

1933

Machine Construction and Design (3rd Year): Technical School Examinations 1933

Department of Education: Technical Instruction Branch

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COURSES IN MECHANICAL ENGINEERING.

(61.)

AN ROINN OIDEACHAIS.
(Department of Education.)

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

TECHNICAL SCHOOL EXAMINATIONS.
1933.

MACHINE CONSTRUCTION AND DESIGN.
(Third Year.)

Friday, May 19th—6 p.m. to 10 p.m.

Examiner—ERNEST E. JOYNT, ESQ., M.I.MECH.E.

Co-Examiner—J. P. HACKETT, ESQ., B.E., A.R.C.S.C.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 books, 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 in your place 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 commencement 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.

Four 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) You must attempt *one*, and *one only* of the first *three* questions (Nos. 1, 2 and 3) and you may also attempt not more than *four* of the remaining *seven* questions (Nos. 4 to 10).

(b) Answers must be written in *ink*; diagrams may be drawn in *pencil*.

(c) Write the number of the question distinctly in the margin of your paper before the answer.

(d) Slide rules, drawing instruments and tables may be used.

1. Determine the diameter of a steel tie rod to sustain an axial pull of four tons, and design a knuckle joint to connect the rod with another of similar diameter. Assume a safe stress of five tons per sq. inch.

[50 marks.]

2. Design a flange coupling for two steel shafts, $2\frac{1}{2}$ inches diameter, with four steel bolts. The coupling is to be of cast iron with protective flanges for the bolt heads and nuts. Assume a safe shear stress in the bolts of 4,500lbs. per sq. inch.

[50 marks.]

3. Design and make a dimensioned sectional drawing of a simple stuffing box with gland secured by four $\frac{3}{8}$ -inch studs for a piston rod $2\frac{1}{2}$ inches diameter. The cylinder cover is $1\frac{1}{2}$ -inch thick, and $\frac{5}{8}$ -inch rope packing is to be used. The gland is to be provided with a renewable bush.

[50 marks.]

4. Describe with the aid of a neat sketch the use, construction and mode of operation of a steam separator.

[12 marks.]

5. Give a brief description of the principal points of difference between a Corliss engine and an ordinary horizontal steam engine with flat slide valve. Sketch the arrangement of the valves in a Corliss engine cylinder.

[14 marks.]

6. Make sketches illustrating the arrangement of *either*, (a) a locomotive axle box, *or*, (b) a boiler water level gauge of modern type with protective fittings.

[12 marks.]

7. Find the diameter and pitch of rivets and general proportions, and make a dimensioned sketch of a double-riveted butt joint for $\frac{1}{2}$ -inch steel boiler plates.

[12 marks.]

8. The headstock of a lathe has a three-speed pulley of diameters, 12", 10" and 8", driven from a similar pulley on the countershaft. There is a double back gear arrangement with alternative gear ratios of 4 : 1 and 12 : 1. If the lowest speed is ten revs. per minute, determine all the other possible speeds.

[12 marks.]

9. Give a brief explanation of the effect on steam cylinder condensation of, (a) length of stroke, (b) speed of revolution, (c) steam jacketing, (d) use of superheated steam.

[12 marks.]

10. Describe with the aid of sketches any method you are acquainted with in which the teeth may be cut in a cast iron gear wheel with 20 teeth, 2 diametral pitch.

[12 marks.]