EN 344

Water Treatment

2 Credits

Instructor: Russ Webb
780 871 5484
Original Developer: Doug Stelmack
Current Developer: Russ Webb
Reviewer: Robert Collins
Created: 13/04/2017
Revised: 08/05/2020
Approval: 15/05/2020
Alternate Delivery: No

The Implementation Date for this Outline is 01/01/2021

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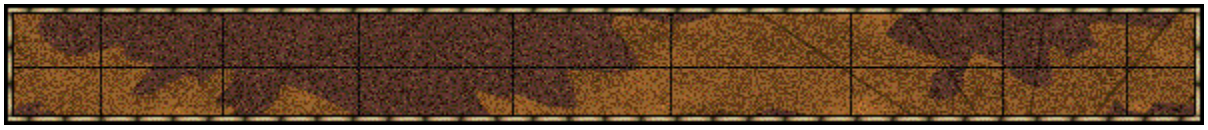
2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400
Toll-free in Canada: 1 800 661 6490

EN 344 Version: 4



Water Treatment

Calendar Description

This course deals with advanced topics in power house water treatment which includes external and internal boiler water, cooling water, industrial waste and potable water treatment. Modern water analysis and equipment are also introduced.

Rationale

This course has been developed to fill the gap of Second Class Power Engineers created by the generation of retiring power engineers.

Industry has shifted their focus from employing the lower level of certification of power engineers to the higher level of certification.

Upon successful completion of this program the student is eligible for a 9 month reduction in qualifying time granted by ABSA.

The six parts of the program are divided into 15 courses where the student has the option of registering for individual courses, Part A, Part B, or both Part A and Part B.

Prerequisites

EN 310, EN 320, EN 410, EN 420, or Third Class Power Engineer's Certificate of Competency

Co-Requisites

None

Course Learning Outcomes

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

1. describe the sources of the impurities found in raw water.
2. describe the effect of the listed water impurities on power plant equipment and processes.
3. explain the significance and importance of standard methods of water analysis.

4. describe which analyses are appropriate at given sampling points including the significance of the sampling point locations.
5. interpret the results of a comprehensive standardized water analysis including the relationship of the various parameters.
6. explain the purposes and principles of testing instruments, including embrittlement detector, total solids meter, and pH meter.
7. explain the purpose of steam purity measurement and process of steam sampling.
8. explain the purpose, equipment, operation, and limitations of sedimentation.
9. explain the purpose, equipment, operation, and limitations of coagulation and flocculation.
10. explain the purpose, equipment, operation and limitations of filtration.
11. explain the purpose, principles, equipment, operation, and limitations of microfiltration.
12. describe how oil is removed from water.
13. explain the purpose, equipment, operation, and limitations of mechanical deaeration.
14. explain the purpose, equipment, operation, and limitations of evaporation.
15. explain the purpose, equipment and operation of lime-soda softening.
16. explain the purpose, equipment, operation, and limitations of hot process phosphate softening.
17. explain the purpose, equipment, operation, and limitations of sodium zeolite softening.
18. explain the purpose, equipment, and operation of hydrogen zeolite softening.
19. describe how silica is removed from water.
20. explain the purpose, equipment, and operation of demineralization, including condensate polishing.
21. explain the purpose, equipment, and operation of electrodialysis (ED) and electrodeionization (EDI).
22. explain the purpose, equipment, and operation of reverse osmosis (RO).
23. discuss the causes, effects, and control of scale.
24. explain the causes, effects, and control of foam in boiler water.
25. discuss the causes, effects, and control of caustic embrittlement.
26. discuss the causes, effects, and control of return line corrosion.
27. discuss the use of chelating agents in boiler water.
28. discuss the use of sludge conditioning in boiler water.
29. discuss the use of pH control in boiler water.
30. discuss the use of chemical deaeration in boiler water.
31. explain the causes, effects, and control of carryover of boiler water.
32. discuss the use of blowdown from boiler water.
33. explain the use and control of chemical feed systems for boiler water.
34. discuss the control of silica to avoid turbine blade deposits.
35. list the water impurities of concern in a cooling water system and the effects caused by each one.
36. describe control methods for a cooling water system for control of corrosion, fouling, and microbiological attack including chloride corrosion and delignification.
37. describe the potential effects of wastewater discharge.
38. compare and contrast mechanical, chemical, and biological methods of wastewater treatment including the advantages and disadvantages of each.

39. specify an appropriate method of wastewater treatment for a particular case study.
40. describe the methods used for potable water treatment and analysis.

Resource Materials

Required Text:

This is material that the student is required to have.

Power Engineering Second Class *A-3 Boilers and Water Treatment* , Edition 2.5 or Edition 2.0.

Calgary, AB: PanGlobal Training Systems Ltd.

Reference Text:

This is material that can be used to supplement the instruction but is not required to complete the course. It can be purchased online or borrowed from the college library.

Flynn, Daniel. J. (Ed). (2018). *The NALCO water handbook* (4th ed.). New York, NY:

McGraw-Hill Education.

NOTE: Additional resource material is provided or accessed through D2L.

Conduct of Course

This course follows the syllabus as set out by the Standardization of Power Engineer's Examination Committee (SOPEEC) and the curriculum recommended by the Interprovincial Power Engineer Curriculum Committee (IPECC).

This course builds on the student knowledge gained through the Fourth Class and Third Class courses.

This course is delivered in a blended format through the D2L online platform. Lectures are pre-recorded videos. Where applicable, video clips are used to support the instruction. In-class sessions are used to reinforce the lessons taught online.

Each topic has online assessments in the form of quizzes, hand-in assignments and a series of online Unit Tests. A closed book Final Exam is administered at the end of the course.

Evaluation Procedures

Lakeland College is committed to the highest academic standards. Students are expected to be familiar with Lakeland College policies related to academic conduct and academic honesty and to abide by these policies.

The marking scheme for this course is:

Chapter Assignments	35%
Unit Tests	35%
Final Exam	30%
Total	100%

The contents and dates of these assessments will be detailed in the course syllabus.

Marks are deducted for late assignments and quizzes. A grade of zero is assigned to missed tests and exams.

A minimum grade of 65% is required to pass this course.

The final exam for this course shall be part of a combined 2A3 final exam for the semester. Water Treatment accounts for 40% of the grade for the combined Final Exam.

A minimum grade of 50% is required on the Final Exam to pass this course.

Students seeking a qualifying time reduction from ABSA must obtain a passing grade for each course in this program, and must satisfy the 80% attendance requirement.

Students may receive a certificate from Lakeland College without the attendance requirement, but they will not qualify for steam time reduction.

Grade Equivalents and Course Pass Requirements

A minimum grade of C+ (65%) is required to pass this course.

Letter	F	C+	B-	B	B+	A-	A	A+
Percent Range	0-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Attendance

As a blended delivery course, attendance will consist of the completion of all the online components. This will include viewing the recorded lessons and completing the assignments and tests.

In order to be successful in this course, the student should complete all the online components, but in order to obtain qualifying time reduction through ABSA, the student must complete a minimum of 80% of all the online components.

In-class sessions are used to reinforce the concepts taught in the online portion of the course. Attendance for these sessions is recommended, but not part of the attendance requirement for qualifying time reduction.

Course Units/Topics

Water Chemistry and Analysis

(Discuss the significance of common water impurities and the application of water analysis)

Water Pre-Treatment-1

(Describe water pre-treatment processes for removal of oil, gases, and suspended solids)

Water Pre-Treatment-2

(Describe water pre-treatment processes for ion removal)

Internal Water Treatment

(Describe boiler internal water treatment processes)

Non-boiler Water Treatment

(Discuss water treatment applications for cooling water, wastewater, and potable water)

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