

## 4th Class Power Engineering Online

### PELM 4300 Steam Generation

4 credits

Topics include lubrication and bearings, pumps and compressor types and operation, boiler safety devices, boiler plant operation and management, energy plant maintenance, and in-plant water treatment as identified in the Alberta Boilers Safety Association Reference Syllabus for 4th Class Part B Power Engineering.

Recommended Prerequisites: It is strongly recommended that students have Math 20/23 or Math 20 Applied, Physics 20 or Science 20 and English 20 (Grade 11).

### Instructors

Indika Arachchi

### Contact Information

Keyano College Power Engineering Department  
780-791-4955  
Powerprocess@keyano.ca

### Tutoring Hours

Please contact the Power Engineering office at 780-791-4955 for an appointment. Tutoring takes place Tuesday evenings.

### Required Resources

(Available at Keyano College Bookstore)

Power Engineering Fourth Class (Textbook), Part A PanGlobal, Edition 3.5, ISBN 978-1-77251-071-3

Academic Supplement, PanGlobal, Edition 2.0, ISBN 978-1-77251-073-7

2018 ASME Boiler & Pressure Vessel Code Volume 1, Academic Abstract 2018 Edition, ISBN 978-177251108-6

### Recommended Resources

(Available at Keyano College Bookstore)

Power Engineering Fourth Class(Textbook), Power Engineering Fourth Class (Workbook), Part A PanGlobal, Edition 3.5, ISBN 978-1-77251-075-1

### Course Outcomes

Upon successful completion of this course, students will be able to:

- Describe lubrication principles and identify types of bearings and their lubrication requirements.
- Apply knowledge of pumps and compressors to plant operations and describe their operation and maintenance requirements.
- Identify various boiler safety devices and describe their purpose and operation.
- Apply plant operation and management principles to the safe startup, operation, and shut down of boilers and auxiliary equipment.
- Identify common tools used in energy plant maintenance and describe their safe usage.
- Explain the necessity for boiler cleaning and maintenance and describe common procedures used in cleaning and maintaining boilers.
- Describe internal and external boiler water treatment methods and testing procedures, and explain the need for boiler water treatment.
- Describe plant water treatment methods and testing procedures, and explain the need for such treatment.

### Learning Outcomes

1. Describe the importance of lubrication and the principles concerned with lubrication.
2. Describe bearing types, methods for care and maintenance of bearings, and bearing lubrication systems.
3. Describe the construction and operating principles of various types of pumps used in plants.
4. Describe the major considerations and procedures for pump operation and maintenance.
5. Describe the operating principles of the different types of compressors.
6. Describe the major considerations and general procedures for compressor operation and maintenance.
7. Explain the code requirements, design, and operation of pressure relief valves for power boilers, heating boilers, and pressure vessels.
8. Explain the design and operation of combustion safety controls on burners and boilers.
9. Describe feedwater devices and control methods used on boilers.
10. Relate the code, operation, and required fittings to the operating principles of fittings found on boilers.
11. Describe the operating and safety controls found on boilers.
12. Describe the operational procedures related to starting up auxiliary equipment in a boiler plant.
13. Describe procedures for safety starting boiler systems.
14. Describe operational procedures related to operating boilers.
15. Describe operational checks for operating boiler plants.
16. Describe generic shutdown and layup procedures for different boiler types.
17. Describe the points and readings that need to be monitored and recorded in a plant.
18. Describe the safe use of common hand tools in the powerhouse.
19. Discuss and describe the safe and proper setup of equipment for hoisting and working above ground.
20. Describe the service and maintenance required for boilers.
21. Discuss general procedures for inspections and mechanical and chemical cleaning of boilers.
22. Describe the general principle, methods and equipment used in preparing raw feedwater

- for steam production.
23. Describe the general principles, methods, and equipment used for internal boiler water treatment.
  24. Discuss the general principles, methods, and equipment used for the treatment of condensate.
  25. Discuss the general principles, methods, and equipment used for the treatment of condenser water and their effects on the cooling tower.
  26. Describe recirculating water systems, their effects, treatment, and tests.

### Evaluation

Students will be graded using percentage scales.

Category	Weight
Section "S" Test	10%
Section "S" Test	10%
"E" Exams	65%
Moodle Chapter & Unit Quizzes	15%
Total Grade	100%

The minimum standard for passing the overall course is a grade of 65%.

### Performance Requirements

The Power Engineering online program provides access to a comprehensive computer question bank designed to highlight subjects in the Alberta Boiler's Branch syllabi. Assessments are generated and marked by the Computer and Power Engineering Instructors. The online program is supplemented by tutorial assistance offered by qualified instructors during posted hours.

### Performance Requirements and Student Services

#### Student Responsibilities

It is your responsibility as a student to contact the Office of the Registrar to complete the forms for Withdrawal or Change of Registration, and any other forms. Please refer to the list of important dates as noted in the Academic Schedule in the Keyano College credit calendar. The Keyano College credit calendar also has information about Student Rights and Code of Conduct. It is the responsibility of each student to be aware of the guidelines outlined in the Student Rights and Code of Conduct Policies.

#### Student Attendance

Class attendance is useful for two reasons. First, class attendance maximizes a student's learning experience. Second, attending class is a good way to keep informed of matters relating to the administration of the course (e.g., the timing of assignments and exams). Ultimately, you are responsible for your own learning and performance in this course.

It is the responsibility of each student to be prepared for all classes. Students who miss classes are responsible for the material covered in those classes and for ensuring that they are prepared for the next class, including the completion of any assignments and notes that may be due.

### **Academic Misconduct**

Students are considered to be responsible adults and should adhere to principles of intellectual integrity. Intellectual dishonesty may take many forms, such as:

- Plagiarism or the submission of another person's work as one's own;
- The use of unauthorized aids in assignments or examinations (cheating);
- Collusion or the unauthorized collaboration with others in preparing work;
- The deliberate misrepresentation of qualifications;
- The willful distortion of results or data;
- Substitution in an examination by another person;
- Handing in the same unchanged work as submitted for another assignment; and
- Breach of confidentiality.

The consequences for academic misconduct range from a verbal reprimand to expulsion from the College. More specific descriptions and details are found in the Student Rights and Code of Conduct section of the Keyano College credit calendar. It is the responsibility of each student to be aware of the guidelines outlined in the Student Rights and Code of Conduct Policies.

In order to ensure your understanding of the concept of plagiarism, you must successfully complete the online tutorial found on [ilearn.keyano.ca](http://ilearn.keyano.ca). Then print the certificate, sign it, and show it to each of your instructors. Your course work may not be graded until you show this signed certificate.

### **Specialized Supports**

The Student Services Department is committed to Keyano students and their academic success. There are a variety of student supports available at Keyano. In the event of a continuing situation with the Covid-19 pandemic, the offered support services will be implemented through a model to respond to the restrictions in force at the time. In-person and virtual services will be offered. In the event of a continuing situation with the Covid-19 pandemic, all Alberta Health Services guidelines will be followed for in-person appointments— ex.) wear a mask, maintain two meters of physical distance, use hand sanitizer, and stay home if you are unwell.

All student services are available during Keyano business hours: Monday to Friday, 8h30-16h30. The College is closed for statutory holidays. If you require support outside of regular business hours, please inform the support service team, and we will do our best to accommodate your needs.

**Accessibility Services:** provides accommodations for students with disabilities. Students with documented disabilities, or who suspect a disability, can meet with a Learning Strategist to discuss their current learning barriers and possible accommodations. Students who have accessed accommodations in the past are encouraged to contact us to request them for the semester. Please note that requesting accommodations is a process and requires time to arrange. Contact us as soon as you know you may require accommodations. For accessibility supports and to book an appointment, please contact [accessibility.services@keyano.ca](mailto:accessibility.services@keyano.ca).

Accessibility Services also provides individual and group learning strategy instruction for all students, as well as technology training and supports to enhance learning. Meet with a Learning Strategist to learn studying and test-taking strategies for online classes. Schedule an appointment with the Assistive

Technology Specialist to explore technology tools for learning. Book an appointment today by emailing [accessibility.services@keyano.ca](mailto:accessibility.services@keyano.ca)

**Wellness Services:** offers a caring, inclusive, and respectful environment where students can access free group and individual support to meet academic and life challenges. Mental Health Coordinators offer a safe and confidential environment to seek help with personal concerns. Students may access services virtually and in-person.

Wellness Services welcomes students to participate in any of the group sessions offered throughout the academic year addressing topics including mindfulness and test anxiety.

Individual appointments can be made by emailing [wellness.services@keyano.ca](mailto:wellness.services@keyano.ca).

**Library Services:** provides students with research and information supports as they engage in their studies. Library staff are available to support you both online and in-person throughout the semester. For a detailed list of library supports and services, go to [www.keyano.ca/library](http://www.keyano.ca/library). For all inquiries, please email [askthelibrary@keyano.ca](mailto:askthelibrary@keyano.ca) or chat with us online.

Begin your research with the [Library's FIND page](#). Search for information and sources for your assignments using the OneSearch, the Library's Catalogue, or by searching in a specific database selected from the [A-Z Database List](#).

Individual support with us is available. For support with citations, research and other information needs, appointments can be booked using the online [Book A Librarian Calendar](#). For support with Moodle, educational tools for assignments, Microsoft Office, Zoom, Teams and more, book an appointment using the online [Educational Technology Support Calendar](#).

Research and subject guides are helpful resources when beginning your research, assignment, using new educational technology, or addressing other information needs. To view a subject or course-specific guide, check out the complete listing of online [Subject Guides](#).

To access additional research resources, including Citation Guides (APA, MLA, Chicago, or IEEE), go to the [Research Help Library page](#).

The Loanable Technology collection is available to support students in their learning pursuits, whether online, in person or both. Items available for borrowing include mobile projectors, webcams, noise-cancelling headphones, Chromebooks, and laptops. For an up-to-date list of technology available for borrowing as well as support available, go to the Library's [Loanable Technology webpage](#).

**Academic Success Centre:** The Academic Success Centre is a learning space in the Clearwater Campus (CC-119) at Keyano College. Students can gather to share ideas, collaborate on projects, get new perspectives on learning from our Academic Content Specialists, or use the Centre's educational resources. The Academic Success Centre provides academic support services to students registered in credit programs at Keyano College in the form of individual tutoring, writing support groups, facilitated study groups, workshops, and study space. Services are **free** to Keyano students.

Academic Content Specialists are available in the areas of Math, Science, Human Services, and English/Humanities. This covers all courses offered at Keyano. The Academic Success Coach can also be found in the Academic Success Centre.

For the most up to date information on how to book a session, please view [the Keyano Academic Success Centre homepage](#).

**Academic Integrity:** The goal of the Academic Success Centre is to foster a student's ability to learn effectively and independently. Students registered at

Keyano College are welcome to drop by the Centre to visit with any of our Academic Content Specialists to discuss their academic concerns.

**Availability:** Monday to Friday: 8:30 a.m. – 4:30 p.m. Flexible times may be available upon request. Virtual and in-person sessions, please email to get in contact with our Academic Content Specialists. For the most up to date information on how to book a session, please view the [Academic Success Centre homepage](#).

**Academic Success Coach:** offers you support and access to resources for your academic success to help you to find the Keys to your Success. The Academic Success Coach will work with you to develop an academic success plan, develop your study and time management skills, and connect you with the right resources here at Keyano. [Academic.success@keyano.ca](mailto:Academic.success@keyano.ca) is the best way to access resources during blended service delivery. The Academic Success Coach is located in the Skill Centre in CC-119 at the Clearwater Campus.

### **E-Learning**

Technology and internet will impact your online learning experience. It's important that you can watch an online video and other course materials, take online quizzes and participate in a live class with your instructor and other students. Live/virtual classes will be hosted in Microsoft Teams or Zoom.

For all course delivery types, you will access your course resources on Keyano's learning management system, **Moodle (iLearn)**. Login in using your Keyano username and password.

Keyano College operates in a Windows based environment, and having the correct tools for online learning is important. Here's a list of recommended system requirements.

### **Internet Speed**

Minimum Internet speeds of 10 Mbps.

Recommended Internet speeds of 25 Mbps (especially if you are sharing your internet at home).

Check your internet speed with [Fast.com](https://www.fast.com).

**System requirements:**

Microsoft Windows	Apple
<b>Minimum Requirements:</b> <ul style="list-style-type: none"> <li>A Windows 10 <b>computer/laptop</b> <ul style="list-style-type: none"> <li>Minimum 4GB of RAM.</li> </ul> </li> <li>10GB+ available hard drive storage.</li> <li>Enough available hard drive space to install the Microsoft Office suite (approximately 3GB). <u>Microsoft Office</u> software is free to all Keyano students and employees.</li> <li>Microphone, webcam and speakers. A headset with a microphone is recommended.</li> <li>System updates must be regularly installed.</li> <li>Anti-Virus / Anti-Malware software</li> </ul>	<b>Minimum Requirements:</b> <ul style="list-style-type: none"> <li>A Macintosh (V10.14 and above) <b>computer/laptop</b> <ul style="list-style-type: none"> <li>Minimum 4GB of RAM.</li> </ul> </li> <li>10GB+ available hard drive storage.</li> <li>Enough available hard drive space to install the Microsoft Office suite (approximately 3GB). <u>Microsoft Office</u> software is free to all Keyano students and employees.</li> <li>Microphone, webcam and speakers. A headset with a microphone is recommended.</li> <li>System updates must be regularly installed.</li> <li>Anti-Virus / Anti-Malware software.</li> </ul>
<b>Recommended Requirements</b> <ul style="list-style-type: none"> <li>8GB of RAM</li> <li>A method of backing up/synchronizing to local or cloud-based storage such as OneDrive is highly recommended. This is included if you complete the setup of KeyanoMail and download MS Office using your Keyano email for free.</li> </ul>	<b>Recommended Requirements</b> <ul style="list-style-type: none"> <li>8GB of RAM</li> <li>A method of backing up/synchronizing to local or cloud-based storage such as OneDrive is highly recommended. This is included if you complete the setup of KeyanoMail and download MS Office using your Keyano email for free.</li> </ul>
<p>Chromebooks are <b>not</b> recommended as they are not compatible with testing lockdown browsers.</p> <p>A Microsoft Surface or iPad or iPad Pro may be possible alternatives in some program areas.</p>	

**Specific Department Requirements:**

Business and OA programs require Windows 10.  
Other programs may utilize Windows based tools as well.

**Computer Software**

Students will be able to get access to Microsoft Office 365 for free using Keyano credentials by [clicking here](#).

**Recording of Lectures and Intellectual Property**

Students may only record a lecture if explicit permission is provided by the instructor or by Accessibility Services. Even if students have permission to record a lecture or lecture materials, students may not share, distribute, or publish any of the lectures or course materials, this includes any recordings, slides, instructor notes, etc. on any platform. Thus no student is allowed to share, distribute, publish or sell course related content (instructor, or students) without permission. It is important to recognize that the Canadian Copyright Act contains provisions for intellectual property.

The [Academic Integrity Policy](#) provides additional information on Keyano College's expectations from students as members of the intellectual community.

**ITS Helpdesk**

If you are having issues with your student account, you can contact the ITS Helpdesk by emailing [its.helpdesk@keyano.ca](mailto:its.helpdesk@keyano.ca) or calling 780-791-4965.



Authorization

This course outline has been reviewed and approved by the Program Chair.

\_\_\_\_\_  
[First Name, Last Name], Instructor

Indika Arachchi

\_\_\_\_\_  
[First Name, Last Name], Chair

Date Authorized

Darren Stacey

\_\_\_\_\_  
[First Name, Last Name], Dean

Date Authorized

Signed copies to be delivered to:

- Instructor
- Registrar's Office