1933

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

Department of Education: Technical Instruction Branch

Follow this and additional works at: https://arrow.tudublin.ie/techexam

Part of the Education Commons

Recommended Citation

This work is licensed under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 License
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.
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 \( P = 2 \), \( Q = 3 \), and \( A = 30 \) degrees.

2. The weight of an iron cylinder is 24 kilogramms, its length 22 cm., 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,
   \[ 80 \cos (A + 30^\circ) \] 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 \( \angle AOB \), \( \angle BOC \) and \( \angle COD \) 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.