COURSE OUTLINE : PHY 103
D Credit – Degree Applicable
COURSE ID 004040
Cyclical Review: February 2020

COURSE DISCIPLINE : PHY

COURSE NUMBER : 103

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

COURSE TITLE (SHORT) : Physics for Scientists & Engineers: C

CALIFORNIA STATE UNIVERSITY SYSTEM C-ID : PHYS 215 - Calculus-Based Physics for Scientists and Engineers: C

CATALOG DESCRIPTION

PHY 103 is the third course in a three-semester sequence intended for students majoring in engineering and the physical sciences. The course covers topics in theory of waves, acoustics, optics, thermodynamics, and modern physics. Computers and numerical techniques are used extensively in the laboratory component of the course.

CATALOG NOTES

Note: PHY 103 may be taken prior to PHY 102.

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 or equivalent and MATH 104E.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1				Analyze the motion of objects with constant acceleration;	Yes
2				apply Newton's laws of motion to the dynamics of physical systems;	Yes
3				use conservation laws to predict the state of dynamical phenomena;	Yes
4				collect quantitative data from observations of physical phenomena;	Yes
5				use computers to perform calculations and to make graphs;	Yes
6				graph logarithmic and exponential functions;	Yes
7				integrate functions using a variety of techniques.	Yes
8	MATH	104E	Calculus and Analytic Geometry	determine work done in applications involving liquids and springs;	Yes
9	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
10	MATH	104E	Calculus and Analytic Geometry	evaluate improper integrals;	Yes
11	MATH	104E	Calculus and Analytic Geometry	model differential equations;	Yes
12	MATH	104E	Calculus and Analytic Geometry	work with exponential and logistic models of growth and decay;	Yes
13	MATH	104E	Calculus and Analytic Geometry	find Taylor and Maclaurin series for a function.	Yes

EXIT STANDARDS

1 Describe important characteristics of waves;
2 analyze the superposition and interference of sound waves;
3 apply the principles of geometric optics to mirrors, lenses, and compound optical systems, such as telescopes and the human eye;
4 provide a microscopic, i.e. atomic, description of an ideal gas through the kinetic theory of such gases;
5 calculate properties, such as pressure, volume, and temperature, of thermodynamic systems;
6 describe the experimental evidence, such as blackbody radiation and the electron double-slit experiment, which led to the introduction of quantum mechanics;
7 apply principles of quantum mechanics to the emission and absorption spectra of atoms;
8 describe the operation and working principles of Michelson interferometers, grating spectrometers, and optical telescopes.

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 about scientific issues and be able to assess the validity of the 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	Ocillatory Motion • Motion of a mass-spring system • Motion of a pendulum • Simple harmonic motion	6		
2	Wave Motion • Amplitude, wavelength, and wave speed • Period, frequency, and phase constant • Mathematical description of a sinusoidal wave • Waves on a string • Angular frequency and wave number • Polarization and wave dimension • Wave equation	6		
3	Sound Waves • Displacement description versus pressure description of sound waves • Speed of sound waves • Ray and wave front representations • Doppler effect	4		
4	Superposition of Waves • Interference of two waves	2		
5	Speed of Light and the Index of Refraction	1		
6	Law of Reflection	1		
7	Law of Refraction • Total internal reflection	2		
8	Dispersion	1		

9	Ray Tracing • Flat mirror • Spherical mirror • Refracting surface • Thin lenses	2		
10	Optical Instruments • Telescope • Human eye	2		
11	Interference of Point Sources	2		
12	Diffraction • Young's double-slit experiment • Huygen's principle • Diffraction gratings	3		
13	Light Polarization • Malus's law • Brewster's angle	2		
14	Fluid Mechanics • Pressure variation of pressure with depth • Buoyant force • Bernoulli's equation	4		
15	Temperature • Celsius, Fahrenheit, and Kelvin as units of temperature • Thermal equilibrium • Thermal expansion • Ideal gas and the ideal gas law	4		
16	Heat and Thermodynamic Work • Heat capacitance • Phase changes • Work in thermodynamic processes • First law of thermodynamics • Heat transfer	6	0	6
17	Kinetic Theory of Gases • Specific heat of an ideal gas • Equipartition principle • Adiabatic processes • Distribution of molecular speeds	6	0	6

18	Heat Engines and Heat Pumps • Second law of thermodynamics • Carnot engine	4	0	4
19	Entropy • Third law of thermodynamics • Microscopic basis of entropy	4	0	4
20	Introduction to Quantum Mechanics • Blackbody radiation • Photoelectric effect • Compton effect • Electron double sit experiment • De Broglie hypothesis	6	0	6
21	Quantum Mechanics • Quantum mechanical wave function • Bohr's model of the hydrogen atom	4		
22	Lab component • Measuring optical effects • Measuring the speed of light • Similar experimental labs	0	54	54
				80

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 an optic experiement).

METHODS OF EVALUATION

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

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 Scientists and Engineers	Required	Brooks Cole	9	Print	Raymond Serway	13: 978-1133947271	2013
Physics 103 Laboratory Manual		Glendale Community College	1	Print	M. M. Afshar		2017