SHIVAJI UNIVERSITY, KOLHAPUR.

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CHOICE BASED CREDIT SYSTEM

Syllabus For

B.Sc. Part -I

Astrophysics and Space Science

SEMESTER I AND II

(Syllabus to be implemented from June, 2018 onwards.)

B. Sc.Part I Semester I

Paper I: DSC 35A :Fundamentals of Astronomy

Theory :30 hrs Marks : 50 Credit: 02

Unit 1 **30 Lectures**

History of Astronomy and Apparent Luminosity of Stars:

Ptolemy's astronomical work, Copernican heliocentrism and Tychonian system, Luminosity (Apparent and Absolute) of stars, Magnitude scale, Luminosity measurement: 1)Visual Method 2) Photographic method and 3) Photoelectric method. **(7)**

Unit 2:-

Stellar Evolution (HR diagram): Life cycle; Stellar Processes (Nuclear) and spectral classification of Stars O, B, A, F, G, K, M. **(7)**

Unit 3: -

The Sun and Planets

Origin of the solar system, Internal structure and surface features of sun, Sun spots and Magnetic field on the sun and Solar activity.

Surface features of planets, Atmospheres and Magnetic fields of Planets and their moons. **(8)**

Unit 4

Asteroids, Meteors, Comets and Galaxies:

Asteroids: Discovery and designation, Origin, Nature and Orbits of Asteroids.

Meteors : Meteor showers and sporadic meteors.

Comets : Periodic comets, Brightness variation in Comets. Gas production rates, dust and ion tails. **(8)**

List of Reference Books:

1. Astronomy structure of the Universe. A.E. Roy and D. Clarke, Adam Hilger Pub.
2. Source Book of Space Sciences, Samuel Galsstone; D.VanNostrand Co. Inc
3. Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, NarosaPub.
4. Structure of the Universe, J.V. Narlikar
5. Introduction to Astrophysics - Baidyanath Basu
6. Astrophysics: Stars and Galaxies- K.D.Abhyankar: Tata McGraw Hill Publication(Chap.2)
7. "Astrophysics: A modern Perspective" - K. S. Krishnaswami New Age International.
8. K. S. Krishnaswami, "Understanding cosmic Panorama" New Age International.
9. Frontiers in Astronomy by Jastrow

B. Sc.Part I Semester I

Paper II: DSC36A:Mathematical course for Astrophysics and Space science

Theory :30 hrs Marks : 50 Credit: 02

Unit1 **30 Lectures**

Vector Algebra and Calculus: **(8)**

Scalar triple product and their interpretation in terms of area and volume respectively, Scalar and Vector fields, Vector Differentiation: Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Del and Laplacian operators, Vector identities.

Unit II: **(8)**

Curvilinear co-ordinate system: Introduction to Cartesian, Spherical polar and cylindrical coordinate systems, transformation equations. General curvilinear coordinate system: Co-ordinate surface, co-ordinate lines, length, surfaces and volume elements in curvilinear co-ordinate system, metric coefficient.

Unit III : **(7)**

Matrices

Systems of linear equations, matrix algebra, eigenvalues and eigenvectors, orthogonality and least squares, symmetric matrices and quadratic forms.

Unit IV: **(7)**

Differential equations

Types of differential equations, degree, order, linearity, homogeneity of differential equations, Method of separation of variables for solving partial differential equations, solutions of Laplace equation in two dimension especially wave equation.

References:

1. Mathematical Physics – P. K. Chattopadhyay New Age International Publishers.
2. Mathematical methods in the Physical Sciences (Second Edition) – Marry L. Boas John Willy and Sons Publication.
3. Mathematical methods for Physicists: Weber and Arfken. (6th edition) Academic press – N. Y.
4. Theory and problems of vector analysis- Schaum outline series- Murray R. Spiegel
5. Differential equations - M. L. Khanna, Meerut Publications.
6. Mathematical Physics -H. K. Dass S. Chand and Company Ltd.
7. Mathematical Physics -B. S. Rajput : Pragati Prakashan Ltd.

B. Sc. I Semester II

Paper III: 35B :Introduction to Space Science

Theory :30 hrs Marks : 50 Credit: 02

Unit I. Introduction to Planetary and Interplanetary Space: 30 Lectures

Solar System, Kepler's Laws, Earth-Moon System, Solar and Lunar types, Exploration of Solar System by Telescopes, Rockets and Satellites. **(8)**

Unit II

Structure of Earth's Atmosphere- Lower, Middle and Upper Troposphere (0-10 km), Stratosphere (10-50km), Ionosphere (50-1000 km), Protonosphere (10,000 to 60,000 km towards sun), Interplanetary space (Beyond 60,000 km towards the sun), Earth as a Magnetic Comet. **(8)**

Unit III

Observational and Experimental tools for Astronomy and Space Science:

In-situ measurements of chemical, physical and dynamical parameters using Kites, Balloons, Aeroplanes, Rockets and Satellite Payloads. **(7)**

Unit IV

Fundamental Particles and basic forces:

Protons, Electrons, Neutrons, Neutrinos, Mesons, leptons, and quarks. The concept of Basic forces viz., strong, weak, electromagnetic and gravitational forces. **(7)**

References:

1. Ionospheric Radio Propagation by Kenneth Davis. National Bureau of Standards Monograph 80 (1965), US Government Printing office, Washington D.C.
2. Physics of the Upper Atmosphere edited by J, A. Ratcliffe, Cavendish Laboratory, University of Cambridge. Academic Press New York and London (1960)
3. Research in Geophysics:Vol.1- Sun, Upper Atmosphere and space edited by Hugh Odishaw, National Academy of Sciences. Washington D.C.
4. Source book on the Space Sciences - Samuel Glasstone, Princeton, New Jersey.
5. The Upper Atmosphere - S K Mitra

B. Sc. I Semester II

Paper IV : 36B:Experimental Techniques in Astronomy

Theory :30 hrs Marks : 50 Credit: 02

Unit 1 **30 Lectures**

Electromagnetic spectrum and Astronomer's tools

The nature of light: Light as an electric vibration, the electromagnetic radiation from a heated object, Doppler shift. **(3)**

Tools of the astronomer: Optical telescopes, (Galielian, Newtonian, Cassegranian & Hubble Space Telescope), Magnifying power & Resolving power of telescopes, UV, x-ray, IR, Radio & gravitational Astronomy, Spectroscope. **(5)**

Unit II

Simple methods of Measurements and Astronomical Units: **(3)**

Measurement of terrestrial distances, distance of moon, distance of planets, Astronomical unit aberration of star light, Trigonometric parallax of stars, light years and parsec.

Interferometry: **(5)**

Michelson's interferometer and it's applications to measure i) wave length of' light ii) refractive index of thin film, construction and working of Fabry – Perot interferometer, superiority of F-P interferometer over Michelson's interferometer.

Unit III Detectors (Working Principle only) **(8)**

Detectors for optical and infrared regions, Application of CCD's to stellar imaging, photometry and spectroscopy, Techniques of observations of astronomical sources from space in infrared. EUV, X-ray and gamma-ray regions of the electromagnetic spectrum.

UNIT-IV: Optical Perspective in minimizing errors.

Aberrations: **(4)**

Aberration in images, Spherical aberration, methods to minimize it, Chromatic aberration, achromatic combination of two thin lenses separated by finite distance.

Eyepieces: **(2)**

Entrance and exit pupils, Common types of eyepieces, Huygen's eyepiece and Ramsden's eyepiece.

REFERENCES

1. Astrophysical Techniques - C. R. Kitchin:

2. Astronomical Observations - an Optical Perspective - Gordon Walker: (Cambridge University press).

3. Astronomical Photometry- Henden and Kaitchuck:

4. Astrophysics-Stars and galaxies - K.D.Abhyankar.
5. Tools of the Astronomers - C. R. Miczaika and W. M. Sinton:
6. Astronomical Techniques- W. A. Hiltner (Ed):
7. Methods of Experimental Physics - Carleton: Vol. XIIA.
8. Geometrical and Physical optics - D. S. Mathur.
9. A Text book of optics (New edition) - Subrahmanyam and Brijlal.
10. Fundamentals of optics - Jenkins and White.
11. Optics (second edition) - Ajay Ghatak.

B. Sc.Part I Semester I Practicals

DSC A(LAB- I)(Paper I &II)

1. I-V Characteristics of solar cell and verification of inverse square law of intensity.
2. Study of Plane diffraction Grating.
3. Determination of focal length of convex and plano-convex lenses by auto collimation method.
4. Calibration of spectrometer.
5. Measurement and identification of spectral lines (Hg and Na source)
6. Intensity distribution curve of ordinary electric bulb using photo cell.
7. Study of solar spectrum
8. Sunspots activity analysis.
9. Measurement of Planck's constant using LED.
10. Measurement of wavelength of given LASER source using diffraction grating.

DSC-B(LAB- II)(PaperIII and IV)

1. Assignment on Vector analysis
2. Problem solving assignment on Differential equations
3. Problem solving assignment on Matrices
4. Constellation map drawings – a) Orion b) Ursa Major (Big Dipper) c) Auriga d) Taurus.
5. To use idea of parallax to determine large distance.
6. Spherical aberration (caustic curve).
7. Resolving power of telescope.
8. Resolving power of Microscope.
9. Cardinal Points by Newton's method
10. Study of polar graph.

- **Report on Field Visit to any local space centre or laboratory or Observatory will remain mandatory.**

Scheme of Marking (Theory)

Sem	Core Course	Marks	Evaluation	Papers	Answer Books	Standard of Passing
I	DSC-A 35A & 36A	100	Semester Wise	Two papers of 50 marks	As per instructions	35%
II	DSC-A 35B & 36B	100	Semester Wise	Two papers of 50 marks	As per instructions	35%

Scheme of Marking (Practical)

Sem	Course	Marks	Evaluation	Sections	Standard of Passing
I AND II	DSC-A LAB & DSC-B LAB	50	Annual	As per instructions	35%