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COURSE IN MOTOR CAR ENGINEERING.

(76)

AN ROINN OIDEACHAIS.
(Department of Education.)

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

TECHNICAL SCHOOL EXAMINATIONS,
1933.

MOTOR CAR ENGINEERING.
(Fourth Year.)

Monday, May 8th—7 p.m. to 10 p.m.

Examiner—RICHARD COULSON, ESQ., A.R.C.SC.I., M.S.A.E.

Co-Examiner—J. P. HACKETT, ESQ., B.E., A.R.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.

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*) Not more than FIVE questions in all may be attempted, of which FOUR must be taken from Section A, and ONE from Section B.

(*b*) Write the number of the question before the answer.

(*c*) 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 questions to be attempted from this Section*).

1. Summarise the present-day trend of light car engine design in the form of a specification embodying popular practice. Your answer should deal with such matters as the number of cylinders, the arrangement of valves, cooling and ignition systems, the type of drive used for the camshaft and auxiliaries, the lubrication system and the type of oil pump employed.

[50 marks.]

2. Give a short account of recent developments in the direction of using an alternative fuel to petrol for commercial vehicles. Outline the modifications in design that are necessary to enable an engine to run on such a fuel and describe in particular how the injection of the requisite quantity of fuel is controlled.

[50 marks.]

3. What is the difference between isothermal and adiabatic compression or expansion of a gas? Which of the two represents more nearly the condition in the cylinder of a water cooled internal combustion engine during the compression and expansion strokes?

Sketch a typical indicator diagram for an engine running on full throttle; identify the lines on the diagram and give approximate values for the maximum compression and explosion pressures.

[50 marks.]

4. Explain the meaning of the term "Module" in connection with spur gearing.

What is the outside diameter of a 3-module gear having 25 teeth, and what should the shaft centre distance be for two equal gears of this size meshing with one another?

[50 marks.]

5. A six-cylinder commercial vehicle engine develops 90 B.H.P. at 1,750 r.p.m.; calculate the torque in inch lbs. available at the flywheel.

Assuming that the vehicle is proceeding along a straight road, make use of the answer you obtain to determine the shear stress in the rear axle drive shafts at the minimum section, which is 2 inches in diameter. Consider that top gear is engaged, and make a suitable allowance for the overall efficiency of the transmission which includes a final worm reduction of 6·5 to 1.

The polar modulus of a solid circular shaft is $\cdot 196d^3$.

[50 marks.]

6. Make a rough sketch of an elevator suitable for dealing with cars up to, say, 2 tons in weight. Discuss the advantages and disadvantages of equipment of this nature compared with a pit, for washing, greasing and repair work in a garage.

[50 marks.]

SECTION B.

(*Not more than One question to be attempted from this Section. Dimensions need not be inserted, but marks will be awarded for the correct proportioning of parts. Scale, full size.*)

7. Draw a longitudinal section through the hollow crankpin of an engine 4 inches bore and 6 inches stroke. Shew in particular the means adopted to make the bore of the crankpin oiltight, and sufficient of the adjoining portions of the shaft to indicate how the oil is fed to the hollow pin.

[100 marks.]

8. Shew, in part longitudinal section, a detachable tappet guide block suitable for three cylinders of a six cylinder engine.

Only one tappet need be shewn in position, but the drawing should include provision for preventing rotation of the tappet during adjustment.

[100 marks.]

9. The auxiliaries of a commercial vehicle engine are driven by a half-inch pitch duplex roller chain. Draw a horizontal section through sufficient of the timing case to shew the 20 tooth auxiliary shaft pinion and the ball bearings in which it is carried; shew also how oil is prevented from leaking along the shaft.

[100 marks.]