L-Università ta' Malta

MATSEC
Examinations Board

Marking Scheme

IM Engineering Drawing and Graphical Communication

First Session 2021

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In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with the MATSEC Examinations Board when in doubt.

PAPER 1

Question			Suggested Answer	Marks Distribution	Marks
1	a		***Space diagram.***		
			Copying the given space diagram using the given scale of 10 mm representing 1 metre.	1	2
			Assigning capital letters to the spaces between the forces.	1	
	b		***Vector diagram.***		
			Using a scale of 10 mm representing 5 kN and drawing a vertical line equal in length to the magnitude of the resultant of the loads on the beam.	1	3
			Labeling the points on the load line by small letters.	1	
			Joining the points from the load line to a point O outside the force diagram. Printing the diagram POLAR DIAGRAM.	1	
	c		***Mag Magnitude of the support reactions.***		
			Draw the funicular polygon in the spaces between the lines of action of the various forces, by transferring parallel lines from the polar diagram to the respective spaces below the space diagram.	½	4
			Locating the intersection of the end reactions and drawing the closer link, labeled 'Closer'. Transferring the 'closer line' to the polar diagram by a parallel line, passing through the point 0.	½	
			Determining using a graphically method the:		
			Magnitude of the support reaction on the left; 34.5 kN	1 ½	
			Magnitude of the support reaction on the right: 28 kN	1 ½	
	d		***Shear force diagram.***		
			Drawing the base line of the shear force diagram by projecting a horizontal line through the point of the closer in the force diagram.	1	3
			Drawing horizontal lines across the spaces covered by the corresponding letters.	1	
			Drawing the appropriate vertical lines and closing the diagram.	1	
	e		***Bending moment.***		
			Measuring the distance from the left reaction to the position where the bending moment is zero. (42 mm from the left reaction)		1
				Total:	**13**
2	a	i	***Follower displacement graph.***		
			Drawing the uniform acceleration and uniform retardation.	4	7
			Given data;- 0° to 180° a lift of 72 mm.		

			Dividing the angular displacement and stroke of follower into the same number of parts and constructing the parabolic curve.		
		ii	Drawing the simple harmonic motion. Given data;- 180° to 300° a fall of 48 mm. Drawing a 48 mm diameter semicircle and dividing it into a number of equal parts. Dividing the cam angular displacement into the same number of equal parts. Join the points by a smooth curve.	2	
		iii	Drawing the uniform velocity. Given data;- 300° to 360° a fall of 24. Joining from the end of the previous curve to the end of the base of the 360° mark of the graph by a straight line. Printing 'FOLLOWER DISPLACEMENT GRAPH'.	1	
	b		Locating the position of the cam centre, drawing a vertical centre line, (Label -follower line of action) and drawing the base circle. Drawing a horizontal line tangent to the base circle, on a level to the base of the cam graph. Drawing a horizontal line equal to the maximum lift of the follower. Drawing the base circle 30 mm radius, a 102 mm radius (30+72) and dividing these circles into the same number of parts to that of the graph. Labeling the radial lines divisions according to the cam rotation. Projecting the points from the graph to the follower line of action. Swinging round the cam centre from the follower line of action to the corresponding points on the radial lines. Constructing the lines representing the follower face perpendicular to the angular displacement radial lines. Drawing a smooth curve tangential to the follower face lines. Labeling the curve 'CAM PROFILE'. Drawing an arrow showing the direction of rotation of the cam.	½ ½ ½ ½ ½ ½ ½ 1 1 ½	6
				Total:	**13**
3	a		Drawing a vertical centre line in the middle of the page and copying the given Figure 3b. Dividing the circle into twelve equal parts and marking on the directing arc one-twelfth of the circumference of the rolling circle to obtain the positions of the centre of the rolling circle. (The angle subtended covered by the rolling circle may be used). Drawing the path of the centre of the rolling wheel A for 270° of rotation.	½ 1 1	6

			Plotting the locus of the point P, by drawing short 35 mm rad. arcs intersecting the arcs from the centre of the directing circle. (Check the points 3 and 9). Drawing the path of the point P for three fourths of a revolution. Writing the technical term for the path of the point P. (Epicycloid).	2 ½ ½ ½	
	b		Labelling the rolling wheel B, by numbering in an anticlockwise direction and indicating the point Q. Marking on the directing arc one-twelfth of the circumference of the rolling circle to obtain the positions of the centre of the rolling circle. (The angle subtended may be used). Drawing the path of the centre of the rolling wheel B for 450° of rotation. Plotting the locus of the point Q, by drawing short 35 mm rad. arcs intersecting the arcs from the centre of the directing circle. (Check the points 3 and 9). Drawing the path of the point Q for one and quarter of a revolution. Writing the technical term for the path of the point P. (Hypocycloid).	½ 1 1 3 1 ½	7
				Total:	**13**
4	a		Calculating the space required for the three views. Drawing the centre lines neatly and copying the two given views.	½ 1 ½	2
	b		Drawing the vertical and horizontal centre lines on the right-hand or the left-hand side of the front elevation. Drawing the end elevation of the right cone and cylinder.	½ 1 ½	2
	c		Determining the line of intersection using; Horizontal section method; Locating the points on the curve by means of drawing horizontal section planes passing through the cone perpendicular to the axis of the cone and drawing circles on the plan. The same section plane passing through the cylinder parallel to the axis represented by rectangles. The points of intersection of the circle and part of the rectangle in the plan view are projected up to the section plane in the front view.		4

			Generators on the cone. Locating the points on the curve by drawing slanting lines from the apex to the base of the cone on the front and end elevation intersecting the cylinder on the end elevation and the horizontal lines of the cylinder. Completing the curve of intersection by joining the points on the front elevation.		
	d		Projecting the points of intersection from the front elevation onto the plan. Representing the curves of intersection by bold lines.	3 2	5
				Total:	**13**
5	a		Drawing the given 200 mm x 150 mm rectangle. Dividing the rectangle into two equal parts and drawing the two centre lines as shown in Figure 5b.	½ ½	1
	b		Dividing two sides of the half of the rectangle into the same number of equal parts and numbering them. Joining the points to the vertex and drawing lines parallel to the centre line of the rectangle. Joining the intersecting points by a curve. Copy the curve on the other half of the rectangle. Constructing the parabola on the second rectangle.	1 1 1 1 4	8
	c		Marking a point A on the axis of the parabola. Constructing a perpendicular line equal in length to 2VA, (V=vertex). Projecting to the axis the intersecting point with the curve to locate the focus. Constructing a perpendicular to the axis making VA=VD. (14 mm) Labelling this line 'DIRECTRIX'.	½ 1 ½ 1	3
	d	i	Length of distance from the vertex to the focus = 14 mm.	½	1
		ii	Eccentricity of the parabola = Distance from focus/ Distance from the directix = Unity -One.	½	
				Total:	**13**
6	a		**Transition piece** Constructing the plan of the top horizontal surface of the transition piece by drawing half a hexagon and a semi-circle 110 mm radius. Drawing the given 70 mm diameter base. Projecting the elevation from the plan.	1 1	2
	b		**True lengths.** Dividing the half of the circular base into a number of equal parts, numbering each point. Joining these points to the corners and centre point on the side of the hexagon, forming	1	3

			a series of curved based triangles. Projecting the generators on the surface of the transition piece on the elevation. (Joining the top and bottom part of each quadrilateral by constructing a diagonal forming two triangles on each quadrilateral). Numbering and lettering the top and bottom of the triangles drawn. Constructing the true length of the generators by transferring plan lengths on to a horizontal line and joining to a projected vertical height.	2	
	c		**Half surface development.** Constructing half of the pattern of the transition piece by transferring the true lengths found and forming one triangle next to each other. Joining the cylindrical lower end by a smooth curve through the points obtained, the top end by a curved part and straight lines for the sides of the hexagon. Number and lettering the pattern.	3 4 1	8
				Total:	**13**

			SECTION B		
7	a		Calculating the space required for the sectional elevation and an end elevation of the complete assembly, on the size A2 drawing sheet. Item 1, Body. Drawing a neat vertical centre-line representing the centre-line of the body. Copying the outline of the front elevation of the grooved vertical column of the body, showing neat tangency for the side webs. Hatching the body, using lines lighter than the bold lines, at an angle of 45°, a small portion of the 6 mm groove and the 20 mm thick round web are not to be shown hatched.	2 ½ 3 3	19
			Item 2, Adjuster. Copying the given outside elevation of the adjuster, on the centre-line and the 28 x 16 mm square end of the adjuster resting on the base of the 175 X 114 mm face.	2 ½	
			Item 3, Block. Drawing the sectional view of the block assembled into the grooved vertical column of the body and the M24 internal thread fitted into the M24 adjuster. Hatching the adjuster in opposite direction to that of the body, using the 45° set square	3 2	
			Item 4, Rest. Drawing the given view of the rest with the 25 X 24 mm diameter cylindrical end fitted in the 24 mm diameter hole	2	

			of the block, the 34 X 24 mm flat part resting on the top of the block.		
			Drawing the horizontal section plane and printing 'SECTION X - X'	1	
	b		**End elevation of the adjustable bar rest.** Constructing the outside end view of the (i) Body, (iii) Block and (iv) Rest.		5
				Total:	**24**
8			Calculating the space required for the sectional elevation on the size A2 drawing sheet.	1	
			Item 1, Valve Body.	1	
			Drawing a neat vertical centre-line in the centre of the page, representing the centre-line of the valve.	2	
			Copying the outline of the front elevation of the valve body, including the two short centre-lines 180 mm between centres for the 20 mm diameter holes on the 25 mm thick base of the body.	1	
			Drawing the two short horizontal centre lines, on each side of the view for the 18 mm radius, of the elongated holes. Drawing the hidden detail by a continuous bold line.	1	11
			Hatching the valve body, using the 45° set square (lines lighter than the bold lines).	3	
			The two 20 mm diameter holes at the base, the 30 mm diameter hole and the two elongated holes are not to be shown in section.	1	
			Constructing a half sectional plan of the body to obtain the position of the intersection of the 18 mm radius of the elongated hole.	1	
			Item 2, Valve seat.		
			Drawing the sectional view of the brass valve seat seated on the 68 mm diameter X 18 mm step of the valve body.	2	4
			Hatching the valve seat in opposite direction to that of the valve body, using the 45° set square	2	
			Item 3, Valve.		
			Copying the mild steel valve vertically, with the tapering end resting on the countersunk hole of the valve seat.	1	
			Drawing the 20 mm end of the valve inserted in the 22 mm internal diameter hole at the top of the nut. A short portion of the valve is to be shown protruding the nut.	1	3
			The valve is Not to be shown in section.	1	
			Item 4, M86 Hexagonal Nut.		
			Drawing the M86 hexagonal nut fitted in the M86 internal diameter of the valve body. Constructing the three flats of the hexagonal headed nut.	2	3

			The M86 nut is to be drawn as an outside view.	1	
			Item 5, Spring. Representing the spring in a schematic manner fitted between the lower end of the M86 nut and resting against the 50 mm diameter face of the valve.		2
			Drawing the horizontal section plane and printing 'SECTION X - X'		1
				Total:	**24**
9	a		Calculating the space required for the sectional elevation and an end elevation of the complete assembly, on the size A2 drawing sheet. Item 1, Shaft. Drawing a neat vertical centre-line, representing the centre-line of the 60 mm diameter shaft. Copying the outline of the given front elevation of the shaft including the slot for the 50 X 8 mm key.	1 ½ 1	
			Item 2, Rectangular Key. Copying the given outside view of the key, seated in the recess key slot on the shaft.	1	
			Item 3, Bracket. Copying the bracket with the 80 mm diameter face A of the shaft in contact with the 60 mm diameter face A of the shaft. The 4 mm key slot of the bracket seated on the key. Drawing the 54 mm diameter X 50 mm cylindrical end of the bracket, including the horizontal and vertical 12 mm thick web. Hatching the bracket, using the 45° set square. The vertical web shown as an outside view.	2 1 1 2	18
			Item 4, 8 mm thick Washer. Drawing the 54 mm diameter X 8 mm thick washer 6 resting on the face of the 54 mm diameter face of the cylindrical end of the bracket.	1	
			Item 6, Wheel. Constructing the sectional elevation of the wheel, with the 54 mm diameter face of the wheel in contact with the 54 mm diameter X 8 mm washer. Hatching the wheel, in opposite direction to that of the valve body, using the 45° set square.	2 1 ½	
			Item 5, Spindle. Drawing the given elevation of the spindle, installed in the 30 mm diameter internal bore of the wheel.	1	
			Item 7, Washer.	1	

			Drawing the 48 X 3 mm thick washer in contact with the 54 mm diameter of the bracket.		
			M 24 Hexagonal nut. Constructing the three/two flats of the hexagonal M 24 nut.	 1	
			Drawing the horizontal section plane and printing 'SECTION X - X'	1	
	b		Constructing the outside end view of the (i) Shaft, (ii)Bracket, (vi) Wheel and Spindle.		6
				Total:	**24**
			SECTION C		
10	a		Constructing a planometric drawing of the toy house with the walls 60 mm high. Showing the interior of the house by eliminating (removing) the two front border walls. Constructing a planometric view of the: i) 85 x 55 bedroom; ii) 80 x 55 bedroom; iii) 135 x 55 kitchen; iv) 100 x 35 bathroom; v) 65 x 40 living room.	½ ½ 2 2 2 2 2	11
	b		Drawing the planometric views of the furnishing of the kitchen, using a personal creative design.		6
	c		Drawing the planometric views of the furnishing of one of the bedrooms, using a personal creative design.		4
	d		Rendering in colour your drawing to enhance its presentation.		3
				Total:	**24**
11	a		Writing the title of the poster 'LUZZU YACTH MARINA'		2
	b		Drawing three graphic applications to use as a mobile application to display the marina services. Presenting these drawings as shown in Figure 11a. i) Suitable theme for the three mobile applications. ii) Visual with an effective colour scheme. iii) Simple graphic application. iv) Unique applications that are not copied.	 2 2 2 2	8
	c		Drawing a bar chart on the poster showing the number of foreign yachts from 1 to 12 metres arriving in Malta between the months January and June 2018. Labelling the bar chart and the axes of the bar chart.	3 1	4
	d		Drawing a line graph showing the number of foreign yachts from 13 to 23 metres arriving in Malta between the months January and June 2018. Labelling the line graph and the axes of the line graph.	3 1	4
	e		Drawing a pie chart showing the total number of foreign yachts < 24 metres arriving in Malta between January and June 2018.	3	4

			January = 15.6° February = 10.9° March = 14^{o} April = 65.5^{o} May = 109.9^{o} March = 14^{o} April = 65.5^{o} May = 109.9^{o} June = 144.2^{o} Labelling the pie chart.	1	
	f		Finalising your designed poster by; i) Using colour and shading to render the drawing; ii) Making use of typography (fonts); iii) Forming an attractive presentation, clearly conveying the information.		2
				Total:	**24**
12	a		Constructing the picture frame 400 x 275 of the estimated one-point perspective of the sauna. Locating the position of the vanishing point (200 mm above the bottom line of the picture frame. Foreshortening of the sauna floor. Constructing the bottom and (top) upper L-shaped benches. Drawing the wood plank for the back support. Representing the brick heater.	2 1 4 6 2 3	18
	b		Representing the towel rack, the vapour-proof light fixture, and the non-slip plastic mat.		3
	c		Rendering in colour the one-point perspective drawing to enhance the presentation.		3
				Total:	**24**