Department	Department of Electrical Engineering	**Dept. Code**	EE
Course Title	Physics for Engineers	**Course Code**	NS110
Pre-requisite(s)	-	**Credit Hrs.**	3

Course Objective	To introduce the concepts of Waves & Oscillations and Electricity & Magnetism BS electrical engineer students to further enhance the understanding of other subsequent engineering courses.

No.	Assigned Program Learning Outcome (PLO)	Level	Tool
02	An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	I	F

I = Introduction, R = Reinforcement, E = Evaluation. A = Assignment, Q = Quiz, M = Midterm, F=Final, L = Lab, P = Project, W= Written Report.

CLO No.	Course Learning Outcome (CLO) Statements:	Tool
01	Verify SHM in learning different oscillations (simple, angular, damped, uniform circular motion) for different pendulums/oscillators (torsional, simple, damped).	Q1, F
02	Recognize different types of waves and learn principle of superposition along with the definitions of resultant wave, interference, fully constructive interference, destructive interference & intermediate interference according to different angles with relevant equations and diagrams.	A1, M1
03	Apply Coulomb's law with derivation and formula to evaluate charged particles, their properties with electric forces and investigate electric force at a distance.	M1, F
04	Relate the Gauss law that gives the concept of electric flux and area vector through a close symmetrical Gaussian surface along with its applications such as cylindrical symmetry, planar symmetry and spherical symmetry.	Q2, F
05	Recognize the relationship between electric potential and electric potential energy and calculate potential from electric field by applying concept of force and displacement and derive potential due to a point charge.	A2, F
06	Understand the concept of different capacitors' (parallel plate, cylindrical, spherical & isolated sphere) capacitances and their parallel/series combinations.	M2, F
07	Identify that the capacitance increases if the space between the plates is filled with a dielectric material and calculate the capacitance and electric field with and without a dielectric.	M2, F
08	Learn definitions of current, current density resistance, resistivity and conductivity & Ohm's law to discover the variations with temperature in resistivity via plot of resistivity and temperature.	M2, F
09	Recognize the concept of magnetic field and magnetic force for a charged particle having uniform speed and apply magnetic force formulation to derive the radius of the charged particle's circular or derive the magnetic force for a current in a magnetic field.	M2, F
10	Describe the Hall effect for a carrying current metal strip to explain that how balance of magnetic and electric fields can be apply to develop a relationship between the charge-carrier number density, magnetic field magnitude, current and Hall potential difference.	M2, F
11	Identify the magnetic field of a long straight wire carrying current and discover that parallel currents attract each other and anti-parallel currents repel each other by applying Ampere's law.	Q3, F
12	Apply Ampere's law to find magnetic field of a solenoid & toroid.	Q3, F
13	Recognize Faraday's law and Lenz's law with different experiments to learn the induced emf (with directions) in a conducting loop and the rate at which magnetic flux through the loop changes to observe energy transfer and calculation of power (rate at which energy is transferred to thermal energy) for a pulled conductive loop inside a uniformly changed magnetic field from the equations of magnetic flux, induced emf, induced current, magnetic force and describe generation of eddy currents.	A3,F
14	Identify that a changing magnetic field induces an electric field and Reformulation of Faraday's Law to relate induced electric field along a closed path to the rate of change of the magnetic flux encircled by the path.	A3, F

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

Note: A relative grading scheme will be used.

National University

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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

Week	Course Contents/Topics	Chapter	CLO
01	Simple Harmonic Motion, the Force Law for SHM, Angular SHM, Simple Pendulum	15	1
02	Damped SHM, Circular Motion & SHM, Numerical Problems	15	1
03	Types of Waves, Sinusoidal Waves, Wavelength and Frequency	16	2
04	Principle of Superposition of Waves & Interference, Numerical Problems	16	2
05	Electric Charge & its Conservation, Coulomb's Law, Electric Field, Electric Field Due To Point Charge, Due To Electric Dipole, Numerical Problems	21,22	3
MIDTERM - I			
06	Gauss' Law, Flux, Flux Of Electric Field, Gauss's Law, Equivalency of Gauss's Law And Coulombs' Law,	23	4
07	Applications: Cylindrical Symmetry, Planar Symmetry, Spherical Symmetry, Numerical Problems	23	4
08	Electric Potential And Energy, Potential From Field, Electric Potential From Point Charge, Numerical Problems	24	5
09	Capacitance, Parallel Plate, Cylindrical & Spherical Capacitors, Capacitors In Parallel And In Series, Capacitors In Dielectrics	25	6,7
10	Electric Current, Current Density and Drift Speed, Resistance & Resistivity and Variation with Temperature, Ohm's Law, Numerical Problems	26	8
11	Magnetic Fields And Field Lines, Crossed Fields: Hall Effect, Circulating Charge Particles, Magnetic Force On Current Carrying Wire, Numerical Problems	28	9,10
MIDTERM - II			
12	Magnetic Field Due To Current, Ampere's Law, Magnetic Field Inside/Outside Wire, Solenoids And Toroids, Numerical Problems	29	11,12
13	Faraday's law of Induction, Lenz's law	30	13
14	Induction and Energy Transfers, Induced Electric Fields, Reformulation of Faraday's Law, Numerical Problems	30	14
FINAL EXAM			

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