UNIVERSITY
OF ARIZONA.

I. The University Proper. Instruction for Everybody.
III. The U. S. Agricultural Experiment Station. For Public Benefit.
IV. The Territorial Museum. Exponent of Products and Resources of Arizona.

Fourth Annual Register, 1894-5.
ANNOUNCEMENTS FOR 1895-6.

TUCSON, ARIZONA.
AUGUST, 1895.
THE UNIVERSITY OF ARIZONA.

"To live is to know what one is worth, what one can do and how it should be done."
—Victor Hugo.

FIFTH ANNUAL REGISTER, 1894-95.

WITH

Announcements for 1895-96.

TUCSON, ARIZONA,
AUGUST, 1895.

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BOARD OF REGENTS.

EX-OFFICIO.

HON. LOUIS C. HUGHES, Governor of Arizona.
HON. F. J. NETHERTON, Supt. of Instruction.

Appointed by the Governor.

REV. HOWARD BILLMAN, A. M., Chancellor, - - Tucson.
JOHN GEORGE HILZINGER, A. M., Secretary, - - Tucson.
SELIM M. FRANKLIN, Ph. B., Treasurer, - - - Tucson.
E. R. MONK, A. M. - - - - - Tucson.
CALENDAR, 1895-96.

1895.
March 15, Friday, ........................................... Winter Term ended.
March 20, Wednesday, ...................................... Spring Term began.
May 28, Tuesday, ........................................... Spring Term ended.
May 29, Wednesday, ....................................... Commencement Day.
September 19, Thursday, } Through the Territory.
September 23, 24, Monday and Tuesday, } Entrance Ex-
Entrainations. } At the University.
September 25, Wednesday, ................................ REGISTRATION DAY.
September 26, Thursday, .................................. Fall Term begins.
November 28, Thursday, ] Thanksgiving Recess.
December 1, Sunday, 
December 20, Friday, ...................................... Fall Term ends.

1896.
January 2, Thursday, } REGISTRATION, WINTER TERM.
Winter Term begins.
February 7, Friday, ........................................... Arbor Day Exercises.
February 22, Saturday, ................................... WASHINGTON'S BIRTHDAY.
March 13, Friday, ........................................... Winter Term ends.
March 18, Wednesday, ..................................... REGISTRATION, SPRING TERM.
March 19, Thursday, ........................................ Spring Term begins.
May 26, Tuesday, .......................................... Spring Term closes.
May 27, Wednesday, ....................................... Commencement Day.

* Entrance examinations will be held September 19, Thursday, at Prescott,
Flagstaff, Phoenix, Yuma, Tombstone, Wilcox, Globe, Florence, and other towns
in Arizona, if written request be filed with the President not later than September
10, 1895.
FACULTY, ETC.

HOWARD BILLMAN, A. M., President, Professor of Civics.

THEODORE BRYANT COMSTOCK, Dr. Sc.
Professor of Geology and Mining.
Director Bureau of Mines.

EDWARD MARSHALL BOGGS,
Professor of Civil and Hydraulic Engineering.
Irrigation Engineer, Agricultural Experiment Station.

WILLIAM STOWE DEVOL, B. S.
Professor of Agriculture.
Director of Experiment Stations.

JAMES WILLIAM TOUMEY, B. S.
Professor of Biology.
Botanist and Entomologist, Agricultural Experiment Station.

HOWARD J. HALL, B. S.
Professor of English.
Librarian.

GEORGE L. HOXIE, M. E.
Professor of Physics and Mechanics.

ROBERT HUMPHREY FORBES, B. S.
Professor of Chemistry.
Chemist, Agricultural Experiment Station.

MEADE GOODLOE,
Assistant Professor of Assaying and Mineralogy.
Assayer, Bureau of Mines.

Professor of Mathematics.

Principal of Preparatory School.
Assistant Professor of English.

GERTRUDE B. HUGHES, (Gr. N. E. Cons.)
Instructor of Elocution and Physical Culture.

Instructor of Stenography and Commercial Branches.

Instructor of Music.

HERBERT BROWN,
Curator of Territorial Museum.

MRS. S. A. BUILL, Matron of Dormitory.
LOCATION CLIMATE, ETC.

The University buildings are situated upon high ground about one mile from the business center of Tucson. They occupy a tract of forty acres in a most healthy location, commanding a view of attractive mountain scenery upon all sides. The water supply is of unusually pure quality, being drawn from a large well on the premises, 100 in feet depth.

Tucson has become a noted health resort, particularly for pulmonary patients, owing to the dryness of the climate and its freedom from sudden changes. The following statement based upon the records of the U. S. Weather Bureau office, is made by Mr. Wm. Burrows, Observer, and Director of the Arizona Weather Service:

"The climate here is so uniform that a record for any one month would afford a very reliable indication of what might be expected in the same month of every year. Precipitation is the only element which is subject to any great irregularity of periodic recurrence. The mean annual rainfall for ten years is a little less than thirteen inches, fully one-half of which ordinarily falls in July and August, although occasional rains may occur in any month, and a much larger proportion than here indicated of the total for the year has been known to fall in December and January. Violent or destructive winds are unknown here."
The University of Arizona is practically conducted under four Divisions.

I. The University proper;

II. The Bureau of Mines;

III. The Agricultural Experiment Station;

IV. The Territorial Museum.

The ultimate control of the University, in all its branches, for instruction and investigation, is vested by law in a Board, appointed by the Governor, of four Regents, one of whom is chosen Chancellor. The Governor and Superintendent of Public Instruction, are ex-officio members of the Board.

The General Faculty is composed of the President and all the Professors, Acting Professors and Assistant Professors. This body legislates for all students, including Preparatory students and those rated as Specials in Art and Business courses.

The educational work is under the direction of the University Faculty, and the practical work of investigation undertaken by the Bureau of Mines and the Agricultural Experiment Station, is managed by the respective Councils thereof.

General correspondence should be addressed to the President of the University.

The Director of Experiment Stations should be consulted upon all matters pertaining to that division, and the Heads of Departments on subjects directly relating to their work.
GOVERNMENT OF STUDENTS.

The facilities provided at the University are freely offered for the benefit of all earnest students, and it is the purpose of the Faculty to give full liberty of action, within necessary limits, to those who show themselves worthy of confidence.

The Students' Association, an organization to which all are eligible, has been formed by the undergraduates. This is working harmoniously, and with good results in the direction of self-government.

Frequent Assembly Exercises, including Public Rhetoricals, with addresses by members of the Faculty and invited speakers, serve to inculcate moral truths and to set forth clearly the principles of right living. Students in the Preparatory School are subject to more direct supervision.

DEMERITS.

In cases of serious infraction of discipline, demerits are given, and any student who obtains 150 demerits in any one year is subject to suspension at the discretion of the Faculty.

ABSENCES.

Parents should understand that all unexcused absences and tardiness are causes for demerits. No excuses will be accepted unless presented at the first appearance afterward of the student at the given exercise, and all excuses must be in writing, signed by parent or guardian, and must indicate the cause of the absence or tardiness.

REQUIREMENTS FOR ADMISSION, ETC.

Applicants for admission to the Freshman Class in the University must be at least 16 years of age,* and must pass satisfactory examinations in English Grammar, Geography, U. S. History, Arithmetic and the rudiments of Algebra.

Admission to the Senior Preparatory Class is open to those Students, at least 15 years of age,* who successfully pass examina-

*In special cases of Students unusually capable and well prepared, this regulation may be abrogated by vote of the Faculty.
REQUIREMENTS FOR ADMISSION, ETC.

In Elementary Grammar, Geography, U. S. History and Elementary Arithmetic.

For admission to the Junior Preparatory Class pupils must be not less than 14 years of age, and be able to read and write satisfactorily, and otherwise show ability to pursue the work laid down in this Register.

ENTRANCE EXAMINATIONS.

The facilities and privileges of the University of Arizona are open to all qualified persons of either sex. Examinations for admission to the University and the Preparatory School will be held on Monday and Tuesday, September 23 and 24, 1895, in the University building. Similar examinations may be held in prominent towns of Arizona, on or about September 19, (Thursday) at places to be announced in the local papers, provided that requests be filed with the President of the University on or before September 5, 1895. This procedure will enable persons living near Prescott, Phoenix, Yuma, Tombstone, Willcox, Solomonville, Florence, Globe, Williams, Flagstaff, etc., to save the expense of a trip to Tucson until they know if they be able to enter.

Regular examinations for entrance at the beginning of the Winter and Spring terms will be held at the University, but if applications are received early enough from other places, arrangements may be made to meet the wants of such as desire to be examined elsewhere.

CONDITIONED STUDENTS.

Those who fail to pass in one subject only may be admitted with a "condition," which must be made up at the next regular Entrance Examination, or earlier. Conditional students may be required to pursue the subject in which they are delinquent with a regular class in the University or the Preparatory School.

ADMISSION TO ADVANCED STANDING.

Students from other institutions of equivalent rank may be admitted to the higher classes upon presentation of properly authenticated certificates, showing clearly to the satisfaction of the Faculty that they are qualified to proceed with such work.

Arrangements have been made with the Arizona Territorial Normal School at Tempe, whereby students from that Institution
may have their record transferred to the books of the University with full credit, upon presentation of a certificate duly signed by the Principal. Students of this University may also obtain the equivalent privilege at the Normal School by presenting the proper certificate of standing signed by the President.

The Faculty desires to establish such relations with High Schools and other educational institutions as will enable it to accept their certificates without question. To this end presiding officers are respectfully requested to correspond with the President.

**REGISTRATION OF STUDENTS.**

All students are required to register on registration day of each term, in the President’s office. Each will receive a card indicating the classes which he is to attend, and a receipt for the matriculation fee, when paid. No class card will be issued until all dues are paid. This card must be presented to the several Professors before enrollment will be permitted. No changes in registration can be made without the consent of the Faculty.

Permission of the Faculty is necessary to register at any time after Registration Day.

No student will be permitted to register in the Spring Term of the Senior Year, as a candidate for a degree, who has not previously made up all failures and “conditions” in subjects required for the degree.

**TERM RECORDS.**

The class standing of each student is determined by the instructor in charge. Regular Term Examinations (or Final Examinations) have been abolished by vote of the Faculty. The method of ascertaining the student's term record is left to the instructor and his report, in all cases, is final.

**MONTHLY REPORTS OF STUDENTS.**

Reports of standing in Classes and in Deportment are regularly sent each month to parents and guardians, from the President’s office. Those to whom these reports are addressed are urgently requested to examine each with care and to spur up delinquent students, or commend those who are diligent, as the case may be. Without such hearty co-operation, good results cannot be anticipated.
PRIZES OFFERED.

THE HUGO ZECKENDORF PRIZES.

A gold medal and silver medal have been offered as prizes by Mr. Hugo Zeckendorf, of Tucson, on the following conditions:

1. The Senior student who presents the best essay upon some subject relating to the duties of citizenship, will be awarded the gold medal.

2. The student who maintains the best class record throughout the Junior year will be awarded the silver medal.

Both awards are subject to regulations of the University Faculty.

The awards of these prizes on Commencement Day, 1895, were:

The Gold Medal, for best Senior essay, to Mercedes Anna Shibell, of Tucson.

The Silver Medal, for best Junior record, to John D. Young, of Sacaton.

DEGREES CONFERRED.

Students who have obtained full credit for the required work in any prescribed course of four years, will be given the degree of Bachelor of Science (B. S.) or Bachelor of Arts (A. B.) according to the character, of the work done.

The advanced degrees of Master of Science and Master of Art are conferred upon Bachelors, graduates from this University or from institutions of similar character, who have successfully pursued a course of study marked out by the Faculty, requiring not less than one year.

The degrees of Civil Engineer, Mining Engineer, Mechanical Engineer, Irrigation Engineer and Electrical Engineer are open to graduates properly prepared, who have pursued special lines of post-graduate work in accordance with Faculty regulations.

Theses will be demanded of all candidates for advanced degrees.
VACATIONS AND HOLIDAYS.

Short vacations (as per Calendar on Page 3) are taken at the Holidays and between the Winter and Spring Terms. The long Summer vacation begins about June 1st and continues until near the close of September.

All legal Holidays are observed by the cessation of ordinary University work, and the Thanksgiving Recess extends from the close of regular exercises on the preceding Wednesday until the Monday morning following.

Appropriate exercises may be arranged by the Faculty for any of the legal Holidays, in which the Students will be expected to join, if required.

Arbor day has been formally adopted by the University Faculty as the regular Anniversary, on which shall be celebrated the foundation of the Institution, in connection with the ceremonies of tree planting.

FACULTY MEETINGS.

Regular meetings of the General Faculty are held weekly.

Students' individual petitions must be in the hands of the President before the hour of Faculty meeting in order to receive attention the same week.

Petitions from classes, or from any two or more of the students, will not be acted upon by the Faculty unless presented in writing to the President, at least two days before the meeting at which action is desired.

LIVING ACCOMMODATIONS.

Provision is made this year for furnishing board and rooms for students, of both sexes, upon the University grounds.

Young men will have excellent quarters in the new Dormitory building.

A separate home for young ladies is in charge of Mrs. S. A. Buell, an experienced and capable matron, who, as last year, will have constant supervision of those rooming in “Ladies Hall.”
STUDENTS' EXPENSES.

There is no charge for tuition in any of the Departments of the University, except in Music, where Instructors' Fees are exacted.

All Students are required to pay once only (upon entrance), a Matriculation Fee of Five dollars.

Charges will be made for materials actually consumed by students in the laboratories.

Board will be furnished at cost. There is no charge for room rent. Each Student, before assignment to quarters, will deposit money enough to cover these items and laundry for one Term in advance. It is estimated that the amount required for the Fall Term will be about fifty dollars, and forty-five dollars for each of the other Terms. The average cost of board last year was $15.00 per month, but it is believed that, with the better facilities and increased attendance of the present year, this cost can be reduced materially.

Students will be provided with simple furniture, including single bedstead. They will supply their own mattress, pillow, bed-clothing, towels, etc., also mirror, wash-bowl, pitcher and slop-jar.

Text-books required may vary in cost between five and ten dollars in different years of the course.

Economical students should readily go through the year with from $135 to $150, excluding clothing.

SPECIAL NOTICE.

Provision for self-support of students, to a limited extent, will be made.

It is especially requested that those who may desire instruction in Ancient Languages, Music, and the branches taught in the Business Schools, will give early notice of their need, in order that we may know in advance what demands we shall have to meet this year.

Address all correspondence to

HOWARD BILLMAN,
President of the University,
Tucson, Arizona.
DEPARTMENTS AND COURSES OF STUDY.

The several Schools and Departments, which together constitute the University, are not independent organizations, but convenient divisions for the administration and specialization of the work of the corps of instructors.

The demands from Arizona students are various and more or less out of keeping with set courses of Study. The Faculty has provided a general (Combined) Course, which is strongly recommended to all who can devote four years to culture studies.

But, in addition, there are provided in every Department in the University, what may be termed Technical Courses, as well as Special Courses for students whose time is limited.

Upon entering the University the student consults the President regarding his or her course. If the Combined Course be taken, a rating is obtained at once from the examination reports. If a Technical Course be elected, the Professor in charge of the Principal Subject is given charge of the student and the Course is reported for Faculty action. Special Students in any Department are directly responsible to the Professor in charge.

A. THE COMBINED COURSE.

The Combined course is here presented as a proper curriculum for the average student, as it embodies the judgment of the Faculty regarding what is most suitable for the broad general culture demanded by modern life. All students who are young enough to delay their technical preparation until after its completion are strongly urged to register in this Course. In some cases, this action may be required as a condition precedent to matriculation, it being the purpose of the Faculty to place each student in the position best calculated to develop his or her talents and to most fully cultivate the power to think independently.

A careful perusal of the following scheme will show that this Combined course includes, practically, the elementary work of the principal Schools of the College of Natural Science and the College of Letters. The branches of Mathematics required are only those which will be assigned in any event, as a condition for graduation from all the Schools of the University. Thus nothing is required which a Regular Student can afford to miss, and those who may af-
COMBINED COURSE.

terward decide to pursue a particular technical course, will have lost little by beginning this.

This is not the Course for those who must quickly acquire a technical training to fit them for the professions at once; but it cannot be too strongly asserted that the time spent in this preliminary general training will be more than made up in the increased capacity for effective work in any field in the years to follow.

**COMBINED COURSE.*

**FRESHMAN YEAR.**

| FALL TERM. | Algebra, 5; English, 5; Physics, 5; Phys. Lab'y, 2. |
| WINTER TERM. | Algebra (Completed), 5; English, 5; Physics, 5; Phys. Lab'y, 2. |
| SPRING TERM | Geometry, 5; English, 5; Botany, (I), 5; Free Hand Drawing, 2. |

**SOPHOMORE YEAR.**

| FALL TERM. | Geometry, 5; English, 1; Chemistry, 5; Systematic Botany, (II) 3; Modern or Ancient Language, 5. |
| WINTER TERM. | Chemistry, 5; English, 1; Trigonometry, 5; Modern or Ancient Language, 5. |
| SPRING TERM | Human Anatomy and Physiology, 5; English, 5; Modern or Ancient Language, 5. |

**JUNIOR YEAR.**

| FALL TERM. | History, 2; English, 3; Zoology, 5; Modern or Ancient Language, 5. |
| WINTER TERM. | History, 2; English, 3; Physiography, 5; Modern or Ancient Language, 5. |
| SPRING TERM | History, 3; English, 2; Geology, 5; Modern or Ancient Language, 5. |

**SENIOR YEAR.**

| FALL TERM. | History of Civilization, 2; English, 3; Psychology, 5; Modern or Ancient Language, 5. |
| WINTER TERM. | History of Civilization, 2; English, 2; Civics, 1; Political Economy, 5; Modern or Ancient Language; 5. |
| SPRING TERM | Astronomy, 5; History of Philosophy, 3; Civics, 1; Constitutional History, 1; Modern or Ancient Language, 5. |

*The numbers given with each subject refer to the recitation hours per week. Two hours of laboratory work or of drawing count as one recitation hour.*
B. TECHNICAL COURSES.

The following Departments offer Technical and Special Courses to students with the necessary preparation.

I. Agriculture and Horticulture.
II. Anatomy (Human) and Physiology.
III. Ancient Languages.
IV. Biology (Botany and Zoology).
V. Chemistry.
VI. Civil and Hydraulic Engineering.
VII. Drawing (Free Hand and Mechanical).
VIII. Elocution and Physical Culture.
IX. English Language and Literature.
X. Geology and Mineralogy.
XI. History and Civics.
XII. Mathematics.
XIII. Mechanical Engineering.
XIV. Mining and Metallurgy (Assaying, Mill work, etc.).
XV. Modern Languages.
XVI. Physics.

Besides these subjects, thorough instruction is also provided in Music (Vocal and Instrumental) and in all the branches of a complete business education, including Stenography, Typewriting, Penmanship and Commercial studies.

Shopwork will be introduced this year and gradually extended.

I. SCHOOL OF AGRICULTURE.

1. AGRICULTURE.

Prof. Devol.

The special work of this department is not taken up by the technical student until he is well advanced in his college course; but provision is made for short practical courses where it is not feasible to devote time enough for the most thorough work. The following is the course required of technical students in agriculture:
1. COMBINED COURSE.

JUNIOR YEAR.

Fall Term.—Soils of the farm; how crops feed.
Winter Term.—Farm equipments; farm plans, buildings, implements.
Spring Term.—Farm crops; their history, description, cultivation and sale.

SENIOR YEAR.

Fall Term.—Farm animals; breeds and care.
Winter Term.—Stock breeding; Veterinary Medicine.
Spring Term.—Veterinary surgery; Rural economy, Original investigation.

2. HORTICULTURE.

Prof. Devol.

The special studies in the horticultural course are as follows:

JUNIOR YEAR.

Fall Term.—Elements of horticulture.
Winter Term.—Propagation of plants; Garden vegetables and market gardening.
Spring Term.—Seed growing; the Greenhouse flower garden and commercial floriculture.

SENIOR YEAR.

Fall Term.—Fruit culture; small fruits, deciduous fruits, citrus fruits.
Winter Term.—The propagation of plants, Arboriculture.
Spring Term.—Forestry, Landscape gardening, Garden tools.

In addition to the course laid down, the student in this course, may, with the consent of the faculty, elect other studies along special lines provided in other departments of the University.
II. HUMAN ANATOMY AND PHYSIOLOGY.

This Department is at present included, with Botany and Zoology, in the School of Biology (Title IV), which see (under 2 Zoology,) for a description of equipment and outlines of courses offered.

III. SCHOOL OF ANCIENT LANGUAGES.

There has heretofore been no demand for instruction in Latin beyond elementary work. It is the intention of the Faculty to gradually throw back this instruction to the Preparatory Classes, and to meet any requests for more advanced instruction which may be made each year.

Greek has not been taught, as yet, because no one has applied for instruction in this language.

Students who may require tuition in Ancient Language at any stage of preparation should communicate with the President of the University. We are better prepared this year to meet demands of this nature.

IV. SCHOOL OF BIOLOGY.

PROFESSOR TOUMEY.

The Biological class-room and laboratory are well lighted, provided with modern apparatus and pipes for gas and water.

The work is largely of a laboratory character. The workroom is equipped with simple and compound microscopes, microtomes and other accessories necessary for histological research. The work in systematic botany is greatly facilitated by the herbarium, which contains about ten thousand specimens of American plants, mostly Arizonan, and which is rapidly increasing.

A collection of about five thousand species of insects, mostly obtained during the past three years in Arizona, and representing the important orders of this branch of Animal life, is open for students' use in the study of invertebrate zoology. A portion of the equipment for use in the study of vertebrate zoology, is an excellent collection of Arizona birds and a smaller collection of mammals and reptiles. The work in human anatomy and physiology is demonstrated by the use of articulate and disarticulate skeletons, anatomical casts and charts.
The courses in this school are so arranged that the advanced work required of students graduating in the schools of Agriculture and Biology and the optional work for special students, are direct continuations of the work required in the Combined Course.

I. BOTANY

COURSE I.—Structure and Morphology of Plants.—As no real progress can be made until the student has learned to observe closely and correctly, students in this course are set to work upon living specimens from our local flora. So far as is expedient, the plants selected for study are those suggested by subjects in Spalding’s Introduction to Botany and other books used for reference. Study of such difficult subjects as ovules, seeds, and Morphology are given special attention. Drawings are made illustrating the various parts of the plant, and notes worked out by the student in connection with these drawings thoroughly fix the subject in the mind. The work is mostly of a laboratory character, supplemented by lectures.

Spring Term.—Five hours a week.
Required of all students graduating in the College of Agriculture and in the Combined course.

Preparation Required.—University Entrance Examinations.

COURSE II.—Systematic Botany.—Special study is given to the flowering plants, especially in regard to distribution and classification. Considerable attention is given to field work, and lectures are given once a week on economic plants of the families studied.

Reference books: Coulter’s Botany of Western Texas; Warner & Watson’s Botany of California and Gray’s Synoptical Flora of North America.

Fall Term.—Three hours a week.
Required of all students graduating in the College of Agriculture and in the Combined Course.

Preparation Required.—Botany, I.

COURSE III.—Systematic Botany (Advanced). Special study of the more difficult orders of Phanerogamic plants, and the identification and preparation of herbarium specimens. An herbarium containing a large number of Arizona plants is of considerable use to students in this work.

One Term.—Five hours a week.
Available to Students who have completed Courses I and II.
Course IV.—Physiological and Anatomical Botany.—Studies in the minute structure and physiology of plant life; work with compound microscope. Each Student is given the Laboratory use of the instrument during the term, and prepares his own slides and makes notes and drawings of the objects which he studies. A Lecture is given one day each week on the subjects previously studied, including the use and care of the microscope, cutting of sections, and on the Physiology of plants. In this course only the higher plants are studied.


One Term.—Nine hours a week.
Required of all Students Graduating in Agriculture and Horticulture. Available to Students who have completed Courses I and II.

Course V.—Cryptogamic Botany.—In this work the student is mostly occupied in the Laboratory in the study of the lower plants. Special attention is given to rusts and smuts and allied forms in their relation to plants of economic importance.
Some attention is given to ferns and mosses.
One Term.—Ten hours a week.
Required of Students Graduating in Agriculture and Horticulture. Available to those who have completed Courses I, II and IV.

II. ZOOLOGY.

The courses in Zoology offer work in human anatomy and physiology, general zoology and entomology.

Course I.—Human Anatomy and Physiology.—Lectures and Recitations on Human and Comparative Anatomy and Physiology, supplemented by Laboratory work, students making drawings and notes illustrative of their work.


Spring Term.—Five hours a week.
Required of all Students Graduating in the School of Agriculture and in the Combined Course.

Course II.—Zoology.—Lectures and text book work on the principles of classification of animals, their structure and development. Laboratory work is given considerable attention. Some time is given to making dissections and to the study of Animal Histology.

FALL TERM.—Five hours a week.
Required of all Students Graduating in the School of Agriculture and in the Combined Course.
Available to those who have completed Course I.

COURSE III.—Entomology.—In this study much attention is given to work upon Insects of economic importance. Lectures are given upon the Anatomy of Insects, their development, transformations, geographical distribution and general classification. The study is pursued at the season when the Students can make collections illustrating the different Orders.

ONE TERM.—Five hours a week, and two hours extra of Laboratory work.
Required of Students Graduating in Agriculture.
Available to those who have completed Zoology, I, II.

V. SCHOOL OF CHEMISTRY.

PROFESSOR FORBES.

The several courses of instruction offered in this school have two main objects in view:

The first object is to afford a general knowledge of Chemistry, and training in laboratory work to those who do not choose this science as their chief subject of study.

The chemistry of the Combined Course, comprising courses I, II, and III beyond, is selected for the purpose of developing these useful characteristics as far as possible in the short time available in a general course of study. The knowledge gained should also be sufficient to enable prospective teachers to give instruction in the elements of chemistry.

The facilities for this work are excellent, comprising a large and well ventilated laboratory on the main floor of the building, and an abundance of apparatus and chemicals with which to preform experiments. The work is also illustrated by excellent collections of minerals, models, charts, and chemical substances, a good chemical library being also accessible to the students.

The second object of the School of Chemistry is to afford special technical training to those students who expect to follow Chemistry or related occupations as a calling. With this purpose in view additional courses are offered, which introduce the student to the main branches of the science, and afford training in a wide range of analytical methods. This advanced work includes quantitative analy-
sis of minerals and ores, agricultural analysis, analysis of gares, assaying, and the preparation and analysis of organic substances.

The Experiment Station Laboratory is also at hand and affords the students opportunities for observing the practical working of an analytical laboratory.

COURSE I.—General and Experimental Chemistry.—Text book and lectures, with laboratory work. Designed to acquaint the student with the main principles of the science.

FALL TERM.—Five hours a week.

Required of all Students in Combined Course and in most of the Technical Courses.

Preparation Required.—University Entrance Examinations.

COURSE II.—General and Experimental Chemistry, (continued). In this course the principles of chemistry previously acquired are applied to the solution of chemical problems, and the student is introduced to the principles of qualitative analysis.

WINTER TERM.—Five hours a week.

Required of all Students in Combined Course, etc.

Preparation Required.—Course I.

COURSE III.—Qualitative Analysis.—This course affords training in the qualitative analysis of ores, minerals, alloys, salts &c., and in writing chemical equations.

SPRING TERM.—Five hours a week.

Preparation Required.—Courses I and II.

COURSE IV.—Quantitative Analysis.—Gravimetric methods.—Various salts and simple minerals are analyzed.

One Term.

Required of Students Graduating from the School of Chemistry.

COURSE V.—Quantitative Analysis.—Volumetric methods.

One Term.

Required of Students Graduating from the School of Chemistry.

COURSE VI.—Quantitative Analysis.—Assaying of various ores, as gold, silver, copper, lead and others.

One Term.

Required of Students Graduating from the School of Chemistry.

COURSE VII.—Quantitative analysis.—Iron and steel analysis.

One Term.

Required of Students Graduating from the School of Chemistry.

*Course VI and VII are given in the Laboratory of the school of Mines, as a part of the Course in Metalurgy.
COURSE VIII.—Quantitative Analysis.—Agricultural analysis, including examination of waters and soils.
   **Two Terms.**
   Required of all Students graduating from School of Chemistry.

   **Two Terms.**
   Required of all Students Graduating from School of Chemistry.

COURSE X.—Quantitative Methods.—Especially Technical gas analysis and the use of the spectroscope in sugar analysis.
   **One Term.**
   Required of all Students Graduating from School of Chemistry.

In connection with the technical courses IV to X, outlined above, suitable reading is required, according to the judgment of the instructor, or the special object held in view by the student.

VI. SCHOOL OF CIVIL AND HYDRAULIC ENGINEERING.

**Professor Boggs.**

This course is designed for young men intending to become civil engineers and surveyors. It provides for thorough training in mathematics, for instruction in the principles which form the common foundation of all the branches of the engineering profession, and for the practical application of these principles to certain lines of technical work. It aims to prepare students for immediate usefulness as subordinates in the field or drafting office, and for positions of greater responsibility after a reasonable amount of experience in the routine of actual practice. Especial prominence is given to those subjects which are the most important factors in the development of the arid region.

1. **Civil Engineering Drawing.**—Lettering; round writing; pen and colored topography; detail drawings; blue printing and other reproductive processes, etc.
   **One Term.**—Fifteen hours a week.

2. **Surveying.**—The elements of general surveying; use of field instruments; platting surveys; calculation of areas; subdivision of land; United States system of public land surveys; resto-
ration of lost corners; true meridians; underground surveys; city surveying; monuments; records; adjustment of instruments; principles and laws governing re-surveys of private lands, judicial functions of surveyors; etc.

A large portion of the allotted time is devoted to field work.

**One Term.**—*Fifteen hours a week.*

3. **Railroad and Canal Surveying.**—Reconnaissance: preliminary surveys; final locations; alinements of curves; gradients; cross-sectioning; setting slope-stakes; calculation of earthwork; construction of maps and profiles; railway curves; switches; turnouts; track-laying; etc.

Much of the work in this subject consists of the execution of actual railway and canal lines in the field and on the drawing table.

**One Term.**—*Fifteen hours a week.*

4. **Topographic Surveying.**—Contour surveys of small areas and of railway and canal lines; contour surveys of large areas, including elements of Geodesy; preparation of topographic and relief maps; methods used in the United States and other governmental topographic surveys; photographic surveying; etc.

Field work and topographic mapping occupy most of the time assigned to this subject.

**One Term.**—*Fifteen hours a week.*

5. **Strains in Framed Structures.**—Determination of strains in bridges, roofs, derricks, and cranes, plate girders, arches, etc., by graphic and analytic methods.

**One Term.**—*Five hours a week.*

6. **Bridge Designs.**—Designing of bridges, roofs and other framed structures; determination of dimensions; calculation of quantities; bills of material; estimates of cost; etc.

**One Term.**—*Ten hours a week.*

7. **Masonry Construction.**—Materials for masonry; foundations: retaining walls; arches; masonry dams; elements of stereotomy; etc.

8. **Railways and Highways**—Railway economics; construction and maintenance of way; standard structures: tunnels; highway construction; etc.

**One Term.**—*Five hours a week.*

9. **Water Supply.**—Hydrography and Meteorology.—Rainfall: flow in streams; absorption and evaporation; supplying capacity of water-sheds; underground water sources; practical design and construction of water-works for cities and towns; etc.

**One Term.**—*Five hours a week.*
10. *Hydraulics.*—Weight, pressure and motion of water; flow through orifices; tubes and pipes; flow over weirs; flow in natural streams and in artificial channels; measurement of water-power; hydraulic motors; pumping machinery; hydraulic rams; etc.

**ONE TERM.**—*Five hours a week.*

11. *Irrigation Engineering.*—General consideration of irrigation projects; storage reservoirs; dams; regulators; falls or drops; flumes, wood, metal and other pipes; aqueducts; laterals and distributaries; application of water; duty of water; excessive use and waste; land drainage; foreign irrigation works; etc.

**ONE TERM.**—*Five hours a week.*

12. *Municipal and Sanitary Engineering.*—Laying out towns and additions; streets, pavements and sidewalks; street railways; plumbing and house drainage; ventilation; construction and operation of sewers; sewage disposal; pollution of streams; self-purification of running streams; etc.

**ONE TERM.**—*Five hours a week.*

VII. SCHOOL OF DRAWING.

Professor Hoxie.

1. **FREE-HAND DRAWING.**

Free-hand Drawing is taught as a University and Preparatory study. The Courses comprise drawing from flat copies placed on the blackboard; Elementary Perspective; Model and Object Drawing, both in outline and shaded.

2. **MECHANICAL DRAWING.**

The equipment of Drawing Tables, Instruments and Models is very complete. A progressive course of instruction is given in the use of instruments, line drawing, lettering, projection drawing, tracing and blue printing.

**COURSE 1.**—*Instrumental Drawing.*

It is expected that the student who successfully completes this Course will be competent to undertake any of the ordinary work of a drawing office, detail drawing, etc.

**ALL THE YEAR.**—*Four to eight or more hours a week.*

Required of all Engineering students, throughout the Freshman year; of Agricultural students two terms, Freshman year.

**PREPARATION REQUIRED:**—Course in Free-hand Drawing, unless by special exemption, for good cause shown.
COURSE II.—Descriptive Geometry.
ONE TERM.—Five hours per week.
Required of Engineering students.
PREPARATION REQUIRED:—Mathematics I, II, III.

COURSE III.—Kinematic Drawing,—The study of Kinematics, the drawing of cams and the study of machine motions of different kinds on the drawing board.
ONE TERM.—Nine or ten hours per week.
Required of Students graduating in Mechanical Engineering.
PREPARATION REQUIRED.—Industrial Drawing I, II.

VIII. SCHOOL OF ELOCUTION.

MISS HUGHES.

The two Departments of Voice Building and Physical Culture are comprised in this School.

1. VOICE BUILDING.

The School of Elocution designs to make a thorough and systematic training of the voice a marked feature of its work.

The first year is one of continuous drill in all the elements of vocal expression; vocal physiology; vocal technique; economy of the breath; methods of delivery; vocal hygiene and health principles; defects of speech; articulation and pronunciation; modulation; inflection; emphasis; pitch; quantity and movement; qualities, application of tone effects; analysis; gesticulation; physical expression.

The second year’s work comprises one hundred and eighty emotional studies; classification and description of groups of emotions; dramatic analysis of Shakespeare’s plays; range and strength in delivery; flexibility of voice; light and shade effects in tone; pause effects; cultivation of the imagination; facial expression; principles of gesticulation; mechanics and application of gestures; pose and counterpoint.

2. PHYSICAL CULTURE.

The Course includes drills in
1. Light Gymnastics.

The Gymnastic drills are designed to give health, tone and
vigor to the body, and to attain ease, precision and harmony in action.

IX. SCHOOL OF ENGLISH.

PROFESSOR HALL.

Work in English is required of all students in the University, except special students, at some part of their course. The School will grow in Library equipment and in other ways as rapidly as the demands of students.

Instruction in the English language or literature extends through both years of the Preparatory course and each year of the University Combined course.

The preparation required for English in the Combined course is found in the Preparatory course; this consists in a thorough knowledge of English grammar and the elements of composition. The text-books used are Whitney & Lockwood's English Grammar and Lockwood's Lessons in English; students entering the Combined course directly cannot be too thoroughly prepared on all the exercises and forms of composition required by the latter.

In the Freshman year, English occupies five hours each week. In the first term popular masterpieces of English and American authors are studied, with the special purpose of cultivating a taste for reading; in the second and third terms Elementary Rhetoric is taught and the work of the first term continued.

American prose writers are studied one hour each week for the first two terms of the Sophomore year, and the study of argumentative composition is taken up in the third term, five hours each week.

In the Junior year English Literature and English History are studied on alternate days throughout the three terms.

In the first two terms of the Senior year two or three hours each week are occupied with a critical study of the works of English writers.

Throughout the course, one public declamation, essay or speech is required in each term, the nature of the exercise depending upon the student's position in the course.
In tabular form the English of the Combined course is as follows:

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<th>FRESHMAN</th>
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<td><strong>FALL</strong></td>
<td><strong>WINTER</strong></td>
<td><strong>SPRING</strong></td>
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<tr>
<td>English, 5; Am. and Eng. Classics; Composition, Rhetoricals — One public recitation or declamation.</td>
<td>English, 5; outlines of rhetoric; composition. Rhetoricals — One public recitation or declamation.</td>
<td>English, 5; rhetoric and composition continued. Rhetoricals—One public essay or declamation.</td>
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<th>SOPHOMORE</th>
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<td><strong>FALL</strong></td>
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<tr>
<td>English, 1; Am. or Eng. Classics or equivalent. Rhetoricals—One public essay or review.</td>
<td>English, 1; continued from English, 5; rhetoric; argumentative and special composition. Rhetoricals—One public argumentative essay or review.</td>
<td>English, 5; rhetoric; argumentative and special composition. Rhetoricals—One public essay or declamation.</td>
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<th>JUNIOR</th>
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<td><strong>FALL</strong></td>
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<tr>
<td>English, 5; English Literature, alternating with English History throughout the year. Rhetoricals—One public essay or original speech each term.</td>
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<td><strong>FALL AND WINTER</strong></td>
<td><strong>SPRING</strong></td>
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<tr>
<td>English, 2; Critical study of English Authors, throughout the two terms. Rhetoricals—Public essays and original speeches.</td>
<td>Graduating Thesis.</td>
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The figures refer to the number of hours of recitation each week.

SPECIAL ENGLISH COURSES.

In addition to the combined course above, the following courses are open to special students in English who show sufficient preparation.

All these courses are required of students electing English as a principal subject. Such students must first have taken all the English of the Combined course or an equivalent.

COURSE I.—Prose Writers of Nineteenth Century.—Text-book, with lectures and discussions. Students will be required to choose works for individual study from the writings of the authors considered in class, reporting periodically.
COURSE II.—Literature of Eighteenth Century.—Same method as in Course I.

COURSE III.—Elizabethan Literature.—Method same as in Course I.

COURSE IV.—Elizabethan Drama.

COURSE V.—Translations from Ancient Literature.—Studies of the best translations of the most celebrated works of Grecian and Roman writers.

COURSE VI.—American Literature.—Students will provide themselves with some of the works of the most prominent authors. It is expected that a large amount of outside reading will also be done in connection with this course.

The above courses occupy one term each, five recitations every week, except Course III, which occupies two terms. The courses will follow each other in the order given, if possible, except Courses V and VI, which may be taken earlier in connection with other courses.

X. SCHOOL OF GEOLOGY AND MINERALOGY.

DR. COMSTOCK, ACTING PROFESSOR GOODLOE.

The courses provided in this school are arranged to meet the needs of both general and professional students.

GEOLOGY.

The instruction in Geology comprises both class-room and laboratory work, with which is combined a large amount of practical field work.

A Geological survey of the Territory is in progress under the auspices of the School of Mines, and competent students will be afforded opportunity for instruction in the methods of field work, Geologic and Topographic.

Collections of rocks and fossils are well selected for illustration, and the Museum is particularly well supplied with Arizona types collected by Dr. Comstock and others. Besides these there are many specimens from other States and countries and accessions are made by gift, purchase and exchange.

The subject of Engineering Geology, or the relations of Geology to engineering work, is made especially prominent in the technical Courses. Special lectures on Agricultural Geology are also given.

COURSE I.—Physiography.—Forms of relief in the earth’s sur-
face; phenomena of currents of air and water; general physical features and their distribution

One Term.—Five hours a week.

Required of Students Graduating in all Colleges of the University.

Preparation Required.—Physics I (or equivalent); Chemistry I, Ia.

Course II.—Structural and Dynamic Geology.—Review of Geognosy, and of the agencies of change in the earth's crust; earthquakes; volcanoes; thermal springs; geysers; atmospheric and sub-aerial factors in structure, earth sculpture and metamorphism.

Required of Graduates in Mining Engineering, Civil Engineering and Agriculture.

Preparation Required:—Mathematics, through Trigonometry; Geology I; Physics II; Mineralogy I, II.

Course III.—Stratigraphic Geology.—Review of the successive stages of Geologic History; method of reading the record; progress in the development of life on the earth.

Required of Students Graduating in Mining Engineering and in the College of Natural Science.

Preparation Required:—Geology I, II; Botany I, II; Zoology III.

Course IV.—Engineering (Economic) Geology.—Practical relations of Geology to Agriculture, to the Arts and to the different branches of Engineering; distribution of ores, rocks and other deposits of economic value.

Required of those who Graduate in Mining Engineering.

N. B. This Course is advised for other Engineering Students, who may, in some cases, be allowed to take it with less preparation than is prescribed below, or to pursue a portion only of this allotted work.


Course V.—Paleontology.—Ancient life on the earth; systematic review of Fossil Botany and Invertebrate and Vertebrate Paleontology, with particular reference to Stratigraphy and Historical Geology.

Available to Students who have taken Geology I, II, III; Botany I, II, IV, V; Zoology.
MINERALOGY.

The Museum of Geology and Mineralogy is intended to properly represent the ores and minerals of Arizona, so as to provide a place for the deposit of everything illustrative of the practical working of the mines, mills and furnaces. A beginning was made in the donation of a valuable collection by Professor Blandy, formerly Territorial Geologist, and by the deposit of the collections of Dr. Comstock. These last comprise many rare minerals from other regions, from which exchanges will be made with institutions and individuals, so as to materially increase the variety of specimens.

The University has also received the collections made at the World's Fair in 1893 by Commissioner T. R. Sorin, including material of great interest and importance for students' use.

The equipment is ample for all present purposes, and additions are constantly being made. The collections include fine samples of the modes of occurrence and of variations in the forms of minerals. This material is rapidly increasing by donations, and by gleanings from all parts of the Territory, a region unsurpassed as a field for the study of the important science of Mineralogy.

Instructions in Mineralogy comprises through courses in Crystallography, Determinative Mineralogy, and Blow-pipe analysis. Special attention is given to Laboratory work, in which the students are made familiar with a great variety of minerals.

COURSE I.—Physical Mineralogy and Blow-pipe Analysis.—Crystallography, and Physical and Chemical properties of minerals; Determination of minerals, etc., by means of the blow-pipe.

WINTER TERM.—Five hours a week.

Required of Students graduating in Mining and Metallurgy.

PREPARATION REQUIRED.—Mathematics, (except in special cases) through Solid Geometry; Physics II, (or I); Chemistry I, Ia, (more will be advantageous); Drawing, (as much as possible of Projection Drawing).

COURSE II.—Determinative Mineralogy.—Laboratory work, involving the determination of the rare, as well as common minerals.

SPRING TERM.—Ten hours a week.

Required of Students Graduating in Mining Engineering and Metallurgy.

PREPARATION REQUIRED.—Mineralogy I.

COURSE III.—Petrography.—Study of the intimate structure of
XI. SCHOOL OF HISTORY AND CIVICS.

1. HISTORY.

A good foundation in History is procured in the Preparatory School. Advanced work in this branch is provided in the Combined Course, and all reasonable demands can be met by special training under the guidance of professors of related branches. With the means at our disposal and the limited request for such instruction, progress must needs be less rapid than in some other directions.

A course in English History is given by Professor Hall in connection with English Literature.

Much attention is being given by the University to the collection and preservation of the material of the local history of Arizona.

2. CIVICS.

THE PRESIDENT AND FACULTY.

The term Civics, as here used, implies those principles which relate to the rights and duties of citizenship. In one sense it covers much the same ground as is ordinarily included in College courses of "Political Science.

For the present the work of this School will be largely in the hands of President Billman, who will deliver a course of lectures at stated intervals to all students in the University. Instruction in Civics is also given as a part of the routine work in two terms of the Senior year, Combined course.

The Hugo Zeckendorf gold medal (see Page 10 of this Register), and the Hall prizes of the American Institute of Civics, are open for competition by students of this University.

The lectures given by the Professors each day in Morning Assembly, and the addresses delivered weekly in Public Assembly have partaken largely of the character of instruction in Civics. Particular attention is also given in the Senior year to such cognate subjects as the History of Civilization, Constitutional History and Political Economy.
As a means of mental discipline, the work assigned by the Faculty in all courses includes a liberal amount of the Pure Mathematics. The Engineering courses especially require thorough training in these branches and in Applied Mathematics.

The range of work done in Pure Mathematics is indicated by the following outline:

**Course I.**—Algebra (completed).
[Algebra is begun and carried two terms as a Preparatory study.]
FALL AND WINTER TERMS.—Five hours a week.
Required of all Regular Students in the University, Freshman Year.
PREPARATION REQUIRED.—University Entrance Examinations in full.

**Course II.**—Geometry.—Plane Geometry.
SPRING TERM.—Five hours a week.
Required of all Regular Students in the University, Freshman Year.
PREPARATION REQUIRED.—Mathematics I.

**Course III.**—Solid Geometry.
FALL TERM.—Five hours a week.
Required of all Regular Students, Sophomore Year.
PREPARATION REQUIRED.—Mathematics I, II.

**Course IV.**—Trigonometry.—Plane and Spherical.
WINTER TERM.—Five hours a week.
Required of all Regular Students, Sophomore Year.
PREPARATION REQUIRED.—Mathematics I, II, III.

**Course V.**—Analytic Geometry.
SPRING TERM.—Five hours a week.
Required of Students in Engineering Courses, Sophomore Year.
PREPARATION REQUIRED.—Mathematics I, II, III, IV.

**Course VI.**—Calculus.
FALL TERM.—Five hours a week.
Required of all Engineering Students, Junior Year.
PREPARATION REQUIRED.—Mathematics I, II, III, IV, V.
APPLIED MATHEMATICS.

Strictly speaking, much of the work of all the Engineering Schools involves the teaching of Applied Mathematics. What is here included covers only certain special branches which have been omitted elsewhere as being general in their application.

COURSE X.—Mechanics.
Required of Students Graduating in the College of Engineering, and in the School of Irrigation, College of Agriculture.

Preparation Required.—Pure Mathematics, I, II, III, IV, V, VI.

COURSE II.—Materials of Engineering.
Required of all Engineering Students, as with Course I.

Preparation Required:—Pure Mathematics I, II, III, IV, V, VI; Applied Mathematics I.

COURSE III.—Strength of Materials.
Required of students as in Course II.

Preparation Required.—Same as in Course II.

COURSE IV.—Astronomy.
Required of Graduates in Civil Engineering and Mining Engineering.

Preparation Required.—All five Courses in Pure Mathematics; Physics I, II, III; Geology I, II.

XIII. SCHOOL OF MECHANICAL ENGINEERING.

Professor Hoxie.

The industries of Arizona are constantly demanding more and better training of those who are to be intrusted with the mechanical details connected with the development of our resources. It is the purpose of the School of Mechanical Engineering to meet this growing want. The facilities afforded in the elementary work are all that could be desired, and new equipment for the advanced students is being added as rapidly as required. The pumping-plant and the engines of the mill of the School of Mines, as well as the extensive electric plant of the University, are also available for instruction.

Students who may select this work will take full courses in Drawing, Physics, Mathematics (pure and applied), and later in
their progress will receive instruction by lectures and in the laboratory on subjects relating to their profession.

Among the topics falling to be discussed in this series of lectures are: Materials of Engineering; Principles of Mechanics; Designing of Machines; Steam Engines and other Motors; Dynamos, etc.; Hydraulic and Wind Engines, and the Study of Mill Work and Machinery.

Detailed Courses, as in other Schools of the College of Engineering, are provided to cover the necessary work. These will be made known upon application to the Professor of Mechanics and Physics.

In the Department of Electrical Engineering, qualified students will receive careful training in the theory and practical operation of electric apparatus and machinery. The equipment in this Department is excellent and rapidly increasing.

Important additions have recently been made to the testing apparatus, and this Department is now prepared to undertake many practical tests of machines, boilers, pumps, engines, etc.

This year a beginning will be made in the direction of shop practice as a required study in the Course.

XIV. SCHOOL OF MINES.

DR. COMSTOCK, ACTING PROFESSOR GOODLOE.

The School of Mines has ample facilities for illustration of the various processes employed in mining work and of the principal methods of ore-treatment. Attached to the Main Building is an Annex, containing machinery and appliances for crushing, sampling, concentrating, amalgamating, leaching, chlorinating, and the electrical treatment of various kinds of ore in large or small lots. The student has access to this apparatus and is required to familiarize himself with its manipulation.

The Assay Laboratory is one of the most complete in the West in its appointments. This is equipped with assay furnaces for crucible work, for scorifing and cupelling, and for retorting mercury from amalgam. An adjoining room, supplied with water, gas and electric current, has a rooomy hood for work involving fumes, with tables and desks for student work, besides all needed appliances for assaying by dry and wet methods, including electrolysis. This room also contains an experimental desk and fitting for making analysis of all kinds required in this Department upon a working scale.
MINING ENGINEERING.

Field work and excursions to mines are made part of the training. Memoirs of practical character upon assigned subjects are required of students sufficiently advanced to prepare them.

COURSE I. — Mine Surveying. — Lectures, Recitations and Field Work. — History, uses and adjustments of instruments; solar compass and solar attachments, practical problems involving the running of surface and underground lines; connection of surveys above and below the surface; practice of U. S. Deputy Mineral Surveyors. Details of mine surveys; setting of bench-marks; running lines in shafts, stopes, etc.; maps, plans, sections; keeping of records. Surveys required to select locations for test-boring, shafts, adits, etc.; methods of reconnoitering.

ONE TERM. — Ten hours a week.

Required of Students Graduating in Mining Engineering.

Preparation Required: — Pure Mathematics, through Trigonometry; Applied Mathematics, through Topographic Surveying; Physics II, III; Drawing I, II.

COURSE II. — Mining Attack. — Methods of exploration and development of veins and other deposits; tools, implements, machinery and explosives, with principles governing their use. Methods of boring, sinking and driving through hard, soft, wet, dry, loose and compact materials. Means of overcoming difficulties arising from dislocations and obstructions, such as faults, rolls, swells, caves, etc. Advantages and drawbacks in the English, Austrian, German, French, Belgian and American systems of excavation. Critical studies of the famous tunnels of the world. Variations required by differences in the objects sought.

ONE TERM. — Five hours a week, with extra problems and drawings.

Required of Students Graduating in Mining Engineering.

Preparation Required: — Mathematics, through Mechanics; Physics II, III; Chemistry I, Ia, III, IV, V, VI; Drawing I, II; Geology I, II, III, IV; Mineralogy I, II.

COURSE III. — Exploitation. — Support: objects and methods of timbering; framing, fitting, bracing. Winning of ores, coal and other materials; overhand and underhand stoping; winzes and intermediate levels. Drainage: pumps, pumping, sumps, ditches; drainage of working shafts and inclines. Ventilation: means and appliances; laws of various states and countries; discussion of funda-
MENTAL PRINCIPLES AND PRACTICAL APPLICATIONS, WITH RESULTS. TRANSPORTATION ABOVE AND BELOW GROUND: MOTORS, CARS, TRACKS, SWITCHES; CABLES, CAGES, SAFETY ATTACHMENTS; HAULAGE IN INCLINES, "MAN-ENGINES," ETC.; TAIL-ROPE AND OTHER SYSTEMS. HOISTING APPARATUS, AIR COMPRESSORS AND SPECIAL MINING MACHINERY.

TWO TERMS.—FIVE HOURS A WEEK, BEIDES PROBLEMS AND DRAWINGS. REQUIRED OF STUDENTS GRADUATING IN MINING ENGINEERING.

PREPARATION REQUIRED.—MATHEMATICS, THROUGH MECHANICS; PHYSICS II, III; MINING ENGINEERING II; ASSAYING (METALLURGY I); STRENGTH OF MATERIALS.

COURSE IV.—ADMINISTRATION.—DESIGNING AND CONSTRUCTION OF MINING PLANT; SETTING, ARRANGING, ADJUSTING; PRESERVATION AND OPERATION; GENERAL ECONOMY. ORGANIZATION OF WORKING FORCE; ECONOMY OF MANAGEMENT; SECONDARY SUPERINTENDENCE; SYSTEM OF REPORTS; DIVISION OF LABOR AND ADJUSTMENT OF RESPONSIBILITY. PREVENTION OF ACCIDENTS. LETTING AND MEASURING CONTRACTS; PRESERVATION OF MAPS, PLANS AND RECORDS. MINE BOOK-KEEPING; ACCOUNTS, FORMS, ANALYSIS, PAY ROLLS, COST SHEETS, ETC.

ONE TERM.—FIVE HOURS A WEEK.
REQUIRED OF ALL STUDENTS GRADUATING IN MINING ENGINEERING.

PREPARATION REQUIRED.—MINING ENGINEERING I, II, III,

METALLURGY.

VISITS TO MILLS AND METALLURGIC WORKS AND THE PREPARATION OF PRACTICAL MEMOIRS BY THE STUDENTS FORM IMPORTANT PARTS OF THE TRAINING.

COURSE I.—ASSAYING.—A COMPLETE PRACTICAL COURSE, PRECEEDED BY PRELIMINARY LECTURES. THE STUDENT LEARNS TO PREPARE HIS OWN SAMPLES AND TO PERFORM ALL THE OPERATIONS FROM THE MAKING OF THE FIRE TO THE WEIGHING OF THE BEAD, ETC., IN THE FIRE ASSAYS, AND FROM THE START TO THE FINISH IN THE WET ASSAYS. THE COURSE IS CAREFULLY GRADED SO AS TO GIVE THE BEST RESULTS.

ONE TERM.—TEN HOURS A WEEK.
REQUIRED OF ALL STUDENTS GRADUATING IN MINING AND METALLURGY.

PREPARATION REQUIRED.—PHYSICS II, III; CHEMISTRY I, Ia. II, III, V.

COURSE II.—ORE DRESSING.—ASSORTING, SAMPLING, CONCENTRATION; FULL DISCUSSION OF PRINCIPLES, MACHINERY AND METHODS. PRACTICAL WORK IN THE MILL.

PREPARATION REQUIRED.—PHYSICS II, III; METALLURGY I.
COURSE III.—"Elements of Metallurgy."—Lectures and Laboratory practice. Analysis and discussion of fuels, fluxes, etc., general conditions affecting economical results. Outlines of the metallurgy of the principal metals. (Introductory to Course IV).

ONE TERM.—Ten hours a week.

Required of all Students Graduating in Mining Engineering and Metallurgy.

Preparation Required.—Metallurgy I, II.

COURSE IV.—"Metallurgy."—Advanced course of lectures, with practice; detailed study of metallurgical processes in general use for the reduction of ores of all kinds. The student is made familiar with actual work on a commercial scale. In connection with this, he is required to design working plants and to make detailed reports of operations in the mill of the School of Mines.

ONE TERM.—Ten hours a week.

Required of all Students graduating in Metallurgy.

Preparation Required.—Mathematics, through Mechanics; Drawing I, II; Metallurgy I, II, III.

In the Combined Course, and in other courses laid out by individual Professors, a certain amount of study of one or other Modern Language is obligatory; usually with the option of Latin as a full equivalent.

XVI. SCHOOL OF PHYSICS.

Professor Hoxie.

This occupies three large rooms on the ground floor of the University building.

The Lecture room is provided with all the accessories needed for experimental demonstration, such as gas, water, solar and electric lanterns, electric currents, of any desired strength, etc.

The collection of apparatus available for instruction in this School is of the most complete modern description, especially that pertaining to Electricity. It includes a large Mather dynamo (of 7½ H. P., 75 lights); small hand dynamo; motors of different sizes; Wimshurst Electric Machine; a very fine Helmholz-Gaugain galvanometer; Deprez-D'Arsonval reflecting galvanometer; portable testing set for measuring resistances; several galvanometers for students' use: Wheatstones' bridges; Ampere's table; large air pump, with acces-
sories; hydraulic ram; whirling table; photometer; lenses; prisms; mirrors; and a large list of other instruments.

COURSE I.—Elementary Physics.—[For general students, who do not require more than a cursory view of the subject.]

Comprises the whole range of the science in outline, covering the divisions of Mechanics and Heat, Electricity and Magnetism, Sound and Light. This course is intended to meet the needs of those who have not the time to pursue more extended study. It may also be taken with advantage by those who wish thereby to lay the foundation for a more thorough course.

FALL TERM.—Five hours a week.
Required of Students graduating in the College of Letters, and of those who pursue the “Combined Course.”

PREPARATION REQUIRED:—University Entrance Examinations.

COURSE II.—Engineering Physics.—Lectures and Recitations, in which all the more important phenomena are fully illustrated by experiments. The subjects pursued are the same as in Course I, but the treatment is much more thorough, as the time is correspondingly increased.

FALL, SPRING AND WINTER TERMS.—Five hours a week.
Required of Students Graduating in the College of Agriculture and Engineering.

PREPARATION REQUIRED:—Mathematics, through Algebra, and preferably through Trigonometry.

COURSE III—Physical Laboratory.—Actual work and experiments by the students in all branches of Physics. Full notes of observations, with written report on each experiment, are required.

WINTER AND SPRING TERMS.—Ten hours a week.
Required of all Graduates in the College of Engineering and in the School of Irrigation in the College of Agriculture.

PREPARATION REQUIRED:—Physics I; or Fall Term of Physics II.
The Preparatory Course, occupying two years, has been especially designed for those who have not had sufficient training to enter the classes of the Freshman Year. It is not the intention to make this an equivalent to the High School, but simply a preparation for actual University work. Thus all the work of the Preparatory years is arranged with an idea of progression from this School through any of the University courses.

It is not the desire of the Faculty to engage in any work which can as well be done in the Public Schools of the Territory, but we have found it impracticable to dispense with classes designed to prepare students for the routine work of the University.

Although this course affords thorough training, as far as it goes, and provides a good foundation for future studies, it is not in any sense complete in itself. One of its main objects is to give training in the best methods of study, *to teach pupils to think*. In many cases, students lacking neither in zeal nor ability, are at a disadvantage in not knowing how best to direct their energies to the matter in hand. It will be the constant aim of the Instructors in the Preparatory School to overcome this difficulty, which has heretofore been the most serious hinderance to educational progress in the West.
SYNOPSIS OF THE COURSE.

Below is given detailed information regarding the work of this School. None of the work is elective, as in the University Courses.

PREPARATORY COURSE OF STUDY.

JUNIOR PREPARATORY.

FALL TERM.

*English.* Language and Composition. Reading of English Classics.

*Mental Arithmetic.*

*Geography.* Especially Resources and Physical condition of the United States.

WINTER TERM.

*English.* Language and Composition.

*Arithmetic.* Begun.

*United States History.* Colonial.

SPRING TERM.

*English.* Composition and Grammar.

*Arithmetic.* Continued.

*United States History.*

SENIOR PREPARATORY.

FALL TERM.

*English.* Composition and Grammar.

*Arithmetic.* Completed.

*United States History.* Brief Descriptive Course.

WINTER TERM.

*English.* Lockwood's Lessons, or an equivalent.

*Ancient History.*

*Algebra.* Begun.

SPRING TERM.

*English.* Lockwood, continued.

*Medieval History.*

*Algebra.* To Quadratics.
MISCELLANEOUS SCHOOLS.

To meet the expressed wishes of a considerable number of applicants, the Board of regents, in 1893, authorized the President to establish certain Schools for instruction in Art and in Business. These, for the present, are necessarily conducted upon a different basis from the regular University Classes.

All students who register for work in these schools are listed as Specials, being thus amenable to the General Faculty, in a measure.

In addition to the Matriculation Fee exacted of all students upon entrance, Instructors' Fees are required of those who elect work in any of the Miscellaneous Schools, excepting when such work is prescribed as part of a University Course. These fees are payable in advance, term by term.

The University has no specific appropriation from which such Schools may be supported, and it is therefore necessary to make the fees mainly pay the expense of maintenance. Such arrangements have been made, however, as will reduce these fees to the lowest possible limits.

For the present in these departments instruction will be confined in the School of Art to music, and the School of Business to book-keeping.

MUSIC.

Little or no attention having been paid hitherto in our public schools to instruction in music we plan to give such general instruction to all students as will enable them to read music at sight, and otherwise prepare them to participate in Assembly exercises, and enter upon chorus work. No fees will be charged for this work, but further training is subject to special fees, as per schedule of rates announced below.

INSTRUMENTAL MUSIC.

This department will aim to meet the requirement of those who wish to study piano and organ music. Much attention will be given to developing a correct taste, expression in execution, and to imparting a thorough understanding of the principles of music.

Term of twenty lessons on piano or organ.......................... $15.00
Use of instrument for practice per term............................ 2.50
VOICE CULTURE.

Special attention will be given to chest development, tone placing, power and flexibility of voice.

Term of twenty lessons $15.00

If the number and accomplishment of students make it practicable at least one public recital will be attempted during the year.

BOOK-KEEPING.

Arrangements will be made to give a thorough course of instruction in Book-keeping to such students as may desire to take up this branch in connection with other work in the University. For this special instruction a fee of eight dollars per term of ten weeks will be charged.

THE TERRITORIAL MUSEUM.

The Arizona Legislature, Session of 1893, passed an Act establishing a general Museum at the University. The object of this is to collect materials of all kinds illustrating the resources and development of the region, and particularly to preserve historical relics, including those pertaining to the aboriginal inhabitants.

Donations of specimens and collections will be received and acknowledged with thanks; but no provision has yet been made by the Legislature for the support of this department, aside from the appropriation of $100 per annum for the salary of a Curator for two years.

A collection has been bequeathed by the late Edward Rose, of Pleasant Valley, Gila county, and the nucleus of additional collections will come from duplicates of the material obtained by members of the Faculty in their annual tours of scientific investigation in the Territory. The collection of minerals made by Mr. Sorin, at the World's Fair, in 1893, is also placed with the foregoing. Historical records of much value are being gradually accumulated as a part of this Museum, and an appeal is made to old settlers and others to bear this fact in mind when making disposition of articles bearing even remote relation to the early pioneers and their history. All records and data of any nature which can be gleaned are worthy of preservation, and we earnestly desire to have them at
their proper place in the University, where they will always be accessible for reference. Books, papers, letters, documents, implements, and records of apparently little importance, may all possess historical value. Portraits of officials and private citizens, accounts of Indian raids and every scrap or relic should be carefully saved and forwarded to the Territorial Museum.

Eventually, this branch of the University must become a most attractive and instructive feature, if the people will aid us in the proper spirit.

The Board of Regents, prior to the passage of the Act established the Museum (which was due to the efforts of Mr. Hunt, of Globe) had formally elected Mr. Herbert Brown as the Curator. Mr. Brown has deposited his large and very valuable collection of native bird skins in the Museum.

THE BUREAU OF MINES.

ACTING DIRECTOR, MEADE GOODLOE.

Since the opening of the University in October, 1891, there has been maintained in connection with the School of Mines, a department for the investigation of the mineral resources of Arizona, under the immediate direction of Dr. Theo. B. Comstock. Circulars of information have been mailed broadcast, announcing the facilities at hand for the treatment of ores on a large scale, the making of assays and the determination of the mineral character and commercial value of specimens sent in. This work has been performed very extensively for hundreds of our citizens who have availed themselves of the advantages offered, both gratuitously and, in certain cases, for fees which must necessarily be demanded.

Owing to a misconception which has arisen in some few instances, from the use of the term School of Mines in this connection, it has been decided, upon the reorganization of the University, to adopt the more appropriate title “Bureau of Mines” to cover this important line of work, which is closely comparable in its scope to that of the Agricultural Experiment Station, though in a different field.

The Bureau of Mines has the advantage of the complete equipment of the School of Mines and of the services of the same officers.
Its purposes, however, are not educational, but experimental and investigatory. We are prepared to examine and report upon the nature and proper mode of treatment of ores; to determine minerals and their commercial value; to assay, make samples and test (on a working scale) all classes of ores by the different processes in use, making detailed reports of all operations.

Tests known as qualitative, i.e., to determine the character of a mineral and whether it contains metal or other substances of commercial value, are made without any charge.

Where the amount of metal in a given ore is determined, assays or analyses are made and charged for at regular rates, as below:

**SCHEDULE OF RATES.**

<table>
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<tr>
<th>Service Description</th>
<th>Preliminary, or specimen tests (qualitative)</th>
<th>Qualitative analysis, giving composition (but not amount of each substance found)</th>
<th>Quantitative analysis, giving exact amount of each substance in combination, at prices according to work</th>
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<td>FREE</td>
<td>$3.50 to $5.00</td>
<td>$5.00 and upward.</td>
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These prices include all charges for the necessary sampling, assaying, etc.

Bulletins are occasionally issued treating of matters of interest to miners and metallurgists. These are distributed gratuitously. Address all communications to

**HOWARD BILLMAN, President,**

**Tucson, Arizona.**
Agricultural Experiment Station.

BOARD OF CONTROL.

The Regents of the University.

STATION STAFF.

Wm. Stowe Devol, B. Agr., Director...Agriculturist and Horticulturist
Edward Marshall Boggs,...Irrigation Engineer and Meteorologist
James W. Toumey, B. S. Botanist and Entomologist
Robert H. Forbes, B. S. Chemist
Mark Walker, Assistant Horticulturist
Mark Walker, Jr. Assistant Chemist
Robert J. Ferguson, Machinist
Lee LaChance, Stenographer

STATION COUNCIL.

The Board of Regents, the President of the University (President) and Director of the Station, together with the members of the Station Staff, ex-officio.

ANNOUNCEMENT.

The Agricultural Experiment Station has been established according to an Act of Congress, and by the Territorial Legislature has been made a department of the University.

The function of the Station is to aid in developing the agricultural and horticultural resources of the Territory, by solving, as completely and rapidly as possible, the complex problems with which the farmers, fruit growers and stock raisers are confronted. In aid of this the National Government has appropriated the sum of $15,000 to be paid annually to the Board of Control for this specific purpose.

The lines along which the work of the station runs, embrace the investigation of the conditions of climate, soil and water sup-
ply in the various parts of Arizona, and the adaptability of the conditions found to the growth of different agricultural and horticultural crops; the range of climate suited to the production of these crops; the maximum, minimum and mean amount of water; the successful cultivation of different farm and garden crops; water storage and the development of water from other sources; the best means of applying water; methods of culture; the best season for planting; breeds of farm animals and their improvement to meet local conditions; the introduction of new fruits, vegetables and farm crops and the distribution of plants and seeds; the development of forest tree culture; the investigation of diseases affecting the plants and the animals of the Territory and the remedies best suited to prevent or eradicate them; the publication of investigations undertaken, and the results obtained, in the form of bulletins, issued periodically and sent gratis to all who apply for them. The range of the work of the Station is only limited by the needs of the Territory and the funds available for use in making the investigations. Those questions which are thought of greatest importance to the Territory come first in the line of work pursued.

To further the ends of the Station in extending its usefulness, the cooperation of all interested in its work is earnestly solicited. Suggestions will be gratefully received and inquiries answered cheerfully, wherever possible, by the members of the Staff, each answering for his own department. No charge is made for answering these questions, and wherever chemical analysis or other investigations, of general public interest and benefit are requested, they will be undertaken whenever possible, and without cost.

The location of the Experiment Station, at the University, is of great benefit, directly and indirectly, to the students in the University. The specialists in the Station work are available as professors in their respective branches, in the University, thus affording a larger corps of teachers specially equipped in the several departments.

Then the Station investigations provide opportunities to students in agriculture and other special branches, for the study of special conditions and methods of special interest to the Territory, which would not otherwise be available.

All communications respecting Station matters should be addressed to,

DIRECTOR EXPERIMENT STATION,

TUCSON, ARIZONA.
LIST OF STUDENTS, 1894-95.

SENIORS.

Charles Oma Rouse .............................................. Florence
Mercedes Anna Shibell ......................................... Tucson
Mary Flint Walker ................................................. "

JUNIORS.

Danforth P. Blake ................................................. New Haven, Conn.
Clara Cramond Fish .............................................. Tucson
Fred. Scott Noble ................................................ "
Mary Osborn ........................................................ "
Mark Walker, Jr .................................................... "
John D. Young ..................................................... Sacaton

SOPHOMORES.

George Hilzinger ..................................................... Tucson
Miriam Katzenstein ............................................ "
Lawrence Archer Lovell ........................................ "
Irene Annette Wetmore ........................................ Fort Lowell

FRESHMAN.

Myra Drachman ....................................................... Tucson
William Lord Drake ............................................... "
Hattie Ferrin ........................................................ "
Lulu Hilzinger ........................................................ "
Jessie Hughes ........................................................ "
Hannah Mansfeld ................................................... "
LIST OF STUDENTS, 1894-95.

Paul Alexander Noble ........................................... Tucson
Bert Orndorff .................................................. "
Fred Watts ....................................................... Tombstone
Minnie Ruth Watts ................................................ "
David Weech ..................................................... Pima

IRREGULAR AND SPECIAL.

Collins, (Surveying) ........................................... Tucson
Alberto C. Garcia, (Metallurgy) .......................... "

PREPARATOR Y CLASSES.

SENIOR PREPARATOR Y.

Solomon Drachman .............................................. Tucson
David Holley .................................................. Rockford, Illinois
Addie Harding ................................................ Tucson
Eugene Allen Tice ........................................ Saric, Sonora, Mexico
Lorenzo Walters ........................................ Saric, Sonora, Mexico
Victor Zabriskie ........................................... Tucson

JUNIOR PREPARATOR Y.

Isabel Buelna ................................................. Tucson
Lotta Bullock ..................................................... Agua Caliente
Mabel Crum ................................................ Tucson
Clara Ferrin ................................................ "
Henrietta Goldtree .......................................... "
Mamie Hoff ................................................ "
Lulu Katzenstein ........................................... "
Ethel Kennedy ............................................... "
LIST OF STUDENTS, 1894-95.

Samuel Mansfeld .................................................. Tucson
Laurette O'Connell ................................................ “
Clinton M. Satterwhite .......................................... “
Dora Scrivener ..................................................... “
Robert Shand ......................................................... “
Eliza Jane Weech .................................................. Pima
Ina Wilkinson ........................................................ Tucson

UNMATRICULATED.

Albert Garfield Drake .............................................. Tucson
Eliza Stevens ........................................................ “
Atanasia Hughes ..................................................... “
James F. S. Hughes ................................................ “
Beryl Nellie Richardson ........................................... “
Lulu N. Riggs ........................................................ “
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