



1934

Machine Design (4th Year): Technical School Examinations 1934

Department of Education: Technical Instruction Branch

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COURSES IN MECHANICAL ENGINEERING.

(65)

AN ROINN OIDEACHAIS.

(Department of Education.)

BRAINSE AN CHEARD-OIDEACHAIS.

(Technical Instruction Branch.)

TECHNICAL SCHOOL EXAMINATIONS.

1934.

MACHINE DESIGN.

(Fourth Year.)

Monday, May 28th—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 are provided with a book of Mathematical Tables.

You may also use slide rules, drawing instruments, manuscript note books, and the following pocket books:—

Fowler's Mechanical Engineer's Pocket Book.

D. A. Low's Pocket Book for Mechanical Engineers.

Molesworth's Pocket Book of Engineering Formulae.

The "Mechanical World" Pocket Book.

Machinery's Handbook.

Lett's Engineer's Diary.

"Practical Engineer" Pocket Book and Diary.

Messrs. Dorman, Long & Co's. Handbook for Constructional Engineers.

The use of books, other than those mentioned, is prohibited.

Write on the first page of the answer book the names of the pocket books you have brought into the Examination.

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.

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.

(a) You may attempt not more than one of the first three questions (Nos. 1, 2, and 3), and 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.

1. Design a cast iron piston with mid web, a steel piston rod with screwed end on cone and a cast iron back cover for a steam engine cylinder 10 inches diameter and a pressure of 120 lbs. per sq. inch. Assume suitable stresses for the piston rod and the cover studs. Make a full-size sectional drawing of the piston, piston rod end and cover in position at the end of the cylinder, allowing $\frac{1}{4}$ -inch clearance. [40 marks.]

2. Design and make a dimensioned scale drawing of a keyless compression coupling to connect the ends of two shafts which are to transmit 40 H.P. at 180 revs. per minute. [40 marks.]

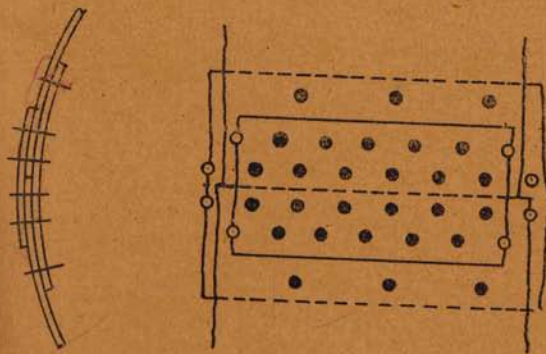
3. Design a cast iron mitre wheel to transmit 50 H.P. to a similar wheel at 100 revs. per minute. The shafts are 4 inches diameter and the teeth are to be $4\frac{1}{2}$ inches in breadth. standard machine-cut involute, whole depth 0.6866 circular pitch. The pitch diameter is 3 feet 4 inches. The stress

the teeth and arms is not to exceed 3,500 lbs. per sq. inch. Draw the elevation of the wheel in vertical section, showing the projection of a few teeth, and a portion of the end view sufficient to give particulars of the number, size and shape of the arms.

[40 marks.]

4. State the advantages, if any, possessed by a boiler joint of the type illustrated as compared with a treble-riveted joint with butt straps of equal width on both outside and inside of the shell. If the plates are $\frac{5}{8}$ inch thick, the rivets $\frac{3}{8}$ inch diameter and the outer pitch $6\frac{1}{4}$ inches, determine the least efficiency of the joint.

[15 marks.]



5. Choose from a table of the properties of standard steelwork sections, a beam suitable for a uniformly distributed load of 6 tons over a span of 12 feet. Make a dimensioned sketch of the method of attachment of the end of this beam to the web of a girder stanchion.

[15 marks.]

6. A flat slide valve 16 inches long by $10\frac{3}{4}$ inches wide bears a steam pressure of 160 lbs. per sq. inch. Assuming a coefficient of friction of 0.2, determine the diameter of a steel spindle to actuate the valve and the proportions of a forked joint cottered to the end of the spindle to form a connection with the end of the eccentric rod.

[15 marks.]

7. A horizontal pressure pump is required to discharge 50 gallons of water per minute after making due allowance for leakage and other losses. Assuming a stroke of 10 inches and 100 strokes per minute, determine the diameter of the pump plunger. Make a dimensioned sketch of one of the discharge valves, 3 inches diameter, resting on its seat.

[15 marks.]

8. Discuss the various considerations which affect the design of bearings for heavy duty. State methods whereby excessive rise of temperature may be avoided, a degree of temperature at which you consider it begins to be excessive and the influence of rise of temperature on the lubrication.

[15 marks]

9. Explain briefly the object and the method of action of a fly-wheel. Calculate the dimensions of a flywheel rim to give out 5,000 foot pounds of energy with a reduction of 5 per cent. of its speed from a mean speed of 160 revs. per minute. Radius of gyration=3 feet 6 inches.

[15 marks.]

10. Describe with the aid of sketches how you would proceed to cut the teeth in the rim of a ratchet wheel with 32 teeth. The profile and the arrangement of the teeth of the milling cutter used should be clearly indicated.

[15 marks.]