

principles involved in the construction of astronomical instruments, and in the theory of astronomical refraction. [Calculation of eclipses and occultations.]

*Third branch—Navigation.*—Sailing by compass; sailing on a great circle; various methods for finding a ship's place at sea; construction and use of charts, including topographical and hydrographic drawing; principles and use of the sextant and circle of reflection, and application of the glass prism to these instruments; the artificial horizon; the azimuth compass; methods of ascertaining the deviation of the compass, produced by local attraction on ship-board; the log, and other instruments for determining a ship's rate of sailing; sounding-instruments; nature and use of the Nautical Almanac; relations of time under different meridians; computation of altitudes and azimuths of celestial objects; finding, by means of observations of the sun, moon, planets, and stars; by observations near the meridian, by single altitudes at a given time, and by two altitudes of the same or different objects; finding the longitude by the chronometer, and determining the ship's place by two such lines; method of finding a line of position, and determining the ship's place by two such lines; rating a chronometer on shore by single altitudes, and by equal altitudes, and finding its error at sea by a series of lunar observations. Theory of the various problems of navigation and nautical astronomy, and the application of spherical trigonometry to their solution; [consideration of the true figure of the earth, and the corrections in nautical problems depending upon it.]

*Fourth branch—Surveying.*—Its principles and practice; measurement of heights and distances; leveling; trigonometrical surveying; hydrographical surveying; direct measurement of a base line; measurement by sound; running lines of soundings; reduction for tides; survey of a harbor or river; fixing the position of shoals, &c.; running survey of a coast; [geodetic corrections in extended surveys;] application of astronomical observations for azimuth, latitude, and longitude.

#### FIFTH DEPARTMENT—PHYSICS AND CHEMISTRY.

*First branch—Mechanics of solids.*—Forces and equilibrium; composition and resolution of forces; uniform and varied motion; motion of projectiles in vacuo, and in a resisting medium; center of gravity; equilibrium of a system of bodies; motion of translation of a body or system; motion and equilibrium about an axis; central forces; falling bodies; pendulum and ballistic pendulum; laws of the planetary motions; effect of friction and adhesion, and of stiffness of cordage; mechanical powers; collision of bodies.

*Second branch—Mechanics of liquids.*—Mechanical properties of fluids; laws of equilibrium and pressure; flotation of bodies; stability and oscillation of floating bodies; specific gravity; [motion of liquids.]

*Third branch—Mechanics of aeriform fluids.*—Air-pump; weight and pressure of the atmosphere; laws of pressure; density and temperature; barometer; pumps; siphon; motion of elastic fluids.

*Fourth branch—Acoustics.*—Theory of waves in general; velocity of sound in different media; [molecular displacement; interference of waves;] reflection and echo; speaking and hearing trumpets; [vibrations of strings, of columns of air, and of plates and bells; communication of vibrations.]

*Fifth branch—Optics.*—General properties of light; catoptrics; dioptrics; chromatics; vision; optical instruments; [physical optics.]

*Sixth branch—Electricity.*—Statical electricity; voltaic electricity; magnetism; electro-magnetism; thermo-electricity.

*Seventh branch—Heat.*—Conditions of heat; characteristics of heat; theories of heat, ancient and modern; sources of heat, conduction, radiation, and convection; specific heat; sensible and insensible caloric; effects of heat; instruments used for the measurement of heat; thermo-dynamics.

*Eighth branch—Chemistry.*—(To be taught by familiar lectures and experiments.)

*Ninth branch—Meteorology and climatology.*

*Tenth branch—[Differential and integral calculus.]*—Its principles and its application to maxima and minima, and the simpler problems relating to curves.]

#### SIXTH DEPARTMENT—ETHICS AND ENGLISH STUDIES.

*First branch—English grammar.*—Orthography; etymology; the analysis and synthesis of sentences; idioms; punctuation.

*Second branch—Descriptive geography.*—Knowledge of the land and water surface; the grand divisions of the earth, and their relative situation; extent and boundaries of the several countries in each of the grand divisions; their natural productions; their commerce, manufactures, and governments; their naval and military strength. The use of globes and maps.

*Third branch—Physical geography.*—The form and motions of the earth; the seasons and climates; the distribution of land and water; mountain ranges; declivities and basins; desert and lake zones; river systems; the currents of the ocean; geographical distribution of plants and animals; influence of physical causes on man.

*Fourth branch—Outlines of history.*—Ancient and modern; in the latter, mainly that of America, England, France, and Spain, during the last three centuries; written biographical and historical exercises.

*Fifth branch—Rhetoric.*—Verbal criticism; the principles of taste, and their application; original compositions, embracing official reports.

*Sixth branch—Ethics.*—The ground of moral obligation; our relations to God, and consequent duties; personal duties; the chief relations of men to each other in society, and the duties thence arising. (To be taught by means of familiar lectures, given by the chaplain.)

*Seventh branch—Political science.*—A review of the origin and structure of the Federal Government of the United States of America, its constitutional law; the acts of Congress for the better government of the Navy; the law of nations generally; the rights and duties of nations in peace and in war.

#### SEVENTH DEPARTMENT—FRENCH.

Reading and writing the French language correctly; exercises in speaking it.

#### EIGHTH DEPARTMENT—SPANISH.

Reading and writing the Spanish language correctly; exercises in speaking it.

#### NINTH DEPARTMENT—DRAWING.

Right-line drawing, sketching, and perspective; topographical and chart drawing.

The foregoing studies shall be distributed into four annual courses, and the cadet-midshipmen shall be arranged in four classes, each class pursuing one of these courses.