Department	FAST School of Computing (FSC)	**Semester**	FALL 2021
Course Title	Applied Physics	**Course Code**	NS1001
Pre-requisite	-	**Credit Hrs.**	3
Course Moderator	Dr. Saman Shahid (saman.shahid@nu.edu.pk)	**Semester**	1st
Course Objectives:	The Applied Physics course is aimed to introduce vector algebra, Newton's law to solve two and three dimensional systems, forces and objects in motion. It is also focused on evaluating simple harmonic motion (SHM), oscillations and waves. The last part of the course is designed for the learning of electricity & magnetism which includes Coulomb's law, Gauss's law, systems of capacitance, Ohm's law, Hall's effect, magnetic forces, current-carrying magnetism, and Ampere's law. The course is a pre-requisite of "Digital Logic Design".		
Course Learning Objectives (CLOs)	At the end of the course, the students will be able: 1. Find position, displacement, velocity, acceleration in 1, 2 & 3 dimensions in numerical problems or MATLAB simulation code/programming. 2. Learn projectile motion with the application of vector analysis to calculate horizontal/vertical motions, equation of the path and horizontal range to apply in numerical problems or MATLAB simulation code/programming. 3. Apply Newton's Laws along with vector notations to evaluate different types of forces: gravitational/weight/normal/tension/friction to apply in numerical problems or MATLAB simulation code/programming. 4. Verify SHM in learning different oscillations (simple, angular, uniform circular motion) for different pendulums/oscillators (torsional, simple). 5. Lean Different Types of Waves (Transverse & Longitudinal), Sinusoidal Waves and their respective parameters: Wavelength, Frequency, Angular Frequency, Wave number, Speed of wave. 6. To understand electric charge, electric current, resistance, resistivity and electric field with different applications through associated laws (i.e., Ohm's Law, Coulomb's law & Gauss' Law) and implement them to calculate related physical quantities in numerical problems or MATLAB simulation code/programming. 7. To understand different types (parallel plate, cylindrical, spherical) & combinations (parallel/series) of capacitances to calculate capacitances along with the other associated physical quantities (e.g. potential difference) in numerical problems. 8. To understand magnetic fields & magnetic forces, their application as current carrying wire, Hall's effect and in circulating charges to calculate related physical quantities to solve numerical problems or MATLAB simulation codes. 9. To understand magnetic fields generated due to currents by Ampere's law to calculate magnetic fields due to different conditions and geometries (e.g. Solenoid and Toroid) and calculate related physical quantities to apply in numerical problems or MATLAB simulation.		

Text Book(s)	**Title**	***Halliday & Resnick* Fundamentals of Physics (Extended 10th Edition)**
	Author(s)	Jearl Walker
	Publisher	© 2013 by John Wiley & Sons Inc.
Ref. Book(s)	**Title**	**Physics for Scientists and Engineers with Modern Physics (6th Edition)**
	Author(s)	Raymond A. Serway & John W. Jewett
	Publisher	© 2004 Thomson books/cole US
	Title	**Physics for Scientists and Engineers (6th Edition)**
	Author(s)	Paul A Tipler and Gene Mosca
	Publisher	W.H. Freeman and Company
	Title	**Physics for Scientists and Engineers (3rd Edition)**
	Author(s)	Fishbane, Gasiorowicz, Thornton
	Publisher	Pearson Prentice Hall
	Title	**Physics for Engineers & Scientists (3rd Edition Extended)**
	Author(s)	Hans C. Ohanian and John T. Markert
	Publisher	W. W. Norton & Company New York. London
	Title	**MATLAB –A practical introduction to programming and problem solving (3rd Edition)**
	Author(s)	Stormy Attaway
	Publisher	Elsevier 2013
	Title	**Programming with MATLAB for Scientists**
	Author(s)	Eugeniy E. Mikhailov
	Publisher	CRC Press Taylor & Francis 2017
	Title	**Introduction to MATLAB for Engineers (3rd Edition)**
	Author(s)	William J. Palm III
	Publisher	The McGraw-Hill Companies

Week	Course Contents/Topics	Chapter
01	Adding Vectors, Components of Vectors, Unit Vectors, Vector & Scalar Products, Position & Displacement (2/3 dimensions), Numerical Problems & MATLAB Implications	03, 04
02	Average/Instantaneous Velocity/Acceleration, Uniform Circular Motion, Numerical Problems & MATLAB Implications	04
03	Projectile Motion, horizontal/vertical motions, equation of the path, max. height, time of flight and horizontal range, Numerical Problems & MATLAB Implications	04
04	Newton Laws of Motion, Forces (1D/2D): Gravitational, Friction, Tension, Weight, Numerical Problems & MATLAB Implications	05
MIDTERM – I		
05	Simple Harmonic Motion, the Force Law for SHM, Angular SHM	15
06	Simple Pendulum, Circular Motion & SHM, Numerical Problems & MATLAB Implications	15
07	Types of Waves, Sinusoidal Waves, Wavelength and Frequency and Wave Speed.	16
08	Coulomb's Law, Charge Quantization & Conservation, Electric Field, Electric Field Due To Point Charge and Dipole, Numerical Problems & MATLAB Implications	21, 22
09	Gauss' Law, Flux, Flux Of Electric Field, Gauss's Law, Equivalency of Gauss's Law And Coulombs' Law	23
10	Cylindrical Symmetry, Planar Symmetry, Spherical Symmetry, Numerical Problems & MATLAB Implications	23
MIDTERM - II		
11	Capacitance, Parallel Plate, Cylindrical & Spherical Capacitors, Capacitors In Parallel And In Series, Numerical Problems & MATLAB Implications	25
12	Electric Current, Current Density and Drift Speed, Resistance & Resistivity, Ohm's Law, Numerical Problems & MATLAB Implications	26
13	Magnetic Fields And Field Lines, Crossed Fields: Hall Effect, Circulating Charge Particles, Magnetic Force On Current Carrying Wire, Numerical Problems & MATLAB Implications	28
14	Magnetic Field Due To Current, Ampere's Law, Magnetic Field Inside/Outside Wire, Solenoids & Toroids & Between two Parallel Wires, Numerical Problems & MATLAB Implications	29

Teaching Methodology:
Lecturing, MATLAB laboratory practice, Assignments, Quizzes, Discussion, Midterm exams, presentations, simulations etc..

Course Assessment:

Assessment Tools	Weightage
Quizzes (3), Assignments (3)	20%
Midterms (I+II)	30%
Final Exam	50%

Important Instructions:

- You may have to secure at least 50% marks to pass the course.
- Plagiarism is not tolerable in any of its form; minimum penalty would be an 'F' grade in the course without prior warning.

Grading Criteria:
An Absolute Grading Scheme may be used for the course evaluation.