

**Four Year Under Graduate Programme (FYUGP)**

**As per provisions of NEP-2020**

**Vinoba Bhave University Hazaribag**



**Subject: Physics**

To be implemented from the Academic Year **2022-23**

(From session 2022-26)

Syllabus for Semester –I

**I.    INTRODUCTORY REGULAR COURSE (IRC)**

(Credits: Theory-03, Practicals-0)

- The INTRODUCTORY REGULAR COURSE (IRC) of Physics is to be studied by the Students opting major subject other than **Physics**.
- Students opting **Physics as major subject have to select** a subject associated with **Physics** (such as Chemistry, Mathematics, Botany, Zoology, Geology, Statistics, etc.) as **INTRODUCTORY REGULAR COURSE**.

Marks: 25 (5 Attendance & others +20 SIE: 1.5Hr) + 75 (ESE: 3Hrs) = 100

Pass Marks: Th (MSE + ESE) = 40

***Instruction to Question Setter***

A candidate has to answer Three Questions out of Five Questions of which Question no. 1 is compulsory and will be of short answer type to be answered in about 100 words (2 Questions to be answered out of 4) and carry 05 marks each. Out of the remaining 04 (four) Questions, 02 (two) are to be answered and carries 15 marks.

NB: Questions may be framed as per the direction issued to the paper setter from Examination Department, Numerical problems may be included  
Some of the questions may be repeated from previous year.

**Note:** *There may be subdivisions in each question*

**INTRODUCTORY PHYSICS**

**Theory: 45 Lectures**

**Unit 1: Mathematical Physics**

(10-Lectures)

Scalar and vector product, Scalar and vector triple product, geometrical interpretation of scalar triple product, Scalar and vector fields .Divergence and Curl of vector field. Del and Laplacian operators. Expression for Divergence and Curl in Cartesian coordinate.  
First order differential equation and integrating factor. Applications to Physical problems. Second order Homogeneous differential equation with constant Coefficients, Application to physical problem.

**Unit 2: Properties of matter**

(10-Lectures)

Elastic-behaviour, Stress-Strain, Elastic constants. Relation between elastic constants.  
Viscosity-Coefficient of viscosity. Streamline and turbulent flow. Poiseuilles equation for flow of liquid through Capillary tube.

Surface Tension-Surface Tension and Surface energy. Determination of Surface tension by Quincke's method.

**Unit 3: Thermal Physics**

(05-Lectures)

Heat-Temperature. Kinetic theory of gases: Assumptions. Derivation of Maxwell's velocity distribution law and its experimental verification, expression for average, root mean square and most probable velocities.

**Unit 4: Waves and Oscillation**

(10-Lectures)

Plane progressive wave and stationary waves-their equations. Theories of free, damped and forced vibrations.

**Unit 5: Special theory of relativity**

(10-Lectures)

Einstein postulates of special theory of relativity, Lorentz transformation equations, Length-contraction, Time-dilation. Variation of mass with velocity, mass-energy relation.

**Reference Books**

- 1) Mathematical physics - H.K.Das
- 2) Mathematical physics - B.D.Gupta
- 3) Mathematical physics – B.S.Rajput
- 4) Mechanics - D.S.Mathur
- 5) Heat and Thermodynamics – Brijlal and Subrahmanyam.
- 6) Waves and oscillations – D.P.Khandelwal.
- 7) Theory of Relativity - Goel and Gupta.

**Supplementary**

- 1) A Treatise on Heat – Saha and Srivastava
- 2) Mathematical physics – G.B.Arken, H.J.Weber.
- 3) Feynman Lectures Vol-I
- 4) The Physics of Waves and oscillations – N.K.Bajaj
- 5) Introduction to Special theory of relativity – R.Resnik

## I. MAJOR COURSE –MJ 1:

(Credits: Theory-04, Practicals-02)

Marks: 15 (5 Attendance & others + 10 SIE: 1Hr) + 60 (ESE: 3Hrs) = 75

Pass Marks: Th (MSE + ESE) = 30

### *Instruction to Question Setter for*

A candidate has to answer Three Questions out of Five Questions of which Question no. 1 is compulsory and will be of short answer type to be answered in about 100 words (2 Questions to be answered out of 4) and carry 05 marks each. Out of the remaining 04 (four) Questions, 02 (two) are to be answered and carries 15 marks.

NB: Questions may be framed as per the direction issued to the paper setter from Examination Department, Numerical problems may be included

Some of the questions may be repeated from previous year.

**Note:** *There may be subdivisions in each question*

### **MATHEMATICAL PHYSICS-I**

**Theory: 60 Lectures**

**Differential Equations:** First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. **(14 Lectures)**

**Partial Differential Equations:** Solutions to partial differential equations, using separation of variables: **(6 Lectures)**

**Vector Calculus:** Vector triple product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. **(6 Lectures)**

**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. Expression for divergence and curl in cartesian coordinate. **(8 Lectures)**

**Vector Integration:** Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications. **(18 Lectures)**

**Orthogonal Curvilinear Coordinates:** Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. **(8 Lectures)**

### **Reference Books:**

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
3. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
4. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones

and Bartlett Learning

5. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
6. Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press
7. Mathematical Physics - H K Das
8. Mathematical Physics - B D Gupta
9. Mathematical Physics - B S Rajput

## PHYSICS PRACTICAL-MJ1LAB

Marks : Pr (ESE: 3Hrs) =25

Pass Marks: Pr (ESE) = 10

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the height of a building using a Sextant.
3. To study the Motion of Spring and calculate (a) Spring constant, (b)  $g$  and (c) Modulus of rigidity.
4. Determination of  $Y$  by bending of beam method.
5. To determine  $g$  and velocity for a freely falling body using Digital Timing Technique

### Reference Books

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal