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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

All questions were very straightforward with none being set to cause any confusion to genuine A Level candidates.

Question 8 called for 5 mm = 1km, which was a very small scale! Very few adopted the scale suggested and a generous allowance was made concerning the magnitude of forces stated. No candidate was unduly disadvantaged by this and credit was given to candidates regardless of which scale was adopted.

Performance varied greatly, with marks ranging from 1% to 94%. Although the sample was small, there was clear evidence that every candidate was able to make some attempt at all questions. A large proportion of candidates were of genuine A Level standard, although there was a disconcerting number that did not attempt the A Level aspects of the syllabus. The examination quite rightly builds upon the O Level syllabus and as such about one third of the paper could be attempted by candidates who had a clear understanding of the O Level syllabus. It was clear that some candidates were not ready for an A Level examination.

Comments on specific questions

Question 1

Almost everyone made an attempt, although only a very small number demonstrated the tangent construction. Similarly, only a few candidates showed tangent points clearly. Candidates should be advised of the importance of making all constructions clear.

Question 2

Part **(b)** was poorly answered. Although the question called for straightforward construction, only a small percentage even attempted this, the rear of the casing being particularly badly done.

Question 3

Most candidates (although not all) got part **(a)** correct, this being a simple construction of the given figure. The 37 mm side length was usually right, and the side angles were generally drawn parallel to the original; however, hardly anyone demonstrated a knowledge of area construction. A vast majority increased the linear size instead of the area.

Question 4

Some candidates did not read the question properly, but rather answered the question showing the whole lampshade. Although this was not penalised, time was wasted.

Too few failed to recognise that the top half was in the form of straight lines and that the lower half was curved. Many of those who did construct a curve failed to include intermediate points for accuracy, and seemed to be satisfied with the intersection points at the corners.

Question 5

Although straightforward, this type of question is usually time-consuming and candidates appeared to recognise this fact. Unfortunately a very high proportion of those who attempted this question did so in oblique projection. Credit was given, although this was technically incorrect. There were very few attempts at constructing the curves.

Question 6

Here, more than half of the question was accessible to good O Level candidates. In spite of this, far too many errors were made in the construction of both the hexagonal and the octagonal parts.

The intersection of the two parts was generally poorly done; there was very little evidence here of construction knowledge.

Question 7

- (a) A huge majority gave the answer 'parabola' instead of 'hyperbola' for the conic section, fortunately there was only one mark for this. Here again, about half of the question was accessible to O Level candidates, the construction of the given views accounting for 30% of the marks.
- (b) A minority showed the simple construction for the height of 'G' (and hence F) above the base. A good proportion of those who got this far were able to demonstrate true length, although only a few were able to relate this to angles.

Question 8

Candidates were given credit for any scale used, and a large tolerance allowed on subsequent answers.

This was not a well answered question; only a few candidates gained full or almost full marks. Far too many failed to appreciate that the hinged reaction point was an important starting point. Similarly, the determination and nature of forces of this standard type of question was not well demonstrated.

Question 9

This was attempted reasonably well, although far too many candidates stopped short of actually drawing a cam. The locus of 'D' did not depend upon the cam and a few answers were seen in isolation for a perfectly acceptable five marks.

Paper 9351/02

Drawing: Engineering

General comments

Candidates in general managed to interpret the assembly instructions correctly and the majority were awarded high marks for this element of the question. The most common failure was not to show the lock nuts under the Spring Seating on the Valve Spindle. Less common, was to show the valve off its seat within the Main Casting at "A".

Most candidates planned the two views to fit on their paper well and the overall standard of their draughtsmanship was very high. Only two elevations were required and therefore it was not possible for a candidate to draw in mixed projection but in view of this, close attention was paid to the symbol drawn to indicate which angle of projection had been used. Many candidates did not appear to know the correct British Standard Symbol particularly those who chose to answer the question using First Angle Projection.

The question called for a **Parts List** to be included but many candidates failed to address this requirement. There was some evidence to suggest maybe this section of the syllabus does not receive the attention it should.

The three **Design Features** were very poorly attempted by the vast majority of the candidates and clearly this is the one area of the syllabus which every candidate, without exception, would be well advised to spend more time studying. Very few candidates (less than 5%) made any attempt to comply with the instruction to show annotated sketches of how they proposed to modify the given components in order to meet the specified requirements.

Two views, both elevations, were called for of the assembled valve and the majority of candidates managed to make an attempt, with varying degrees of success, at the half-sectioned elevation but only approximately 60% moved on to attempt the end elevation. Most encouragingly less than 1% of candidates failed to use the correct scale and approximately 90% showed the correct area in section i.e. the half sectional view on the line G-H.

Clearly Centres have spent time teaching candidates how to indicate a sectioned area and most showed different sectioned components by a varied spacing and orientation of their cross hatching lines. Equally pleasing was to see the number of scripts on which an attempt had been made to differentiate between the outline of the component and the section lines within that outline by varying the thickness and density of the lines.

Detailed observations

Design features

The Examiners are conscious of the fact the candidates will have limited, if any, practical experience and therefore the *Design Features* which are set year on year are based upon the knowledge which the candidates can reasonably be expected to have acquired whilst studying the subject over the two years of the course. The first of the requirements for this examination, how to fasten the Cover Plate to the Main Casting must have been seen over and over again whilst producing drawings of engineering components which are bolted together. The obvious solution was either studs screwed into the top of the Main Casting or tapped holes in the top of the Main Casting and set bolts passed through the Cover Plate. A few candidates suggested cutting a screw thread on the 180 mm diameter spigot of the Cover Plate and tapping the same size thread in the Main Casting. This was accepted although it was rather impractical from an economics point of view - accepted in recognition of the candidate's lack of practical experience.

The second requirement, how to make a gas tight joint between Face D of the Main Casting and the Outlet Pipe flange was very straightforward, the most commonly offered solution - a rubber gasket - was perfectly acceptable, paper gaskets were not and neither was a coating of mastic spread on one of the two faces.

The third design feature, how the Spring Seating should be machined in order to satisfy two requirements demanded that attention should be paid to those two conditions i.e. to support the Compression Spring and to contain it in its working position. The simplest solution was to reduce the 76 mm diameter shank at its square end to such a diameter the Spring would slip over it, say 49 mm dia. (the internal diameter of the Spring is given on the question paper as 50 mm) and make this reduced diameter sufficiently long to contain the spring when in its free state, perhaps a minimum length of one and a half coils pitch.

As mentioned in the **General Comments** section, with only very few exceptions candidates did not comply with the question's instruction to show by annotated sketches, suitably positioned on the answer sheet, their solution to these design problems. Centres should stress over and over again that when a question calls for a particular response, marks are allocated to that instruction and failure to comply can only have one result - no marks can be awarded.

Parts list

As mentioned previously, many candidates made no attempt to include a *Parts List* and it is difficult to understand why when one considers its composition is so straightforward. One possible explanation could be it is a case of poor management on the candidate's part in pacing themselves in terms of the time spent on the various elements of the question. Centres should stress to their candidates the wisdom of making some attempt at every part of the question rather than concentrating on completing one section. The principal concern when assessing the merits of the **Parts List**, in the case where such a list was attempted, was the lack of knowledge exhibited by the compiler on the properties of suitable material for the component under consideration. For example, the material suggested for the compression spring was variously quoted as cast iron, brass, mild steel and in one case, plastic. In some cases candidates did not appear to appreciate what they were listing as for example "Valve Seat" when on the same list they included "Valve Stem".

The question paper lists the principal component as the Main Casting and refers to it as a casting in the notes so it was difficult to understand why many candidates entered "mild steel" as a suitable material for this item. Brass was often listed as the material for the Valve Spindle.

Centres should be aware that the most important entry on a **Parts List** is the material from which the item is made and as such carries the most marks. Few candidates were awarded the maximum mark for "Choice of Material". The majority of attempts however gained marks for the format of the list, for the components listed and for the quality of their presentation.

Projection symbol

Considering the number of times candidates should have shown this symbol on their drawings throughout the course there was a surprising number of scripts which either did not show the symbol at all or showed it contrary to BS 308 or PD 7308. Remarkably those candidates who chose to draw their solution using Third Angle Projection on the whole included the correct symbol. Equally interesting, solutions using this angle of projection were very much in the minority. The most common mistake found on scripts using First Angle Projection which did show a symbol was this symbol was drawn "opposite hand" to the British Standard.

By this is meant candidates showed the two concentric circles to the left of the truncated cone with the cone tapering from the largest diameter on the left to the smallest diameter on the right.

Standard of draughtsmanship

Taken as a whole, the standard was good to excellent, there were a lot of fillet radii to be drawn which in themselves are time consuming but candidates did very well. Cross hatching to represent sectioned areas in many cases was well attempted. Perhaps the one observation which Centres might like to consider is the time this activity takes is time consuming and candidates should assess how big is the area to be hatched and in the light of that decision decide how far apart they will space their section lines. Obviously the larger the area the wider apart the line can be, thus saving valuable time. The angle at which the cross hatching lines are drawn is recommended as 45° unless keeping to such an angle would create problems in differentiating between different components. A relatively few candidates, used an angle of 60° which would suggest this is the angle they have been taught to use.

Assembled drawing

Half Section on Cutting Plane G-H

The required section was not particularly difficult to visualise after studying the given half sectional view on E-F and that probably helped many candidates to produce an acceptable interpretation of the given drawing.

By far the majority of the candidates interpreted the assembly instructions correctly and also understood where the cutting plane had to be considered. Where the assembly was incorrect two patterns emerged, either the Valve Spindle was drawn the correct way up but not drawn on its seat at "A" or it was drawn the wrong way up with the valve stem projecting up through the Cover Plate. Several candidates failed to plan their layout correctly before they started work and as a result they had insufficient space in which to show all the Outlet Pipe. In view of the paucity of components which had to be "bolted on" to the Main Casting (only one in actual fact) this was a very serious failing and consequently lost marks for the profile of the pipe. Planning the layout of a drawing in order to accommodate all the required views on the one sheet of paper is something to which a lot of attention should be paid throughout the course.

Few candidates paid attention to Note 1 on the question paper allowing licence not to detail every single fastening where more than one occurred but to indicate clearly the position of those omitted and as a result lost marks. This was especially so in connection with the Cover Plate. As mentioned earlier very few candidates showed by annotated sketches how they intended to fasten this item to the main casting and by not indicating the centre-lines of their studs or bolts on the two required elevations lost marks.

Obviously if some form of gasket was fitted between the two flanges the thickness of this gasket would be seen in the elevation but many candidates showed the two flanges butted up tight.

The inlet recess below the valve seat was frequently omitted and many candidates showed the main casting projecting into the reduced diameter of the Valve Spindle. The effect of this on the operation of the valve would be to prevent the Valve Stem from lifting off its seat.

The most common mistake with very few Centres being exempted was in the way their candidates attempted to show the compression spring in this sectioned view. The question specified in writing all the necessary information required to draw the spring and stated very clearly where the spring fitted within the casting. Clearly the knowledge of how to show this detail was almost totally unknown and is an area of the syllabus that needs to be addressed in the future. Lock nuts are also a common feature which appears to have received scant attention. Because these nuts appear right at the bottom of the drawing it just may be possible the average candidate had not reached the point at which the problem had to be faced. Where candidates did make an attempt two common faults occurred time and again. The first one was the appearance and method of assembly of the nuts. The two nuts are not of equal thickness, the thin nut is always screwed on first so that the thicker nut, which carries the load when in use, is the least stressed. The second common mistake was not to show the nuts in correct projection. If one elevation shows the three sides of the nut then when that position is projected on to a second elevation only two sides of the nut will be seen within a rectangle because no chamfer is in profile. Of those scripts which did show two views of the nuts quite the majority showed the same number of sides on both elevations.

The outside view of the valve to the right of the vertical centre-line required very little work relative to the sectioned view to the left of the same line. Most candidates managed to draw a reasonable profile of the Main Casting. The most notable omission was a line to suggest the shadow where the casting changed section approximately 203 mm below its top. This is always a tricky detail to draw but a single, or maybe two lines approximately 4 mm apart, stretching from the vertical centre-line to within about 5 mm of the outline just above the plate which carries the four 26 mm diameter holes in the back plate would have been perfectly acceptable.

On a similar tack the lower section of the Main Casting is cylindrical with a diameter of 112 mm but approximately 160 mm from the bottom of the casting this is increased in diameter to 124 mm. Most candidates failed to show the horizontal line to indicate this change in section on the outside view. Whilst it might be argued the line showing the change in the upper part of the casting is not strictly necessary there can be no case to be made for not drawing the line on the lower section.

The Cover Plate has a spigot of 180 mm diameter and 22 mm long, the Main Casting into which this spigot fits is only 20 mm deep which means there must be a gap between the two when assembled but many candidates showed the underside of the Cover Plate's top 20 mm thick lip sitting tight down on the Main Casting. Few, less than 1%, showed the position of their Cover Plate Design Feature on this view as required by Note 1 on the question paper.

End View in direction of Arrow EV

As mentioned earlier in this report, Centres would be well advised to encourage their candidates throughout the course to practice working on several areas of a drawing at the same time rather than spending all of their time in completing one view at the expense of the others. In this particular examination it was perfectly obvious many candidates spent practically all their time working on the first mentioned elevation on the question paper and ran out of time before they could make a start on the second elevation. Without much practice this technique is not favoured by most candidates, in terms of examination technique however it pays handsome dividends and is therefore worth practicing. The explanation why this is so is because marks are generally picked up at a faster rate in the early stages of a view than they are when fine detail is being added towards the completion of that view.

Without exception, every candidate who attempted this part of the question showed the required view of the assembled valve which was most pleasing to observe.

The most common omission was the end view of the method of fixing the Cover Plate to the Main Casting i.e. the candidate's answer to Design Feature 1 or the intended position as required by Note 1. Equally few candidates showed either a bolt head or nut on the flange of the Outlet Pipe, only one was required, again in accordance with Note 1.

The bosses of the 26 mm diameter holes on the back plate are given as projecting 7 mm above the thickness of the plate itself but very few candidates managed to show this feature correctly despite there being two examples of how it should be done on the plan view of the Main Casting on the question paper.

Again the line required to show the step in diameter of the lower cylindrical length of the Main casting from 112 mm to 124 mm diameter was omitted by the vast majority of candidates.

There is no need to go over the mistakes involving the lock nuts; where they had been correctly projected when considering the thickness issue from the first elevation any error was ignored but not when it was an issue of the number of sides of each nut portrayed. Three sides on one elevation required two sides on the other.