

2502/305
POWER PRODUCTION
SYSTEMS
June/July 2020
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN MECHANICAL ENGINEERING
(PLANT OPTION)

MODULE III

POWER PRODUCTION SYSTEMS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Drawing instruments;

Electronic calculator;

Tables of Thermodynamic and Transport Properties of Fluids by Rodgers and Mayhew.

Answer FIVE questions out of the following SEVEN questions in the answer booklet provided.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 3 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

- ✓ 1. (a) (i) List **three** objectives of carrying out boiler blown downs. (6 marks)
- (ii) State **six** safety precautions observed when performing boiler blow down. (6 marks)
- (b) Outline **three** boiler defects stating two causes of each. (6 marks)
- (c) List **four** requirements of a flash steam recovery unit. (4 marks)
- (d) With the aid of a diagram, describe a flash steam recovery process. (4 marks)
- ✓ 2. (a) List **three** benefits for boiler water treatment. (3 marks)
- (b) Outline **four** impurities found in raw boiler water stating one effect of each. (6 marks)
- (c) Describe **three** boiler maintenance checks for each of the following conditions:
- (i) running; (6 marks)
- (ii) shut down. (5 marks)
- (d) With the aid of a diagram, describe the operation of a parallel flow steam condenser. (4 marks)
- ✓ 3. (a) State **four** requirements of steam traps. (4 marks)
- 20 (b) Outline **four** heat losses in a steam plant. (4 marks)
- (c) Outline **four** maintenance checks on a steam distribution system. (4 marks)
- (d) (i) Outline **three** functions of an oil burner. (8 marks)
- (ii) With the aid of a diagram, describe the operation of a rotary cup oil burner. (4 marks)
4. (a) List **four** factors considered in selecting grate stokers for boilers. (8 marks)
- 8 (b) With the aid of diagrams, explain the following operating principles of stokers:
- (i) overfeed; (8 marks)
- (ii) underfeed. (8 marks)

(c) A coal fired boiler plant consumes 400 kg of coal per hour. The boiler evaporates 3,200 kg of water at 44.5° C into superheated steams at a pressure of 12 bar and 274.5° C. If the calorific value of the fuel is 31,760 kJ/kg, determine:

- (i) equivalent evaporation from and at 100° C;
- (ii) thermal efficiency of the boiler.

Take: Specific heat capacity of steam as 2.1 kJ/kgK.

(8 marks)

✓ 5.

(a) (i) State **three** sources of radioactive air contamination in a nuclear power plant.

(ii) List **four** safety measures for a nuclear power plant.

(7 marks)

(b) Outline **four** factors to consider when selecting a site for nuclear power plant.

(4 marks)

(c) With the aid of a diagram, describe the operation of a nuclear power plant heat exchanger used in sodium graphite reactor.

(5 marks)

(d) Outline **four** benefits of energy monitoring and targeting.

(4 marks)

6.

4

(a) (i) Outline the operational difference between impulse and reaction turbines.

(ii) With the aid of a diagram, describe the construction and operation of a pelton wheel turbine.

(8 marks)

(b) Outline **four** factors to consider in selecting a water turbine.

(4 marks)

(c) Explain **two** methods of controlling gaseous pollutants in a power plant.

(4 marks)

(d) Describe the following pollution control units:

(i) electrostatic precipitator;

(ii) fabric filter.

(4 marks)

✓ 7.

10

(a) Outline **four** boiler accessories plant.

(6 marks)

(b) Outline **three** types of steam plants.

(4 $\frac{1}{2}$ marks)

(c) With the aid of a diagram, describe the **four** circuits of a steam plant.

(9 $\frac{1}{2}$ marks)

THIS IS THE LAST PRINTED PAGE.

2502/305

June/July 2020

