SHIVAJI UNIVERSITY, KOLHAPUR.

Accredited By NAAC with 'A' Grade

Revised Syllabus For

Bachelor of Science

Part- II

Astrophysics and Space Science

CBCS PATTERN

Syllabus to be implemented from

June, 2019 onwards.

SHIVAJI UNIVERSITY KOLHAPUR

B. Sc. Part – II (Astrophysics and Space Science) CBCS Syllabus with effect from June, 2019

B. Sc.Part II Semester III

Paper V DSC-35C Celestial Mechanics

Theory :36 hrs Marks : 50 Credit: 02

Unit 1 Fundamentals of Dynamics: (9hrs)

Reference frames. Inertial frames, Review of Newton'sLaws of Motion. Galilean transformations. Galilean invariance. Momentum of variable mass system: motion of rocket. Motion of a projectile in uniform gravitational field.Dynamics of a system of particles. Centre of Mass. Principle of conservation ofmomentum. Impulse.

Unit 2Work and Energy: (9hrs)

Work and Kinetic Energy Theorem. Conservative and nonconservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium.Elastic potential energy. Force as gradient of potential energy. Work & Potential energy.Work done by non-conservative forces. Law of conservation of Energy.

Unit 3 Rotational Dynamics: (9hrs)

Angular momentum of a particle and system of particles.Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

Unit 4: Gravitation and Precessional Motion

Gravitation: Law of gravitation. Gravitational potential energy. Inertial & gravitational mass. Potential and field due to spherical shell and solid sphere. **(3 hrs)**

Precessional motion : (6 hrs)

Precession, torque necessary for precession, nutation, gyroscope, Lanchester's rule, gyrostatic pendulum, motion of rolling disc.

References:

1. Feynman Lectures, Vol.I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
2. Mechanics, D.S. Mathur, S.Chand and Company Limited, 2000
3. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
4. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
5. Classical Mechanics By Goldstein

Paper VI DSC-36C : Introductory Quantum Mechanics

Theory :36 hrs Marks : 50 Credit: 02

Unit 1 : Origin of Quantum Mechanics: **(9hrs)**

Limitations of Classical Physics; Landmark discoveries leading to origin of Quantum Physics: Explanation of Black body radiation Spectrum, Photoelectric effect ,Compton effect and Pair Production (Qualitative discussions only).

Unit 2: Matter Waves **(9hrs)**

De-Broglie hypothesis and derivation of wavelength of matter wave, explanation of wave packet, group velocity, phase velocity, relations between them, Davission and Germer experiment, Bohr's quantum condition on the basis of matter waves, Heisenberg's uncertainty principle (statement and explanation)

Unit III Schrodinger's Equation **(9hrs)**

Physical interpretation of wave function, time dependent and time independent Schrodinger's wave equations (one and three dimensional), probability current density, eigen values and eigen functions,expectation values.

Unit IV Math Interlude : **(9hrs)**

Linear Vector spaces; Linear operator; Hermitian operator; Simultaneous measurability of observables; General Uncertainity Relation and Dirac Notation.

References

1 Quantum Mechanics (Kindle edition) by G. Aruldas, PHI Learning Private Limited, Delhi-1100092, 2009.

2. Quantum Mechanics : An Accessible Introduction by Rober Scherrer, Pearson Publisher.

3. Concepts of Modern Physics: Beiser, Mahajan and Choudhary, Published by Tata Mc Graw Hill Education, Pvt Ltd. New Delhi.

4. Quantum Mechanics by sing, Bagade, Kamal Sing, Chand & Comp.

5. Concepts of modern Physics by S.L. Gupta and S. Gupta, Dhanpatrai and Sons.

Paper VII DSC-D35 Cosmic Electrodynamics
Theory :36 hrs Marks : 50 Credit: 02

UNIT-I : Hydrodynamics **9 hrs**
Equation of continuity and conservation of mass, ideal fluid and Euler's equation of motion, Navier stroke's equation for viscous fluid.

UNIT-II : Electrodynamics **9hrs**
Scalar electric potential(φ),Vector magnetic potential,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 of the sky, red colour of sunset and sunrise.

UNIT-III : Magneto hydrodynamics **9hrs**
Idealized hydrodynamic equation, diffusion and frozening-in a magnetic field, MHD equation (magnetic pressure and magnetic tension), confinement of plasma,

UNIT-IV :Sun and solar activity **9hrs**
Basic structure of sun, Sun's interior, the photosphere, the solar atmosphere (chromospheres and corona). Salient features of sunspots, Sun's rotation and Solar field, Explanation for observed features of sunspots.

Reference Books:

1) Fundamentals and Frontiers of Astronomy – Jastrow & Thomson.
2) Dynamic Astronomy - Robert T. Dixon.
3) Astronomy – Robert H. Baker.
4) Souece Book on Space Science – Samuel Glastone.
5) Fundamental of Astronomy and Astrophysics – Michael Seed.
6) Introductory Astronomy and Astrophysics – Zeilik and Greogary.
7) Moons and Planets – William K. Hartmann.
8) Our Solar System – A. W. Joshi and N. Rana.
9) The Structure of Universe – Jayant Naralikar.
10) Astrophysics (Stars & Galaxies) – K. D. Abhyankar.
11) Stars, Life, Death and Beyond – A. K. Kimbhavi and Jayant Naralikar.
12) Theoretical Hydrodynamics – Bansilal.
13) Classical Electrodynamics – Jackson.
14) Cosmic Electrodynamics – J. H. Pidington.
15) Fluid Dynamics – Rutherford.
16) An Introduction to Stellar Structure – S. Chandrashekher.
17) Electrodynamics–Gupta, Kumar and Singh.

DSC-D36 Thermal Physics
Theory :36 hrs Marks : 50 Credit: 02

Unit 1 Zeroth and First Law of Thermodynamics:

Extensive and intensive ThermodynamicVariables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept ofTemperature, Concept of Work & Heat, State Functions, First Law of Thermodynamicsand its differential form, Internal Energy, First Law & various processes, Applications ofFirst Law: General Relation between C_P and C_V, Work Done during Isothermal andAdiabatic Processes, Compressibility and Expansion Co-efficient.

9hrs

Unit II Second Law of Thermodynamics:
Reversible and Irreversible process with examples.Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle,Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law ofThermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence.Carnot's Theorem. Applications of Second Law of Thermodynamics: ThermodynamicScale of Temperature and its Equivalence to Perfect Gas Scale. **9hrs**

Unit III Entropy:
Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples.Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes.Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle.Third Law of Thermodynamics. Unattainability of Absolute Zero.

9hrs

Unit IV Thermodynamic Potentials: Thermodynamic Potentials: Internal Energy, Enthalpy,Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations. **9hrs**

References:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
4. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.

5 Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

Practical Course

DSC-C & D 35 & 36(Paper V,VI,VII &VIII)

Mechanics

1. To study the random error in observations
2. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
3. To determine the value of g using Kater's Pendulum.
4. Study of Amplitude decay using Simple Pendulum
5. To calculate g using Bifilar Pendulum
6. Modulus of rigidity of a wire by Dynamical method
7. To determine moment of Inertia of Disc
8. To determine time of descent for spherical and cylindrical body rolling down an inclined plane.

Group B : Optics

1. Determination of Cauchy's constants
2. Compare dispersive powers of crown and flint glass prisms using composite light
3. Determination of Wave length of light using Fresnel's Biprism
4. Verify Brestwer's Law of Polarization
5. Comparison of Positive and Negative crystals using polarid
6. Cardinal points using Searle's Goniometer
7. Study of normal shift using material of different refractive indices
8. Newton's Rings

Group C : Electricity and Magnetism

1. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.

2. To study the response curve of a parallel LCR circuit and determine its (a) Antiresonant frequency and (b) Quality factor Q.

3. Measurement of components of Earth's magnetic field using Earth Inductor
4. Measurement of angle of Dip and Declination using dip circle
5. To determine absolute capacitance of a capacitor using Ballastic Galvanometer
6. To convert a Galavanometer into Ammeter and Voltmeter
7. To verify Maximum power transfer theorem
8. To Verify tangent law in Magnetism

Group D : Thermal Physics

1. To verify Stefan's law
2. To determine Thermal conductivity by Lee's Method
3. To determine Mechanical equivalent of heat
4. To determine temperature cefficient of thermistor
5. To determine temperature coefficient of resistance of LED
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To determine latent heat of water
8. To determine Heat of ionization/ Enthalpy of mixture

Note : Sky observation will remain mandatory for the course work

Scheme of Marking (Theory)

Sem	Core Course	Marks	Evaluation	Papers	Answer Books	Standard of Passing
III	DSC-C 35C & 36C	100	Semester Wise	Two papers of 50 marks	As per instructions	35%
IV	DSC-D 35D & 36D	100	Semester Wise	Two papers of 50 marks	As per instructions	35%

Scheme of Marking (Practical)

Sem	Course	Marks	Evaluation	Sections	Standard of Passing
III AND IV	DSC-35,36 LAB & DSC-D-35,36 LAB	100	Annual	As per instructions	35%

Nature of Question Paper

Instructions:

1. **All questions are Compulsory.**
2. **Figures to the right indicate full marks.**
3. **Use of Log table/ Calculator is allowed.**
4. **Neat diagrams to be drawn wherever necessary.**

Time : 2hrs **Total Marks 50**

I Choose the correct alternative **10 marks**

1) A] B] C] D]
2) A] B] C] D]
:
:
:
:
10) A] B] C] D]

II Attempt any two **20 marks**

A]

B]

C]

III Attempt any four **20 marks**

A] **C]** **E]**

B] **D]** **F]**

*** Note : Equal weight age should be given to all units**