Second Class (Edition 2.5) Part B1

Course Outline with Outcomes

These learning materials were designed to directly address the SOPEEC 2015 Canadian syllabus for 2nd Class Power Engineering Certification.

Content

3. Steam Turbine Operation and Maintenance

Learning Outcome

Discuss procedures for operation and maintenance of a large steam turbine.

Learning Objectives

1. Describe the detailed hot and cold start-up procedures for a large steam turbine, including safety precautions.
2. Describe the detailed shutdown procedure for a large steam turbine including safety precautions.
3. Explain what checks are performed on a large steam turbine during normal operation.
4. Sketch the flow of steam and condensate through a condensing steam turbine and a non-condensing steam turbine.
5. Explain the preventive maintenance requirements for a large steam turbine. Include shaft alignment, bearings, clearances for thrust, blades, shaft seals, correction of blade fouling, erosion and cleaning.
6. Describe the purpose of and procedure for static and dynamic balancing.

4. Steam Condensers

Learning Outcome

Discuss condenser principles, performance, operation and auxiliaries.

Learning Objectives

1. Describe the principles and design of jet, air cooled, and surface condensers.
2. Describe the purpose, principle and design of surface condenser support and expansion systems.
3. Explain the significant parameters in condenser performance.
4. Calculate condenser thermal efficiency from the test data.
5. Explain the procedures used to troubleshoot condenser performance.
6. Explain the procedures used to backwash and clean a condenser.
7. Describe the purpose, principle and design of air ejectors and vacuum pumps.
8. Describe the purpose and flow of cooling water systems.
9. Describe the purpose, principle and design of cooling water intake screens, circulating pumps, cooling towers, and cooling ponds.
10. Describe the purpose, principle and design of condenser atmospheric exhaust (relief) valves.
11. Describe the purpose, principle and design of condensate pumps.

5. Internal Combustion Engines - Components and Auxiliaries

Learning Outcome

Explain the design, selection, and components of internal combustion engine installations, including auxiliaries.

Learning Objectives

1. Explain design, applications, and selection criteria for the different types of reciprocating internal combustion engines.
2. Explain fuels and combustion processes and fuels used by internal combustion engines.
3. Describe the design of internal combustion engine scavenging and supercharging arrangements.
4. Describe the design and components of internal combustion engine fuel conditioning systems, injection systems, and ignition systems.
5. Describe the design and components of internal combustion engine cooling systems and cooling water conditioning systems.
6. Describe the purpose, design and components of internal combustion engine lubricating oil systems.
7. State the purpose and describe the control of a typical internal combustion engine including the operation of safety devices.

6. Internal Combustion Engines - Operation and Maintenance

Learning Outcome

Describe general maintenance requirements, and detailed operating and troubleshooting procedures for internal combustion engines.

Learning Objectives

1. Describe the detailed startup procedures for an internal combustion engine.
2. Describe the detailed shutdown procedures for an internal combustion engine.
3. Explain the routine maintenance and monitoring requirements for an internal combustion engine.
4. Explain the major maintenance and overhaul requirements for an internal combustion engine.
5. Explain the troubleshooting of combustion and engine problems.

7. Gas Turbine Design and Auxiliaries

Learning Outcome

Explain the design and components of a large gas turbine and related auxiliaries.

Learning Objectives

1. Explain applications and selection criteria for the different types of gas turbine engines.
2. Describe the principles and design of open and closed cycle gas turbine systems.
3. Describe the principles and design of combined cycle and cogeneration systems using gas turbines.
4. Describe the principles and design of gas turbine regeneration, intercooling, and reheating.
5. Describe the principles and design of gas turbine shaft arrangements.
6. Describe the design and components of gas turbine compressors, combustors (combustion chambers) and turbines.
7. Describe the design and operation of gas turbine air intake and exhaust systems.
8. Describe the design and operation of a gas turbine lubricating oil system.
9. Describe the design and operation of a gas turbine fuel system.
10. Describe the design and operation of a gas turbine steam or water injection system and a dry low NO_x system.

8. Gas Turbine Operation and Control

Learning Outcome

Discuss operating procedures, and control and monitoring components of a large gas turbine.

Learning Objectives

1. Describe the components and operation of gas turbine supervisory and control systems.
2. Describe the principles and design of gas turbine protection devices.
3. Describe the detailed hot and cold startup procedures for a gas turbine, including safety precautions.
4. Describe the detailed shutdown procedure for a gas turbine, including safety precautions.
5. Explain the routine maintenance and monitoring requirements for a gas turbine.
6. Describe the major maintenance and overhaul requirements for a gas turbine.
7. Explain the troubleshooting of gas turbine problems.

9. Lubrication

Learning Outcome

Explain the components of a lubrication application and maintenance program.

Learning Objectives

1. Describe the methods of manufacture and the different classifications of lubricants.
2. Describe the significance and measurement of lubricating oil characteristics, including viscosity, relative density, API (American Petroleum Institute) gravity, pour point, and dielectric strength.
3. Explain the typical causes of lubricating oil deterioration.
4. Describe the types of lubrication additives.
5. Describe a typical power plant lubrication program, including a lubrication survey.
6. Explain the different types of lubricating/governing/seal oil systems.
7. Describe the components and operation of a typical lubricating oil purification system.
8. Describe the various applications of ball-and-roller bearings and their lubrication, including bearing seals.

10. Piping

Learning Outcome

Explain piping system design, inspection, and maintenance.

Learning Objectives

1. Explain selection criteria for piping materials.
2. Calculate the required thickness and the internal design pressure of piping.
3. Describe typical inspection procedures for piping installations and repairs.
4. Describe a typical routine inspection procedure and schedule for high-energy piping.
5. Explain the effects of high temperature on piping strength.
6. Describe the design and installation criteria for a piping system layout.
7. Explain the theory and effects of water hammer.

11. Mechanical Drawing

Learning Outcome

Interpret construction and process drawings.

Learning Objectives

1. Interpret the information provided in orthographic, isometric, and oblique projections.
2. Interpret the information provided in construction drawings with sectioning and dimensioning.
3. Interpret the information provided in Process Flow Diagrams.
4. Interpret the information provided in Piping and Instrumentation Diagrams (P&IDs).
5. Explain the use of isometric piping system and spool drawings in piping systems.