COURSE OUTLINE : PHY 102
D Credit – Degree Applicable
COURSE ID 004038
Cyclical Review: February 2020

COURSE DISCIPLINE : PHY

COURSE NUMBER : 102

COURSE TITLE (FULL) : Physics for Scientists and Engineers: B

COURSE TITLE (SHORT) : Physics for Scientist & Engr:B

CATALOG DESCRIPTION

PHY 102 is the second course in a three-semester sequence intended for students majoring in engineering and the physical sciences. The course covers topics in electricity and magnetism, including fields, potentials, Maxwell's equations, and electromagnetic waves. Applications, such as circuits and electric motors, will also be covered. Computers and numerical techniques are used extensively in the laboratory component of the course.

Total Lecture Units: 4.00

Total Laboratory Units: 1.00

Total Course Units: 5.00

Total Lecture Hours: 72.00

Total Laboratory Hours: 54.00

Total Laboratory Hours To Be Arranged: 0.00

Total Contact Hours: 126.00

Total Out-of-Class Hours: 144.00

Prerequisite: PHY 101 and MATH 104E.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1	PHY	101	Physics for Scientists and Engineers: A	analyze the motion of objects with constant acceleration;	Yes
2	PHY	101	Physics for Scientists and Engineers: A	apply Newton's laws of motion to the dynamics of physical systems;	Yes
3	PHY	101	Physics for Scientists and Engineers: A	calculate the work performed by forces;	Yes
4	PHY	101	Physics for Scientists and Engineers: A	explain conservation of energy, momentum, and angular momentum;	Yes
5	PHY	101	Physics for Scientists and Engineers: A	use conservation laws to predict the state of dynamical systems;	Yes
6	PHY	101	Physics for Scientists and Engineers: A	collect quantitative data from observations of physical phenomena;	Yes
7	PHY	101	Physics for Scientists and Engineers: A	organize data in tables, and present data using graphs;	Yes
8	PHY	101	Physics for Scientists and Engineers: A	use computers to perform calculations and to make graphs.	Yes
9	MATH	104E	Calculus and Analytic Geometry	determine the area between curves ,the average value and arc length of a function;	Yes
10	MATH	104E	Calculus and Analytic Geometry	determine work done in applications involving liquids and springs;	Yes
11	MATH	104E	Calculus and Analytic Geometry	evaluate definite and indefinite integrals using a variety of techniques, including integration by parts, trigonometric substitution, and partial fractions;	Yes
12	MATH	104E	Calculus and Analytic Geometry	evaluate improper integrals;	Yes
13	MATH	104E	Calculus and Analytic Geometry	model differential equations;	Yes
14	MATH	104E	Calculus and Analytic Geometry	represent functions as power series and determine their radius and interval of convergence;	Yes
15	MATH	104E	Calculus and Analytic Geometry	find Taylor and Maclaurin series for a function.	Yes

EXIT STANDARDS

1 calculate the electric field and potential of a charge distribution;
2 calculate the electric force on a charged body;
3 calculate the magnetic field of a current distribution;
4 calculate the magnetic force on a current-carrying wire;
5 analyze both DC and AC circuits with resistors, capacitors, and inductors;
6 describe the operation and working principles of electromagnetic devices, such as mass spectrometers, cyclotrons, electric motors, electric generators, and transformers.

STUDENT LEARNING OUTCOMES

1 use computers to collect and analyze data
2 demonstrate the ability to effectively and safely use scientific apparatus, such as calipers, micrometers, balance scales, lasers, ultrasound detectors, voltmeters, oscilloscopes, interferometers and spectrometers
3 use the Internet to find information on scientific issues, and to assess the scientific validity of that information
4 apply theoretical knowledge to problems in experimental science and engineering
5 use differential and integral calculus to model physical phenomena

COURSE CONTENT WITH INSTRUCTIONAL HOURS

	Description	Lecture	Lab	Total Hours
1	Electric Charge	1	0	1
2	Coulomb's Law	1	0	1
3	Electric Field	2	0	2
4	Motion of a Charged Particle in an Electric Field	2	0	2
5	Gauss's Law • Point charge • Uniformly charged rod • Uniformly charged plane • Uniformly charged sphere	4	0	4

6	Electric Potential • Relation between potential and potential energy • Relation between potential and field • Point charge • Uniformly charged rod • Uniformly charged plane • Uniformly charged sphere	6	0	6
7	Conductors • Atomic structure • Properties of conductors in electrostatic equilibrium	2	0	2
8	Dielectrics • Atomic structure • Electric dipole • Electronegativity and triboelectricity	1	0	1
9	Electric Current • Current density • Current in material bodies • Resistance • Ohm’s law • Ohmic devices • Electric power	4	0	4
10	DC Circuits with Resistors • Reduction of resistors in series to an equivalent resistor • Reduction of resistors in parallel to an equivalent resistor	2	0	2

11	Capacitors • Capacitance • Parallel-plates capacitors • Energy stored in a capacitor	2	0	2
12	DC Circuits with Resistors and Capacitors • Reduction of capacitors in series to an equivalent capacitor • Reduction of capacitors in parallel to an equivalent capacitor • Charging and discharging a capacitor	2	0	2
13	Kirchhoff's Rules • Kirchhoff's current rule • Kirchhoff's voltage rule	6	0	6
14	Magnetic Force • Magnetic force on a single charge • Magnetic force on a current element	6	0	6
15	Magnetic Field • Biot-Savart law • Force between two infinite straight wires • Force between two coaxial circular wires • Ampere's law • Gauss's magnetic law • Magnetic dipole	6	0	6

16	Magnetic Inductance • Faraday's law • Induced electric field, electromotive force, and current • Lenz's law • Inductance	4	0	4
17	Inductors • Coil inductors • Kirchhoff's voltage rule for inductors • Energy stored in an inductor	2	0	2
18	DC Circuits with Resistors, Capacitors and Inductors • Reduction of inductors in series to an equivalent inductor • Reduction of inductors in parallel to an equivalent inductor • Oscillations in DC RLC circuits	1	0	1
19	AC Circuits • Electric generators • AC voltage source • AC R circuits • AC RC circuits • AC RL circuits • AC RLC circuits • Phasors • Transformers	4	0	4
20	Maxwell's Equations	4	0	4

21	Electromagnetic Waves • Plane electromagnetic waves • Energy and momentum carried by plane electromagnetic waves • Production of electromagnetic waves • The electromagnetic spectrum	2	0	2
22	Laboratory Content (48 hours) • Electrostatics • Simple Electric Circuits • Introduction to DC Circuits • Oscilloscopes • Filament Temperature of a Light Bulb • Charging and Discharging a Capacitor • RC Circuits • Kirchhoff's Laws • Charge-to-Mass Ratio of the Electron • Electromagnets • Magnetic Forces • The Magnetic Permeability Constant • DC RLC Circuits • Introduction to AC Circuits • AC Resonance • Making an Electromagnet	0	54	54
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OUT OF CLASS ASSIGNMENTS

1 problem sets (e.g. analytical word-problems assigned on a weekly basis);
2 written lab reports (e.g. describe and analyze the results of a circuit experiment).

METHODS OF EVALUATION

1 lecture examinations (including multiple-choice questions, short-response questions, and analytical word-problems);
2 final examination (including multiple-choice questions, short-response questions, and analytical word-problems);
3 laboratory practical examinations;
4 evaluation of problem sets;
5 evaluation of written lab reports.

METHODS OF INSTRUCTION

- [x] Lecture
- [x] Laboratory
- [ ] Studio
- [ ] Discussion
- [x] Multimedia
- [ ] Tutorial
- [ ] Independent Study
- [ ] Collaboratory Learning
- [ ] Demonstration
- [ ] Field Activities (Trips)
- [ ] Guest Speakers
- [ ] Presentations

TEXTBOOKS

Title	Type	Publisher	Edition	Medium	Author	IBSN	Date
Physics for Scientist and Engineers	Required	Brooks Cole	9		Raymond A. Serway	978-1133947271	2013
Physics 102 Laboratory Manual	Required	Glendale Community College			M. M. Afshar		2017