

1934

Building Construction (Honours): Technical School Examinations 1934

Department of Education: Technical Instruction Branch

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COURSE IN BUILDING.

(38)

AN ROINN OIDEACHAIS
(Department of Education).

BRAINSE AN CHEARD OIDEACHAIS
(Technical Instruction Branch).

TECHNICAL SCHOOL EXAMINATIONS.

1934.

BUILDING CONSTRUCTION.

(HONOURS.)

Wednesday, May 30th—7 p.m. to 10 p.m.

Examiner—F. W. WARWICK, ESQ., B.A., B.E., A.R.C.S.C.I.

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 book, notes, or scribbling paper.

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 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.

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) Not more than *six* questions in all may be attempted.
- (b) Answers must be written in *ink*; diagrams may be drawn in *pencil*.
- (c) Small diagrams and sketches, to illustrate written descriptions, should be made upon the squared paper.
- (d) Write the number of the question before the answer.
- (e) Equal values are assigned to the questions.

NOTE.—The following values are to be used in the calculations :—

- Safe tensile stress in steel=16,000 lbs. per square inch.
 Safe compressive stress in concrete=600 lbs. per square inch.
 Modulus of elasticity for steel= 30×10^6 lbs. per square inch.
 Modulus of elasticity for concrete= 2×10^6 lbs. per square inch.
 Weight of reinforced concrete=150 lbs. per cubic foot.

1. Design a reinforced lintel for a window opening 10 feet wide in a 14 inch brick wall. The height of the eave over the lintel is 15 feet and the roof transmits a load of 600 lbs. per foot run to the top of the wall. (Brickwork weighs 112 lbs. per cubic foot.) Describe fully how you would cast the lintel.

2. A short concrete pillar of rectangular section $16'' \times 14''$ is reinforced by four one-inch diameter steel rods, one at each corner with centres 2 inches in from the concrete surface. What vertical load will it carry—

- (a) when the load is axial;
- (b) when the load acts at a point 2 inches from the centre of the section on a line passing through the centre parallel to the longer side.

3. What are the reasons for using vertical stirrups for reinforced concrete beams and binding stirrups for reinforced concrete columns? Explain how you would determine the spacing of the stirrups in each case.

4. What are the proportions and properties of the materials required for red concrete roofing tiles. Describe, with sketches, a form of interlocking tile and also the mould and hand-operated machine for manufacturing such tiles in quantity.

5. A reinforced concrete T-beam has a flange 4 feet wide and 4 inches thick and a rib 10 inches wide and 18 inches deep. It is reinforced with four $\frac{3}{4}$ -inch diameter bars 20 inches below the compression edge.

Neglecting any compression in the rib, find :—

- (a) the position of the neutral axis;
- (b) the moment of resistance of the section.

6. Give a sketch design for a water-tank of 10,000 gallons capacity carried on reinforced concrete columns at a height of 15 feet above foundation level.

State and explain the points in design and construction requiring special attention arising from the requirement that the tank should be watertight.

7. What is meant by the "Fineness Modulus" of an aggregate? Explain how this modulus is obtained. Give an example to illustrate its use in determining the proportions in which the coarse and fine aggregates should be mixed.

8. A column 15 inches square has a reinforced concrete footing 6 feet square and 26 inches thick reinforced with seven $\frac{3}{4}$ -inch round bars in each of the two directions parallel to the sides of the square.

Give a sketch to show the form of the footing and the arrangement of the reinforcement and calculate the stress in the steel when the total load is 70 tons.

9. Describe how you would sample and test the compressive strength of the concrete being used on a particular job.

Give the dimensions of the specimen and note any precautions you would take in testing it. If the cement used is standard Portland, what breaking stress would you expect? Describe the manner in which failure takes place and explain the reason.