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FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned.**

GEOMETRICAL AND MECHANICAL DRAWING

GCE Advanced Level

<p>Paper 9351/01 Applied Geometry</p>

General comments

The overall standard of work presented in this year's examination was disappointing. The main problem is that many candidates are insufficiently versed in the basic geometrical constructions necessary for solving the compulsory questions in **Section I**. This was particularly evident in **Questions 1** and **2**.

Presentation of answers continued to be of a high standard.

Comments on specific questions

Section I

Compulsory questions

Question 1

Very few candidates knew the construction for determining the line of intersection of the cylindrical hole in the sphere and, as a result, gained only the one mark given for **(a)** and a further mark for the sphere in plan. Of those who attempted the remainder of the question, many failed to read the question carefully enough and wasted time drawing a through hole in the sphere.

Question 2

This question was also answered very badly, with most candidates gaining one mark only for copying the given view.

Question 3

- (a)** Most candidates gained the one mark for drawing the given view.
- (b)** Although most candidates correctly identified the conic section AB as an ellipse and gained one mark, relatively few were able to identify the section BD as an hyperbola, for which a further two marks were given. Many candidates incorrectly identified the conic section BD as a parabola.

A surprisingly large number of candidates omitted this part of the question.

- (c)** Most candidates attempted this part of the question with varying degrees of success. Two marks were given for the construction of the complete cone, one mark for establishing points B, three marks for the construction for the truncation and one mark each for accuracy of the lines of intersection AB and BD. The most common error was a failure to project divisions horizontally from AB and BD to AD before completing the construction of the truncated cone. In addition, a number of candidates attempted to construct the development by horizontal projection from the given view and others based their construction on the truncated part of the cone only.

Question 4

- (a) Three marks were given for a full size view of the logo. Solutions often showed an irregular pentagon and were penalised. All accurate methods used for drawing the pentagon were given equal credit.
- (b) It was expected that candidates would use a simple construction to determine the area of the pentagon, e.g. by geometrical reduction and subsequent simple calculation. Many candidates used graphical integration, which resulted in a very cluttered answer. Two marks were given for determining the area of the pentagon.
- (c) This part of the question required candidates to use graphical integration to determine the area of the hole. Most candidates were able to do this and gained up to six marks for the construction.
- (d) Most candidates gained the two marks given for an answer within the allowed tolerance.

Section II*Optional questions***Question 5**

Although most candidates used the correct axes for an isometric view of the casting and gained three marks, very few used the isometric scale for which a further three marks were given.

Generally, the base and cylinder including the hole were drawn accurately and gained up to four marks. In order to construct the four curved lines on the body, it was first necessary to draw a scrap view of the quarter ellipse and the R96 arc, for which three marks were given. Four marks were given for appropriate construction on the isometric view and three marks for the accuracy of the curved lines on the isometric view. In general, very satisfactory marks were gained for this question.

Question 6

- (a) Most candidates drew the displacement diagram to the correct size using an appropriate horizontal scale and gained two marks
- (b) As a result of not reading the question carefully enough, marks were lost for inaccuracies in the size and form of the cam, particularly the minimum cam radius and the required offset. Up to sixteen marks were given for an accurately constructed and drawn cam. The most common errors were the omission of line of tangency in the construction and not showing anti-clockwise rotation.
- (c) To gain the two marks given, the part of the perimeter of the cam which produced simple harmonic motion had to be indicated precisely on the outline of the cam and not as an annotation giving an angular dimension. Answers on the displacement diagram or removed from the outline of the cam were not given credit.

Most candidates attempted this question and there were quite a number of answers that gained full marks.

Question 7

- (a) Of the relatively few candidates who attempted this question, most gained the three marks for drawing the given figure accurately.
- (b) There were a small number of excellent answers to this question, which were given full credit. The majority of candidates, however, gained only those marks given for the first stages of the construction for the locus, i.e. the division of the circle centre O and the division of the arc AB into the same number of equal parts.
- (c) Three marks were given for the construction for the locus of E and a further two marks for the accuracy of the line of the locus. Relatively few candidates gained these marks.

Question 8

Answers to framework questions usually show a sound knowledge of this part of the syllabus. Answers this year, however, were disappointing.

- (a) The frame was drawn accurately and annotated correctly using Bow's notation by all candidates and gained up to four marks.
- (b) Most candidates, although aware of the correct method to be used to determine the magnitude and direction of the two reactions, failed to produce accurate answers. Three marks were given for construction and up to four marks for accuracy. Again, it is suggested that candidates might be advised to check their answers to graphical solutions by calculation.
- (c) This part of the question was answered badly with the majority of candidates unable to demonstrate the correct construction to determine the magnitude and nature of the three forces indicated.

Question 9

- (a) Many solutions omitted to show the semi-elliptical lug and hole in the front view and as a result lost three of the six marks given for this part of the question.
- (b) Most candidates attempted the first auxiliary and completed the major part of it with minor detailed inaccuracies. Common errors included a failure to construct the curved top edge of the lug and the omission of hidden detail.
- (c) The second auxiliary view obviously presented difficulties for most candidates although there were a number of completely accurate solutions. Up to seven marks were given this part of the question.

Paper 9351/02
Drawing: Engineering

General comments

The standard of presentation of answers was good and there were many examples of excellent draughtsmanship for which candidates are to be congratulated.

The majority of candidates showed a very satisfactory understanding of the assembly of the component parts of the Power Take Off Drive. It would appear also that most candidates found the content of the Paper accessible to them although, as always, not all of them completed the work required.

Many candidates advantaged themselves by drawing rough sketches of the assembly and layout of their answers.

Design features

Generally, this element of the Paper was answered very badly. Nine marks were given for '*These design sketches should be supported by annotated sketches suitably positioned on your answer sheet*'. In addition, the Paper stated '*it is essential that the designed items are drawn clearly on the required views*'. Most candidates failed to gain these marks.

Design Feature (i) - It was expected that appropriately headed bolts would be shown as a means of securing the bearing cap to the main casting and most candidates who answered this part of the question showed this. A number of impractical solutions were shown and these gained little credit.

Design Feature (ii) - The use of either some form of a key or a shouldered screw through the centre of the bearing cap were the most common solutions and given equal credit.

Design Feature (iii) - Most candidates omitted this part of the question completely. Of those who did attempt a solution, few answers were suitably proportioned. The usual method used to allow power to be taken off in either direction of rotation was a key, but appropriate lock nuts were given equal credit.

Interpretation of assembly

A total of ten marks was given for the correct assembly of parts. The most common error was the incorrect positioning of the ball bearing in the main casting. In addition, a few candidates positioned the horizontal bevel gear adjacent to the right hand support for the horizontal direct drive shaft.

Accuracy of components**Question 1****(a)** *Sectional view XX*

Most candidates gained the three marks given for the base including the bosses of the main casting.

Eight marks were given for the ball bearing holder and support. Many candidates failed to realise that the support was hollow and, as a result, failed to show the section of the inclined web. A further common error was to position the centre line of the horizontal drive shaft the incorrect height above the base, which resulted in the incorrect meshing of the bevel gears.

Four marks were given for the ball bearing and the bearing retainer. Errors on the shape and positioning of the bearing retainer were common.

Three marks each were given for the bevel gears and most solutions showed these drawn satisfactorily, as were both the horizontal and vertical drive shafts, for which a further four marks were given. Few solutions however, showed an accurate representation of the splines on both shafts and few candidates showed the required circlips.

The right hand support for the horizontal drive shaft was usually drawn accurately although there were numerous errors in the split bearing and the bearing cap was often omitted.

Two marks were given for accurate fillet radii and two marks for the correct section shading technique. It was expected that an appropriate angle and pitch would be used and that there would be a reverse direction of shading for adjacent sectioned parts. A further two marks were given for the correct parts being sectioned. There were many inaccuracies in the sectioning, both in the technique and in the parts which had to be shaded. It will be realised that candidates who drew an outside view of the assembled Power Take Off Drive were considerably penalised.

Six marks were given for showing the chosen design features accurately.

(b) *End view*

The most common errors in this relatively straightforward view were the omission of the recess in the base, incorrect positioning of the boss and not showing that the support for the ball bearing holder was hollow.

(c) *Plan*

Again, marks were lost for minor errors of detail, particularly in the sloping sides of the ball bearing support in the main casting.

Question 2

Most candidates drew the correct symbol of projection for the drawing, although many of the symbols drawn were badly out of proportion. This was surprising as an accurately proportioned symbol of projection was given on the insert of the Question Paper.

Question 3

Marks for this part of the Paper varied very considerably between candidates. The principal weakness was a lack of knowledge of the material most suitable for each particular component. It was not uncommon for steel to be given for every component. Nevertheless, there were some excellent answers to this question.