1934

Mathematics and Drawing of Electrical Design (3rd Year): Technical School Examinations 1934

Department of Education: Technical Instruction Branch

COURSE IN ELECTRICAL ENGINEERING.

AN ROINN OIDEACHAIS.
(Department of Education.)

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

TECHNICAL SCHOOL EXAMINATIONS.
1934.

MATHEMATICS AND DRAWING OF ELECTRICAL DESIGN.

(Third Year.)

Thursday, May 17th—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*) *Six* questions only may be attempted, of which not more than *four* may be taken from Section A. 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 four of the six questions you may attempt should be taken from this section*)

1. Estimate the value of :

$$ax^2+bx+c.$$

when $x=5$, and

$$\begin{aligned} 3a+2b+\ c&=24,\\ 7a+4b-6c&=\ 8,\\ 5a-4b+5c&=25. \end{aligned}$$

2. Two current vectors OA and OB, with the latter leading in phase act outwardly from a point O in a vector diagram and the phase angle AOB is 22 degrees. If OA=30 and OB=50 amperes, estimate by *calculation* the resultant current and its phase angle with respect to OA.

3. Estimate the value of kB^x when B=7,200 ; its values being 6,250 and 11,600 respectively for B=6,000 and 8,000.

4. The current i in a circuit is given by :

$$\frac{20}{e^{mt}}-20\cos at$$

in which $a=10$ radians per second and $m=4$. Calculate the values of i for $t=0$, 0·1, 0·2, 0·3, 0·4 and 0·5 second, and then graph i against t.

5. The annual expense Y of a cable is :

$$320+\frac{144}{a}+2500a \text{ pounds.}$$

Find for what value of a the differentiation of Y with respect to a will be zero. Show also that the annual expense for this value of a is a minimum.

6. Prove that the differentiation of $a \tan bx$ with respect to x is equal to : $\dfrac{ab}{\cos^2 bx}$,

a and b being constants.

7. Explain why a constant term has to be added to the integration of a function. Integrate 8 $(\cos^2 x)\ d\ x$.

8. The reactance of a transformer is given by :

$$A+\frac{B}{b^2}\int_0^b x^3\ dx.$$

Estimate its value for A=3·2,B=2·1, and b=1·5.

Section B.

9. Draw *free hand* sketches of *either* : (*a*) two views of a large armature spider, indicating how it supports the iron laminations of the core ;

Or,

(*b*) A diagram of a starter for a direct current series wound motor showing the connections, and the no-load volt and over-load protective devices.

10. Design and draw to scale *one* of the following :—

(*a*) A mid cross sectional view of one of the magnet poles of a direct current series wound motor, showing its winding and the attachment of the pole to the yoke. Data given : Flux per pole, 3·6 megalines, cross section of the yoke 2×10 inches, pole core length, 6 inches, 10 turns per pole, and full load input current 100 amperes. The yoke and pole core are to be made of cast steel ;

Or,

(*b*) The panels and general equipment for a 12 K.W., 100 volt, direct current self-contained set of engine, dynamo and battery.