Technical Schools:Examination Papers   City of Dublin Technical Schools

1934

Mathematics, Mechanics and Technical Drawing (2nd Year): Technical School Examinations 1934

Department of Education: Technical Instruction Branch

Recommended Citation

Department of Education: Technical Instruction Branch, "Mathematics, Mechanics and Technical Drawing (2nd Year): Technical School Examinations 1934" (1934). *Technical Schools:Examination Papers*. 120.
https://arrow.tudublin.ie/techexam/120

COURSE IN ELECTRICAL ENGINEERING.

AN ROINN OIDEACHAIS.
(Department of Education.)

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

TECHNICAL SCHOOL EXAMINATIONS.
1934.

MATHEMATICS, MECHANICS AND TECHNICAL DRAWING.

(Second Year.)

Friday, May 25th—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, except the book of logarithms supplied to you.

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, of which not more than *three* may be selected from Section A, *two* from Section B, and *two* from Section C. *Question No.* 11 must be one of the questions attempted. 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. Books of logarithmic and, trigonometrical tables (four places) are provided. You may use a slide-rule and drawing instruments.

SECTION A·

(*Not more than three of the seven questions to be attempted should be taken from this section*).

1. Supposing $L = \dfrac{1\cdot 48}{10^3} \log \dfrac{a}{r}$, and $C = \dfrac{0\cdot 0194}{10^6 \log \dfrac{a}{r}}$, find the values of L, C, and $\dfrac{1}{\sqrt{LC}}$, when $a = 320$ and $r = 0\cdot 84$.

2. The candle power of a lamp within certain limits is proportional to E^x, and its value is 150 when E is 220. Estimate its candle power when E is 206 supposing the value of x is $4\cdot 26$.

3. A coil of closely packed enamel-coated wire is to be wound on an iron cylinder 6 inches in diameter. Estimate the length in metres of wire needed (*a*) for a single layer coil, and (*b*) for a seven layer coil, the total turns in each case being 700, and the diameter of the wire $0\cdot 08$ inch.

4. A cylinder of volume 6,800 cubic inches is required to have a diameter 4·5 times its axial length. Estimate what its length and diameter should be.

5. Express $(at + b)$ in degrees, a being 314 radians per second, t 0·0014 second, and b 0·34 radian. Also graph $P = 20 \cos (\theta + 30°)$ watts for the range of angles $\theta = 0$, 15, 30, 45, 60, 75 and 90 degrees.

6. Find the value of the expression,

$$\frac{2.5}{\cos \theta} - \tan \theta$$

for each of the following values of θ ; 0, 5, 10, 15, 30, 45, and 60 degrees. Graph the results and from it find the minimum value of the expression.

SECTION B.

(Not more than two of the seven questions to be attempted should be taken from this section.)

7. A tank is fitted at the top with a short vertical tube containing a loaded water-tight piston of diameter 24 inches. A vertical pipe of diameter 3 inches, and length 120 feet is also fitted into the top of the tank. The tank and the full length of the pipe are then filled with water. Find the weight of the loaded piston that will just keep it balanced at the level of the top of the tank. Friction may be neglected, and the weight of a cubic foot of water taken as 62·5 pounds.

8. A force P poundals acts upon a body in a straight direction for t seconds. If the body starts from rest, and as a result of the force attains a velocity v feet per second, show that $Pt = Mv$, M being the mass of the body in pounds. Also find the angular acceleration of a point on a rotating disc which uniformly changes its speed from 360 to 120 R.P. M. in 6 seconds.

9. Explain the terms Kinetic Energy and Potential Energy. Give three illustrations in which one form of energy is converted into another form of energy. A fly wheel has 63×10^6 foot pounds of stored energy at speed 360 R.P.M. If its speed drops to 240 R.P.M. in 2·5 seconds find how much power in watts the fly wheel gives to the shaft through this fall in speed.

SECTION C.

10. Draw a *free-hand* sketch of *either*,—(*a*) an end view of a six pole interpole direct current machine, showing the positions of the armature, commutator, brushes, and magnet poles. Polarities, and direction of rotation should be indicated.
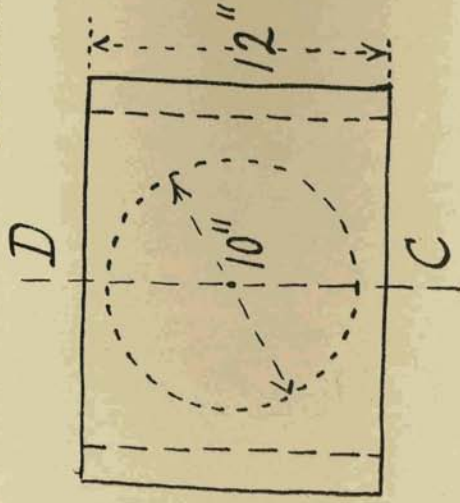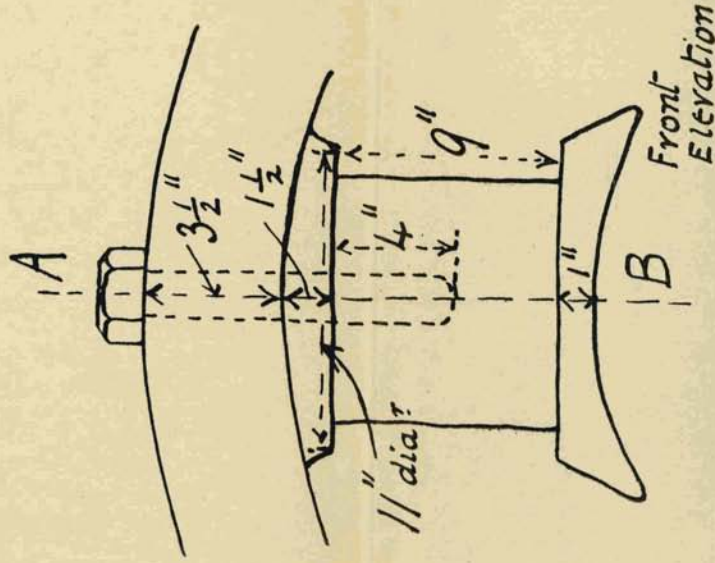
Or,

(*b*) A line diagram of a battery charging set including in detail some type of automatic cut-out suitable for the set.

11. The *free-hand* dimensioned sketch on the accompanying sheet represents one of the main pole cores and its attachment to the magnet yoke of a direct current machine. Construct a scale drawing of a cross sectional view through a plane containing the lines AB and CD.
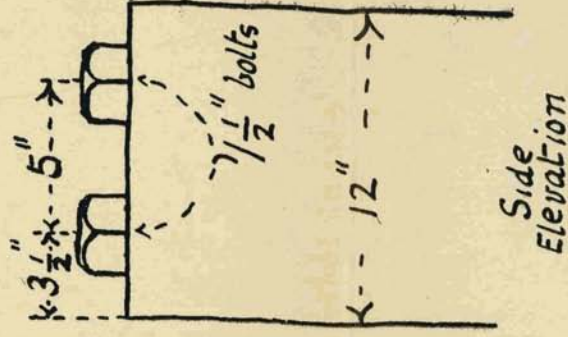
Mathematics, Mechanics & Technical Drawing.

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Ques 11

Side Elevation

$3\frac{1}{2}"$ $5"$

$7\frac{1}{2}"$ bolts

$12"$

Front Elevation

A

$3\frac{1}{2}"$

$1\frac{1}{2}"$

$9"$

$4"$

$1"$

B

$1"$ dia?

D

$10"$

C

$12"$

View from the bottom end of the magnet pole