24)Text book on Spherical Astronomy- W.M.Smart

25)Modern Physics (revised edition)- R. Murugeshan, Er. Kiruthiga Sivaprasath

26)Spherical astronomy-M.L.Khanna

27)Introduction to Fluid dynamics Aitchison,

28) Plasma Astrophysics, Sturrock, P., Academic Press, 1967.

29)Fluid Mechanics, 2nd ed Landau & Lifshitz.,,, Butterworth-Heinemann, 1998

DSC-IC and DSC-ID -Practicals Marks-100 (Credits: 08) List of Experiments

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.

Part – II: Study tour and/or Night sky observation.

Practical Examination: Each candidate has to perform a total of 4 experiments (one experiment from each group)

Practical Marks distribution:

i) Each experiment carries 20 marks X 4 = 80

ii) Journal = 10

iii) Report on Part - II = 10

Course Outcomes:-

- Explain the fundamental principles that underpin theoretical and observational astrophysics and astronomy.
- Inculcate the importance of astrophysics and astronomy to the core areas of stellar astrophysics, fluids, hydrodynamics, electrodynamics magneto hydrodynamics, plasma galaxies and cosmology.
- To develop the student's competence in the application of methods of mathematics and in an astrophysical context.