Course title: Fundamentals of Physics

Course code: NRG 102	**No. of credits**: 2	**L-T-P**: 20-08-0	**Learning hours**: 28

Pre-requisite course code and title (if any): None

Department: Department of Natural Resources

Course coordinator: Dr Nithiyanandam Y	**Course instructor:** Dr Nithiyanandam Y

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Course type: Audit	**Course offered in:** Semester 1

Course description: The M.Sc. Geoinformatics course contains intense subjects, those require a basic knowledge in Physics for better understanding. Since, students undertake this course are from diverse backgrounds, a bridge course is required to fill this gap. Hence, a compulsory audit course of two credits is offered for students who have not done a course in Physics at 10+2 / bachelor's level.

Class objectives:

Develop an understanding of

- Selected fundamental concepts and principles in physics.
- How these concepts are used in practical applications.

Course content

S no	Topic	L	T	P
1	Measurement: The International system of Units, Changing units, length, time and mass; Motion along a straight line, two and three dimensions: Motion, position and displacement, average velocity and speed, instantaneous velocity and speed, acceleration, constant and free fall accelerations, momentum, projectile motion, circular motion, and relative motion.	2	1	0
2	Force and motion: Newtonian mechanics, Newton's first law, force, mass, Newton's second law, Newton's third law, friction, drag force.	2	0	0
3	Energy: what is energy? Kinetic energy, Work and kinetic energy, work done by the gravitational and general variable forces, and power; Potential energy, work and potential energy, determining potential energy values, conservation of energy.	2	1	0
4	Gravitation: Newton's law of gravitation, gravitation and the principle of superposition, gravitation near earth's surface, gravitation inside earth, gravitation potential energy, planets and satellites: Kepler's law, Satellites: orbits and energy, Einstein and gravitation.	2	1	0
5	Oscillation: simple harmonic oscillation, energy in simple harmonic motion, pendulums and circular motion, forced oscillation and resonance.	2	1	0

	Waves: types of wave, wavelength and frequency, the speed of a travelling wave, the wave equation, interference of waves, sound waves, travelling sound waves, intensity and sound level, the Doppler effect, supersonic speeds and shock waves.			
6	Thermodynamics: Temperature, the zeroth law of thermodynamics, measuring temperature, thermal expansion, temperature and heat, first and second laws of thermodynamics, heat transfer mechanisms.	2	1	0
7	Electromagnetic waves: Maxwell's rainbow, the travelling electromagnetic wave, radiation pressure, reflection and refraction, total internal reflection, polarization by reflection; Optics: Types of images, mirrors, interference, diffraction and polarization, Geometrical optics, dispersion of lights and optical instruments; Interference, diffraction and relativity.	4	2	0
8	Energy from nucleus: Nuclear fission, nuclear reactor, thermonuclear fusion, cosmology, the cosmic background radiation, dark matter, the big bang.	2	0	0
9	Applications of physics fundamentals in geospatial technologies.	2	1	0
	Total	**20**	**8**	**0**

Evaluation criteria

Test 1: Written Test: 15%
Test 2: Written Test: 15%
Test 3: Written Test: 40%
Tutorials/assignments/Quizzes: 30%

Learning outcomes:

Upon completion of this course, a student will be able to:

- Understand basic concepts and principles in different branch of physics like energy, thermodynamics, waves, and optics. [Test1, Test2, Tutorials/assignments/Quizzes]
- Realise the physics behind remote sensing thought in other courses. [Test3]
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Pedagogical approach:

The course will be delivered through class lectures and tutorials.

Materials:

Books:

1. Christman, J. R. *et al.* (1997) *Student's companion, Fundamentals of physics*. Wiley.
2. Elachi, C. and van Zyl, J. J. (2006) *Introduction To The Physics and Techniques of Remote Sensing*. Wiley (Wiley Series in Remote Sensing and Image Processing).
3. Giambattista (2010). *Fundamentals Of Physics (sie)* McGraw-Hill Education (India) Pvt Limited.
4. Halliday, D., Resnick, R. and Walker, J. (2010) *Fundamentals of Physics*. John Wiley & Sons.

5. Rees, G. and Rees, W. G. (2012) *Physical Principles of Remote Sensing*. Cambridge University Press.
Additional information (if any)
Student responsibilities: Attendance, Feedback, discipline, and timely submission of assignments.

Course Reviewers:

- Dr A.R.Prabhakaran, Associate professor of Physics, Pachaiyappa's College, University of Madras.
- Mr. Samudraiah, Former Deputy Director, Space Application Center, ISRO.