

UNIVERSITY OF MALTA

**THE MATRICULATION EXAMINATION
INTERMEDIATE LEVEL**

**APPLIED MATHEMATICS
May 2013**

EXAMINERS' REPORT

**MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD**

**Applied Mathematics
Intermediate Level
May 2013**

Part 1: Statistical Information

The distributions of grades awarded in the May 2013 session are given in the table below.

GRADE	A	B	C	D	E	F	Abs	Total
Number	5	11	12	6	6	8	2	50
% of Total	10	22	24	12	12	16	4	100

The candidates did quite well in this examination, with 28 out of 50 students (56%) obtaining Grades A to C, and 24% obtaining grades D and E, for a total pass rate of 80%. There were 10 students (20%) who failed or were absent for this examination. This performance is slightly worse than last year, when more students sat for the examination, and there were relatively less absentees or failures (12 out of 78, or 15%). The following are the comments on the individual questions.

Part 2: Comments regarding candidate's performance

Q1: This question was generally well answered. However, some common faults were noted.

In part (i), the schematic layout was not drawn according to standard practice and therefore proper orientation, direction and location of the forces were incorrect. Although the question clearly stated that there is a resultant in order to find P, conditions of equilibrium were sometimes used during the calculations.

In part (ii), moments were not always taken at A, thus making it more difficult to solve this part of the question.

Q2: This question deals with finding the centre of gravity of two standard combined three dimensional solids.

In part (i), the hint on the position of the centre of gravity of the hemisphere was not always applied. In some cases, candidates did not know the formula for the volume of a cylinder or a hemisphere.

In part (ii), the common mistake was either hanging the resulting solid from the wrong point or calculating the angle which the axis makes with the horizontal.

Q3: This was a standard question on the impact of two identical smooth spheres.

Part (i) required the application of the Law of conservation of momentum. However some did not consider the vectorial nature of the velocity, neither in the diagram nor by using the standard notation of direction.

In part (ii), Newton's Law of Restitution to calculate e was not applied properly when considering the relative speeds, leading to a negative value of e , which is obviously incorrect.

In part (iii), the change in the KE usually denoted as the final condition – initial condition yields the result of the loss in KE. Some errors occurred when they considered the energy interchanges only of either S or T and not of both spheres.

In part (iv), many did not have a clear understanding of the impulse between the two spheres, commonly mixing up which impulse belongs to which sphere, whilst some mixed up the speeds using one speed from S and the other from T.

Q4: This question on projectiles was on the whole well answered.

However, some did not locate a datum and positive direction, a characteristic required to answer such questions. Consequentially the vectorial nature of the displacement and velocity was not considered, thus resulting in wrong answers. A common mistake to find the angle α was by simply using the two given distances of 56 m and 32 m and finding the tangent angle between them. There was a minority of students who still regard such problems as a scalar reply, breaking down each stage into finite pieces and considering each one in turn. Some got lost in the calculations and a few eventually arrived to the correct answers.

Q5: This question was well answered.

In part (i), the forces in equilibrium were either resolved or Lami's theorem was applied to find the correct angle, θ , the string makes with the *vertical*.

In part (ii), the extension was properly evaluated as long as the equation governed by Hooke's law was properly stated and applied,

In part (iii), the horizontal distance was generally correctly evaluated as extended length times $\sin \theta$.

Q6: This question was very well attempted by most candidates.

Though part (i) was easy, some candidates ignored the "no slipping condition".

In part (ii) a small number of students chose to apply Newton's Second Law parallel to the plane, but left out the component of acceleration down the plane.

Q7: This question was very well answered.

Parts (i) and (ii) were very well tackled by the majority of candidates.

In parts (iii), (iv) and (v), however, a small number of students did not apply the formula for the power, that is $P = Tv$, where T is the tension in the cable found in part (ii). Instead they used energy, thus making many fundamental errors in writing down the energy equation.

Q8: This was well tackled only by about a quarter of the candidates.

The following were the most common errors.

- (i) Many students ignored the work done against friction.
- (ii) For the normal reaction R between the plane and the particle, some candidates wrote down erroneously that $mg = R \cos \alpha$.

(iii) There was confusion in the direction of friction during the subsequent motions.

Q9: This question was poorly answered.

A large number of the students drew an incorrect diagram. The most common error was that of placing the two pegs at A and C. A small number drew the two rods with B vertically above the level of AC.

There was also a clear lack of understanding among the candidates about the reaction at the hinge at B. All students did not realize that the reaction at B must be *horizontal* since the external forces are symmetrical about the vertical line through B.

Q10: This question was generally well attempted.

A significant number of students drew the string parallel to a line of great slope instead of *horizontal*. A few tried to resolve the forces in too many directions, but taking moments about a suitable point was completely forgotten. It should be remarked that for a large body question, the "right" thing to do is "resolve twice, moments once".

Chairperson
2013 Examination Panel