L-Università ta' Malta

MATSEC
Examinations Board

Examiners' Report

Intermediate Level Applied Mathematics

Special September Session 2020

Summary of Results

Grade	A	B	C	D	E	F	Abs	Total
Number	3	9	7	7	6	9	9	50
%	6	18	14	14	12	18	18	100

Grade	A - C	A - E	FAIL
Number	19	32	9
%	38	64	18

Comments on Candidates' Performance

Question 1. The question regarding a composite laminate of different areal mass was generally answered well. The common mistakes for part (a) were that each kg/m^2 had to be multiplied by the individual area. The COG of the triangle needed to be taken at a distance from AD and not from BC as commonly mistaken. The candidates generally knew how to apply the theory to find the distance of the centroid of the lamina from AB. In part (b) some suspended the laminate from C. The question explicitly states the system is in equilibrium with AB horizontal. The candidate only had to take moments about the suspension point C of either the total at the computed centroid from part (a) from C (or individual triangle and square from C) equal to the moment of W from C.

Question 2. The candidates found the question very difficult and only a few answered correctly part (a). Few visualised that the given $ABCD$ setup can be replaced by a triangle ABC of same geometric size with the forces to be determined along AB, BC and CA. Many found the moments about A, B and C, but did not use the same points ABC for the triangle. Such candidates could not proceed at this point. For candidates who successfully completed part (a), most knew how to complete part (b) and (c) provided no algebraic mistakes were made.

Question 3. The question on projectiles was answered quite well. The question explicitly gave the procedure to adopt for the solution. For part (a) the main problem was when the candidates failed to separate and/or resolve vertically and horizontally. When this was not done the candidates could not proceed. Following the given procedure equating for t, two possible routes for solution presented (i) solving the resulting trigonometric function for $\sin 2\alpha$ to directly give $\alpha = 20^\circ$, (many did not know that $\sin 2\alpha = 2\sin\alpha\cos\alpha$); (ii) few realised that if entering $\alpha = 20^\circ$, the two

solutions for time will be equal therefore proving that $\alpha = 20^\circ$. In part (b) most solved the distance of 3.66 m using $\alpha = 20^\circ$. The main problem in (c) was that a few gave the incident velocity as 25 m/s, instead of the correct $25\cos\alpha$, whilst others did not use the coefficient of restitution for the rebound velocity. Few candidates used the time to hit the ground found in part (a) or part (b).

Question 4. The problem was generally answered well. The few difficulties encountered were not converting km/hr into m/s correctly and not correctly resolving parallel to the slope. In part (b) some neglected to include the 20 N resistance to motion in their solution.

Question 5. The major problem was that the candidates did not present a "horizontal force P", many considered P acting up and parallel to the slope (with other components of forces drawn properly), consequently any resolution was incorrect. Few presented an incorrect combination of resolutions: parallel to the slope with vertical; or horizontal with perpendicular to the slope for the solution. Some completely omitted the resolution of P, even if properly drawn. The substitution of R of one equation into the other was usually done correctly.

Question 6. The sketch of this problem was correctly drawn by most candidates although the forces in the rods were not correctly defined; this could be done by examining the forces acting on the separate rods of the framework. Still when the forces were evaluated, the forces in the rod were correctly expressed whether they were in tension or in compression. On the whole, this problem was correctly worked by most of the candidates.

Question 7. In some cases, the diagram for the situation described in the problem was not correctly drawn. Another common mistake was the tensions in the two strings were considered to be equal in the first part of the problem. This provided the wrong result. When working the second part of the problem, one of the equations had to be expressed in terms of the angular velocity which was unknown in this case. However, the tensions could be defined in terms of the angular velocity. Using the fact that the tension is positive, a decision could then be taken about the possible range of values of the angular velocity.

Question 8. In attempting part (a) of the problem, the potential energy was correctly defined in most cases, but the elastic potential energy was not correctly expressed by a number of candidates; this led to a wrong evaluation of the natural length of the string. In part (b) of the problem, the loss of potential energy was equated to the gain in kinetic energy and elastic potential energy. In evaluating the elastic potential energy, the correct result of part (a) of the problem was supposed to be used.

Question 9. Most candidates failed to calculate the force F correctly as they did not differentiate the given velocity equation to obtain the acceleration. The second part of the problem was correctly attempted although some of the candidates failed to evaluate the constant of integration, thus leading to an incorrect or incomplete result. In part (c) of the problem, the result of the scalar product had to be integrated for the given interval of t. The gain in kinetic energies could be obtained as the difference of the energy by calculating the kinetic energy at the ends of the interval; some candidates only partially attempted part (d) where they had to show that the result of this part is equal to the result of part (c).

Question 10. Most of the candidates that tried this problem failed to define the actual velocity of the bullet as the sum of the velocity of recoil and the velocity of the bullet relative to the gun. The hint provided at the end of the problem was probably ignored. The actual velocity was used to calculate the appropriate momentum on both parts of part (a) of the problem. In part (a) (ii) it is stated that the barrel of the gun is inclined at 30° to the horizontal; here some candidates discussed a situation where the gun was on the slope of a plane inclined at 30° to the horizontal. This is a totally different situation from that intended. As a result of this, the calculated velocities were incorrect. In part (b) of the problem, the horizontal impulse had to be evaluated; this is equal to the change in momentum. Most of the results obtained were wrong.

Chairperson
Examination Panel 2020