



1933

# Power Producing Plants (4th Year): Technical School Examinations 1933

Department of Education: Technical Instruction Branch

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# COURSE IN ELECTRICAL ENGINEERING.

(56)

AN ROINN OIDEACHAIS  
(Department of Education).

BRAINSE AN CHEARD-OIDEACHAIS  
(Technical Instruction Branch).

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TECHNICAL SCHOOL EXAMINATIONS.

1933.

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## POWER-PRODUCING PLANTS. (Fourth Year.)

*Tuesday, May 23rd—6.15 to 8.15 p.m.*

*Examiner—R. G. ALLEN, ESQ., B.SC., A.R.C.S.C.I., M.I.E.E.*

*Co-Examiner—PEADAR A. MACCIONNAITH, M.SC., A.C.S.C.I.*

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### GENERAL INSTRUCTIONS.

You are carefully to enter on the Answer Book and Envelope supplied your Examination Number and the subject of examination, but you are not to write your name on either. No credit will be given for any Answer Book upon which your name is written, or upon which your Examination Number is not written.

You must not have with you any book, notes, or scribbling paper.

You are not allowed to write or make any marks upon your paper of questions.

You must not, under any circumstances whatever, speak to or communicate with another candidate; and no explanation of the subject of the examination may be asked for or given.

You must remain seated until your answer-book has been taken up, and then leave the examination-room quietly. You will not be permitted to leave before the expiration of twenty minutes from the beginning of the examination, and will not be re-admitted after having once left the room.

If you break any of these rules, or use any unfair means, you are liable to be dismissed from the examination, and your examination may be cancelled by the Department.

*Two hours are allowed for this paper. Answer-books, unless previously given up, will be collected at 8.15 p.m.*

## INSTRUCTIONS.

Read the General Instructions on page 1.

- (a) Not more than five questions are to be attempted.
- (b) Equal values are attached to the question.
- (c) Answers must be written in *ink*; diagrams may be made in *pencil*.
- (d) Write the number of the question distinctly, in the margin of your paper, before the answer.

1. In a test for the gross calorific value of a sample of oil the following data was obtained:—

Weight of oil burned	...	3.9 grams.
Quantity of water heated	... ..	1860 grams.
Initial temperature of the water		10°C.
Final temperature of the water		32°C.

Estimate the calorific value per pound of oil in British Thermal Units. Describe this test with the aid of a sketch.

2. Sketch a representative section through a modern type of steam boiler. Name the parts and describe their functions. Also explain, giving a sketch, a method of measuring the quantity of water supplied to the boiler.

3. Describe with the aid of a sketch the functions of superheaters and economisers as used in a boiler plant. Two power stations have identical machinery and boiler plant and supply identical loads. The steam consumption of one is 14 lbs. of steam per kilowatt-hour while that of the other is only 12 lbs. Give reasons which would account for this difference.

4. Explain the function of a flywheel when used in a reciprocating single cylinder engine. A flywheel on the shaft of a variable speed motor has a kinetic energy of  $9 \times 10^5$  foot pounds when its speed is 300 R.P.M. and on account of a large increase of load on the shaft the speed drops to 100 R.P.M. in 1.5 seconds. Assuming that one

joule is equal to 0.737 foot pounds estimate the power in kilowatts given out by the flywheel to the load during the fall of speed.

5. A triple expansion steam engine driving an alternator develops equal power in each cylinder. The mean indicated pressure in the low pressure cylinder is 12 lbs. per sq. in., its piston area is 600 sq. ins., the stroke 2 feet, and the engine speed 200 R.P.M. Estimate the B.H.P. of the engine, assuming the ratio of the B.H.P. to the I.H.P. to be 0.76. Also estimate the annual consumption of coal in tons assuming that 1.2 lbs of coal are used per B.H.P. hour and the engine runs 18 out of each 24 hours.

6. Name two types of steam turbines and give a free-hand sectional longitudinal elevation through one of them. Also describe the passage of steam through the turbine and explain how it gives up its energy to the blading.

7. State the essential features of two types of gas producing plant for supplying gas engines and describe with the aid of sketches the operation of one of them.

8. State the different electrical methods of ignition used in gas and oil engines and describe with the aid of a circuit diagram the operation of one of them.

9. If the efficiency of a water turbine, including pipe losses, is 80 per cent. show that a flow of water of one cubic foot per second will give approximately 9 B.H.P. per 100 feet of fall. Also describe the construction and operation of one type of speed governor suitable for a water turbine. (One cubic foot of water weighs 62.3 lbs.)

10. Explain with the aid of sketches *either* (a) the essential features of a screw-cutting lathe and describe in detail the process of cutting the thread for a three-quarter inch bolt, *or* (b) a method of winding a six pole D.C. armature core which has 120 slots; the armature to be lap wound with one turn per coil and four coil-sides per slot. A partial view of the winding, core, brushes and commutator should be shown.