Deccan Education Society's

FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

FIRST YEAR B.Sc.
Physics

SEMESTER – I

Academic Year 2016-2017

Deccan Education Society's
Fergusson College (Autonomous), Pune
Faculty of Science
Course structure for B.Sc. (Physics)

Semester	Course Code	Title of the Course	No. of Credits
I	PHY1101	Mechanics and Properties of matter	2
	PHY1102	Heat and thermodynamics	2
	PHY1103	Physics Practical - I	2
II	PHY1201	Introduction to Mathematical Physics	2
	PHY1202	Electricity and Magnetism	2
	PHY1203	Physics Practical - II	2

Preamble:

Fergusson College is awarded academic autonomy by the UGC beginning the year 2016-17. This autonomy is for a period of six years. We shall be following the semester pattern for academic transactions and the Credit Based Assessment System will be followed for assessment. The curriculum for the graduate programme in Physics is designed to cater to the requirements of the Autonomy and the Credit system following the UGC guidelines.

Physics is one of the oldest branches of natural sciences. It forms the foundation of the scientific process.

The programme is aimed to be more learning centric than teaching centric. The courses are designed so that a student progressively develops a deeper understanding of various aspects of physics.

Physics is learnt more through experimentation than only through classroom sessions. The experiments are designed to develop logical thinking and analytical ability. Reading between lines is important and some open ended experiments, assignments and small projects are designed to develop these skills.

Continuous assessment is an integral part of the credit system. This will help students learn their subjects systematically and thoroughly.

The under graduate programme in physics is spread over three years with two semesters every year. There will be two theory courses and one laboratory course each semester for the first and the second year. For the third year, there will be six theory courses and three laboratory courses each semester.

Objectives:

1. To explore different areas of physics.
2. To develop theoretical foundation and experimental skills to study various natural phenomena.
3. To train students for in depth study of physics.
4. To encourage students to explore applications of physics in various walks of life.
5. To inculcate research culture by introducing projects at the final year of the course.

PAPER CODE: PHY1101 **PAPER – I: MECHANICS AND PROPERTIES OF MATTER** **No. of Credits: 2** **No. of Lectures: 36**		
	Title and Contents	**No. of Lectures**
Unit -I	**Moment of Inertia** **Moment of Inertia:** Definition of MI, Radius of gyration, Statement of parallel and perpendicular axis theorems. Derivation of MI of: i) Circular Ring, ii) Circular Disc, iii) Annular Ring, iv) Spherical shell & solid sphere, v) Hollow cylinder & Solid cylinder, vi) Flywheel, axel & its Applications, vii) Spring **Gyroscope:** Principal, construction, working and applications	**10**
Unit -II	**Gravitation:** Newton's law of gravitation**,** Gravitational force, Gravitational field and Gravitational potential, Gravitational potential energy of a multi-particle system, uniform solid sphere and galaxy**,** Central force, Kepler's laws of planetary motion	**8**
Unit –III	**Elasticity:** Basic concepts of elasticity, Hook's law, three types of elastic moduli, Poisson's ratio, Relationship between Y, k, η. Bending of beam, bending moment, cantilever load at free end, loaded uniformly, due to its own weight. Determination of Y by bending of a uniformly loaded beam. Determination of elastic constant using Searle's method	**8**
Unit –IV	**Fluid Mechanics:** Laminar and viscous flow, viscosity, Coefficient of viscosity, Streamline flow and Turbulent flow (Tubular flow), Equation of continuity of flow, Energy of fluid. Bernoulli's theorem (Steady flow), Euler's equation. Applications of Bernoulli's theorem: Venturi meter, Pitot tube, Aerofoil, Bunsen burner, Atomizer, Spinning of a ball. Critical velocity and Reynold's number	**10**
Reference Books:	1. **University Physics**: Sears and Zeemansky, XIIth edition, Pearson Education 2. **Physics:** Volume I, Resnick/Halliday/Krane John Wiley & Sons (Sea) pvt ltd. 4th edition. 3. **Properties of Matter**: D. S. Mathur, Shamlal Charitable Trust New Delhi 4. **Mechanics:** D. S. Mathur, S. Chand and Company New Delhi. 5. **Concepts of Physics, Vol I**: H. C. Varma, Bharati Bhavan Publishers	

PAPER CODE: PHY1102
PAPER – II: HEAT AND THERMODYNAMICS
No. of Credits: 2 **No. of Lectures: 36**

	Title and Contents	No. of Lectures
Unit -I	**Concepts of Thermodynamics:** Thermodynamic state of a system and zeroth law of thermodynamics, Thermodynamic Equilibrium, Adiabatic and isothermal changes, Work done during isothermal changes, Adiabatic relations for perfect gas, Work done during adiabatic change, Indicator Diagram, First law of Thermodynamics, Reversible and Irreversible processes	**8**
Unit -II	**Applied Thermodynamics:** Conversion of heat into work and its converse, Carnot's cycle and Carnot's heat engine and its efficiency, Second law of Thermodynamics, Concept of entropy, Temperature-Entropy diagram, T-dS Equation, Clausius-Clapeyron latent heat equations	**8**
Unit –III	**Heat Transfer Mechanisms:** Heat Engines (Otto cycle and its efficiency, Diesel cycle and its efficiency), Refrigerators (General principle and coefficient of performance of refrigerator, The Carnot refrigerator, Simple structure of vapour compression refrigerator), Air conditioning principle and its applications	**8**
Unit –IV	**Equation of state:** Equations of state, Andrew's experiment, Amagat's experiment**,** Van der Waals' equation of state**,** Critical constants**,** Reduced equation of state, Joule-Thomson porous plug experiment	**8**
Unit –V	**Thermometry:** Temperature Scales (Centigrade, Fahrenheit and Kelvin scale), Principle, construction and working of following thermometers (Liquid and gas thermometers, Resistive type thermometers, Thermocouple as thermometer, Pyrometers)	**4**
Reference Books:	1. **Physics:** Volume I, Resnick/Halliday/Krane John Wiley & Sons (Sea) pvt ltd 2. **Sears and Zemansky's University Physics, 12th Edition**, H. D. Young, R. A. Freedman, A. L. Ford, F. W. Sears, Pearson Education 3. **Concept of Physics Vol I:** H. C. Verma, Bharati Bhavan Publishers 4. **Heat and thermodynamics**: Singhal, Agarwal and Prakash. 5. **Heat and Thermodynamics**: Brijlal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi	

	PAPER CODE: PHY1103 **PAPER – III: PHYSICS PRACTICAL - I** **No. of Credits: 2** **No. of Experiments: 10**
	Title of Experiment
1	Measurement of least count of various instruments
2	Moment of Inertia of a disc by torsional oscillations
3	Viscosity by flow through a capillary tube by Poiseuille's method
4	'Y' by bending
5	Plotting of graph and analysis
6	Moment of inertia of a flywheel
7	Calibration of thermocouple
8	Thermal conductivity by Lee's method
9	Demo experiment I
10	Demo experiment II

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SEMESTER – II

Academic Year 2016-2017

PAPER CODE: PHY1201 PAPER – I: INTRODUCTION TO MATHEMATICAL PHYSICS No. of Credits: 2		No. of Lectures: 36
	Title and Contents	**No. of Lectures**
Unit -I	**Complex Numbers:** Introduction to Complex Numbers, Algebra of Complex Numbers, Argand diagram, Algebra of complex numbers using Argand Diagram, Rectangular, polar and exponential forms of complex Numbers, De-Moivre's theorem (statement only), Trigonometric, hyperbolic and exponential functions, Powers, roots and log of complex numbers, Application of complex numbers to determine velocity and acceleration in curved motion. *Problems*	**10**
Unit -II	**Vector Analysis:** Differentiation of vectors with respect to scalars, Scalar and vector fields, Vector differential operators, Gradient of scalar field and its physical significance, Curl of vector field and its physical significance, Vector integrals (line, surface and volume integral with their examples), Statements of Gauss divergence theorem and Stoke's theorem. **Vector identities:** a) $\nabla \times \nabla\emptyset = 0$ b) $\nabla \cdot (\nabla \times V) = 0$ c) $\nabla \cdot (\nabla\emptyset) = \nabla^2\emptyset$ d) $\nabla \cdot (\emptyset A) = \nabla\emptyset \cdot A + \emptyset(\nabla \cdot A)$ e) $\nabla \times (\emptyset A) = \emptyset(\nabla \times A) + (\nabla\emptyset) \times A$ f) $\nabla(\mathrm{A} \times B) = B \cdot (\nabla \times A) - A \cdot (\nabla \times B)$	**8**
Unit –III	**Partial Differentiation:** Definition of partial differentiation, Successive differentiation, Total differentiation, Exact differential, Chain rule, Theorems of differentiation, Change of variables from Cartesian to polar co-ordinates, Implicit and explicit functions, Conditions for maxima and minima (without proof) *Problems*	**8**
Unit –IV	**Applications of differential equations:** **First order differential equations:** Growth and decay (Charging and discharging in CR Circuit, LR circuit, Radioactive decay, Population problems), Temperature Problems (Cooling of a body), Falling Body Problems (Equation of Motion for velocity and position of the body when all resistance is proportional to velocity of body) **Second order differential equations:** Simple Harmonic Oscillator, LCR Circuit, Buoyancy	**10**
Reference	**1. Mathematical Physics**, B. D. Gupta, Pragati	

Books:	Prakashan, Meerut 2. **Mathematical Methods in Physical Science,** Mary L. Boas, Wiley Publications 3. **Schaum's Outline of Vector Analysis,** Murray R. Spiegel, McGraw Hill Professional 4. **Theory And Problems Of Differential Equations (Schaum's Outline Series),** Bronson, Tata McGraw-Hill Education	

PAPER CODE: PHY1202 PAPER – II: ELECTRICITY AND MAGNETISM No. of Credits: 2		No. of Lectures: 36
	Title and Contents	**No. of Lectures**
Unit -I	**Dielectrics:** Polarization of matter (Atomic view, Induced charges, Free charges and bound charges), Polarization charges and dipole moment, Electric susceptibility and polarization vector, Electric displacement and examples, Gauss's law in dielectrics, Boundary conditions at dielectric surface	**10**
Unit -II	**D C circuits:** Growth and decay of current in R-L circuit, Growth and decay of current in L-C circuit, L-R-C series circuit	**6**
Unit -III	**A C circuits:** Phasors, Resistance and Reactance, L-R-C series circuit, Power in AC circuit, Resonance in AC circuit,	**10**
Unit –IV	**Magnetism in matter:** Ampere's circuit law and it's applications, Gauss law for magnetism, Magnetic Materials (Ferro magnetic, Paramagnetic, diamagnetic), Cause of magnetization (Spin magnetic moment and orbital magnetic moment, Bohr magneton), Concepts of **H**, **B**, **M**, χ, μ, Relation between **B**, **H**, **M**, Hysteresis	**10**
Reference Books:	1. **Fundamentals of electricity and Magnetism**, Arthur Kip, McGraw-Hill 2. **Sears and Zemansky's University Physics, 12th Edition**, H. D. Young, R. A. Freedman, A. L. Ford, F. W. Sears, Pearson Education	

	PAPER CODE: PHY1203 **PAPER – III: PHYSICS PRACTICAL - II** **No. of Credits: 2** **No. of Experiments: 10**
	Title of Experiment
1	Determination of frequency of A. C.
2	Study of LCR circuit
3	Verification of circuit theorems
4	Study and calibration of spectrometer
5	Charging, discharging of capacitor
6	L-R circuit: Vector diagram and power factor
7	Diode characteristics
8	Temperature coefficient of resistance
9 & 10	Study visit