1933

Mathematics, Mechanics and Drawing (1st Year): Technical School Examinations 1933

Department of Education: Technical Instruction Branch

SECTION C.

11. A, B, and C are the positions reckoned clockwise of three points on a circularly laid electric main, the respective straight distances between A and B, B and C, and C and A, being 400, 600, and 500 yards. Draw to scale the main and find M, the position of the centre of the triangle ABC. Estimate the shortest and also the longest direct distance of M from the main.

COURSE IN ELECTRICAL ENGINEERING.

(50)

AN ROINN OIDEACHAIS.
(Department of Education.)

BRAINSE AN CHEÀRD-OIDEACHAIS.
(Technical Instruction Branch.)

TECHNICAL SCHOOL EXAMINATIONS.
1933.

MATHEMATICS, MECHANICS AND DRAWING.
(First Year.)

Friday, May 19th—7 to 10 p.m.

Examiner—R. G. ALLEN, ESQ., B.SC., A.R.C.SC.I., M.I.E.E.
Co-Examiner—PEADAR A. MACCIONNAITH, M.SC., A.C.SC.I

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.

Three hours are allowed for this paper. Answer-books, unless previously given up, will be collected at 10 p.m.

INSTRUCTIONS.

Read the General Instructions on page 1.

(*a*) The working of the questions and the answers must be in *ink*.

(*b*) Diagrams and drawings must be made in *pencil*.

(*c*) Full credit cannot be obtained for any question unless all the calculations are shown clearly, and construction-lines definitely indicated.

Where calculations are made with the aid of the slide-rule a note should be made in the margin, thus—(S.R.).

(*d*) *Seven* questions only may be attempted, Question 11 and *six* others, of which not more than *four* may be taken from Section A, and *two* from Section B. Equal values are assigned to the questions.

(*e*) Write the number of the question before the answer.

NOTE.—You are expected to make neat and correct diagrams of reasonable size. You may use a slide-rule and drawing instruments.

SECTION A.

(*Not more than four of the seven questions you may attempt should be taken from this section.*)

1. Find the value of R from the formula:

$$R^2=P^2+Q^2+2PQ \cos A,$$

when P=2·8, Q=3·4, and A=30 degrees.

2. The weight of an iron cylinder is 24 kilograms, its length 22 cms., and density 7·8 grams per cubic centimetre. Estimate the area and perimeter of its cross-section.

3. An equilateral triangle has a side-length of 14 inches. Find, by calculation, the distance of the centre of the triangle from one of its corners. Also find the area of the triangle in square centimetres.

4. The power in watts supplied to a load is measured by the voltmeter-ammeter method. The indication of the voltmeter, which has an error of 5 per cent. too high, is 206 volts. Estimate the correct value of the power supposing that the indication of the ammeter is 24 amperes and its error is 4 per cent. too low.

5. In a house, 8 electric lamps each rated at 120 watts are used on an average for 4 hours per night, and domestic appliances which require 3 kilowatts are used on an average of 1·25 hours per day throughout the year. Estimate the annual cost of the electric energy, the price of the kilowatt-hour being 5 pence for lighting and 0·75 pence for domestic purposes.

6. A wattmeter indicates,

$$80 \cos (A+30^\circ) \text{ watts.}$$

Find the readings on the wattmeter for A=0, 15, 30, 45 and 60 degrees. Also graph these readings against values of A, and state for what value of A the reading will be 80 watts.

SECTION B.

(*Not more than two of the seven questions you may attempt should be taken from this section.*)

7. The pull of an electromagnet is expressed as $\frac{B^2}{8\pi} A$ dynes. Find what value of A is necessary in order that the pull may be one ton when B=18,000. One pound weight may be taken as equal to 445,000 dynes.

8. A weight of 120 pounds is suspended from C, the middle point of a length of rope, attached to two supports, A and B, which are on the same horizontal level. Find the tension on the rope (*a*) when the angle ACB is 60 degrees, (*b*) when the rope is shortened so that the angle ACB becomes 120 degrees.

9. State what is meant by the *Polygon of forces*. Horizontal wires A, B, C and D exert the respective pulls of 20, 40, 30 and 50 lbs. weight upon the top of a steel mast. Assuming these forces act at a common point O and the angles AOB, BOC and COD reckoned clockwise are respectively 45, 60, and 30 degrees find the resultant pull on the mast and the angle its direction makes with OA.

10. A horizontal straight lever has a fulcrum at F. On the left side of F downward vertical forces act on the lever at points A, B, and C and have the respective values of 10, 8, and 12 lbs. FA, FB, and FC are respectively 5, 8, and 12 inches. The lever is kept horizontal by a force acting in a vertical plane at a point on the lever 8 inches from F. Find the value of this force supposing its direction is inclined 60 degrees to the length of the lever.