GEOMETRICAL AND MECHANICAL DRAWING

Paper 9351/01
Applied Geometry

GENERAL

The paper was a very straightforward one, with nothing in any question that should confuse the genuine A level candidate.

The mark range was an unprecedented 1% to 98%. The candidate who scored the 98 actually did nothing wrong, but did not show evidence of construction for the ellipse tangent. This was probably the best paper that I have seen in very many years of assessment! Conversely, very poor scripts were also witnessed where the candidates concerned did not attempt to answer any question. What little there was on the paper was entirely in inches, the candidate taking, for example, three inches as thirty millimetres and one and a half inches as fifteen millimetres.

The average mark was low, was below 40%, and maybe a third of the candidates should not have been entered for this examination, not even being up to a low '0' level standard. Fewer than 30% of entries gained half marks or more!

Reasonable candidates were able to tackle the seven *required* questions, although a significant proportion seemed to be unable to attempt some. This appears to have been a lack of knowledge rather than of time.

PARTICULAR

Question 1

Although this was a very straightforward question to start the examination, a high proportion of candidates failed to begin the question with a cycloid. This omission was not penalised heavily, and up to five marks were available for other aspects of the question.

Question 2

This could have been answered either by auxiliary projection or by true length construction. Generally this was well answered, although a significant number of candidates were unable to construct the given view.

Question 3

This was a very straightforward question, which had a small discriminator (1 mark) for the construction of the ellipse tangent. Some efforts seemed to be based upon scaling and copying the question, although the Centre points of R85 and R75 were generally reasonably well located. This was not the case with the R20 location. The ellipse seemed to present no real problem, although even some very good candidates failed to construct more than a few points. More construction would have ensured accuracy. Only a very few demonstrated how to construct the ellipse tangent.

Question 4

This was not a well answered question. Some candidates failed even to construct the given question accurately and only a minority seemed to understand the concept of true length. Although this was not a complicated request, only a small percentage were able to generate a reasonable solution.

Question 5

This was a comparatively straightforward truss quesion. Candidates who really understood the subject were able to deal easily with this question. Regrettably far too many candidates failed to start the funicular polygon at the zero bending moment point and hence were not able to determine correct answers for reactions and loads. There were also some attempts (usually Centre-based) that did demonstrate a basic understanding of vectors. A common fault, for example, was to assume that the vectored loads of 400 kN and 200 kN equated to a total load of 600 kN.

Question 6

A majority of candidates gained three or four marks merely for copying the question. Too few projected extra points to make curves sufficiently accurate, although there was reasonable evidence that knowledge of auxiliary views was reasonable. Although this question was not badly answered, very few candidates produced a really good auxiliary projection.

Question 7

This was a very straightforward cam question. Most candidates laid out the starting point correctly (as given in the question) and a vast majority were able to construct a performance graph, although splitting the UAR diagram did confuse a few. There were too many attempts that showed tangents from the base diameter circle instead of the offset circle. Giving timings in the question did not seem to present any problem.

Question 8

This was probably the worst answered question on the paper. Although the question was straightforward and typical of questions in recent years, only a very few candidates were able to locate the centre of the smaller sphere - with too many scaling the given drawing. There were some efforts to construct a reasonable cutting plane and main sphere in the auxiliary view, although very few attempts went any further. there appeared to be a lack of understanding of the basic principles.

Question 9

As usual, the isometric drawing was straightforward, although rather time-consuming. Many of the candidates who attempted this question failed to construct an isometric scale. The lowest point ‘N’ was not always placed at the bottom as called for.

GEOMETRICAL AND MECHANICAL DRAWING

Paper 9351/02
Drawing: Engineering

General comments

Large differences in the quality of scripts were evident again this year, with the better candidates submitting solutions that were a credit to themselves and their teachers. Regrettably many of the weaker candidates had either not been adequately prepared for this subject or did not have the ability to cope with the subject at this level. Invariably the lack of knowledge related to common but important aspects of engineering drawing, aspects which are fundamental to the syllabus include; conventions for threads, various types of line, hatched and unhatched areas in sections, proportions for standard hexagonal nuts and bolts, labelling and dimensioning, etc should all be very familiar to candidates at this level but were very often interpreted poorly.

More care was needed in checking the direction of viewing for the requested views. A number of candidates failed to interpret the instructions correctly, submitting views from the wrong viewing directions and thus lost marks because features or components were missing. However the majority of candidates set out the three required views and found little difficulty in assembling the components correctly. Regrettably many candidates, generally from particular Centres, failed to realise the importance of stating the form of projection they had used. This element of the examination has been emphasised in past reports but continues to be overlooked.

The standard of draughtsmanship was generally good although some solutions were not bold enough and difficulty was experienced by examiners in interpreting aspects such as thread conventions.

Drawing

Whilst the accuracy with which dimensions were taken off the given drawing (Fig. 2) were generally correct many of the weaker candidates experienced difficulty with the diaphragm.

It was disappointing that the majority of candidates showing the standard hexagonal headed bolts on their solutions had not used the recommendations B.S. 308 (PD 7308) proportions. Even more surprising was the large number of solutions where they had been omitted completely.

Far too many candidates seemed to have poor knowledge of the various types of non-return valves and yet it is an important part of the syllabus.

Whilst the standard of draughtsmanship generally remains high, there is a definite decline in the knowledge and applications of conventions in recent years; surprising since there are numerous excellent examples of these in the candidates version of BS308 (PD 7308).

A number of candidates showed parts that interfered with each other and therefore could not function or indeed be assembled. This indicates a poor understanding of how common engineering devices work and illustrates very clearly how important it is that candidates have a ‘hands on’ opportunity to strip and then reassemble suitable mechanical devices as a part of their course.

Design

Whilst the majority of candidates were able to correctly assemble the given components as requested, it was disappointing to note that very few made any serious attempt to supply adequate solutions for the Design Features.

Design Feature i): a means of sealing the joint between the inlet flange and the outlet chamber. A gasket was the expected solutions fabricated from a material that could withstand petrol and/or oil over a period of time. Several candidates failed to remove the centre, hence fuel could not enter the outlet chamber. Provided there was evidence of a small circular vee groove, an 'O' ring was accepted although not the preferred option.

Design Feature ii): suitable non-return valves in the ports of the inlet flange and outlet chamber. Suitably proportioned ball, metal/plastic disc valves kept against their seats by light springs were expected to control the flow of fuel. A box flap valve was not considered a suitable solution although suggested by several candidates. Regrettably a number of candidates could not differentiate between the two valves and consequently failed to position the light spring accordingly.

Design Feature iii): a plain bearing to guide pump rod. Whilst many candidates provided a suitable solution, few indicated that a press fit would be required when placed in a suitable housing, machined into the pump body. Ball, roller and needle bearings were not considered to be suitable answers although offered as solutions by several candidates.

Design Feature iv): a method for ensuring that the M6 pump rod remains secured to the diaphragm. Various nuts screwed onto the M6 portion of pump rod were the expected method. Unfortunately the vast majority of candidates failed to ensure that their nut would not become loose in use. Rather surprisingly many failed to position a suitable washer between their threaded fastener and the rather delicate diaphragm so that it would rupture very quickly in use.

Design Feature v): an eccentric cam imparting 5 mm of movement for activating lever. The majority of candidates giving details of a suitable cam had positioned it correctly and it would indeed have displaced the arm of the activating lever 5 mm as requested.

Parts List

The majority of candidates attempted this part of the paper with much of the tabulated data presented well and comprehensively.

The complete list would have had twelve or more items including the given components, high tensile bolts and washers apart from the components required for the Design Features.

Detail drawing of Pump Rod

Whilst the instrument drawing of the views presented few problems for most candidates, many failed to fully dimension their views. Disappointing to note, at this level, the number of candidates who failed to adopt BS308 (PD7308) guidelines for their dimensioning. Very few candidates were able to suggest a suitable bearing material such as bronze.