UNIVERSITY OF MALTA

THE MATRICULATION CERTIFICATE EXAMINATION
ADVANCED LEVEL

GRAPHICAL COMMUNICATION &
ENGINEERING DRAWING
May 2012

MARKING SCHEME

MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD

Graphical Communication & Engineering Drawing

Paper I

Question 1 – Isometric projection

Part (i)

Constructing isometric scale, noting	
Use of 45º line for true lengths	1 mark
Use of 30º line for isometric lengths	1 mark

Part (ii)

Copying the given views in iso measurements; if not in iso award only 1 mark	2 marks
Considering suitable points in elevation (in nameplate area)	0.5 mark
Locating points in plan	4 marks
Joining points to form new curved part	1 mark
Drawing vertical line representing top edge of cut	0.5 mark

Part (iii)

Drawing top part ellipse by boxing up; if drawn by approx compass method award 1½ mark	2 mark
Transferring points assumed in nameplate area in isometric projection	3 marks
Joining points + line representing top edge of cut; if only this line is correct award only ½ mark	2 marks
Putting A at topmost point	2 marks
Correct spherical radius	1 mark

Question 2 – Palmate section

Part (i)

Copying the given views	2 marks

Part (ii)

Assuming suitable points in given plan	1
Points correctly located in auxiliary elvn; if only the top point is correct award only ½ mark	6
View correctly lined	1

Part (iii)

Good corresponding use of XY and X1Y1; points correctly located in ordinary elevation; if only the bottom squarish part is correct award 1.5 marks.	8
Correct points correctly joined	2

Question 3 – Screw threads

External 2-start LH square thread

Using a pitch of helices of 48mm; award even if the thread drawn is a vee thread	1mark
Dividing 48mm into 12 parts; award even if the thread drawn is a vee thread	1
Finding square cross-section as 12 x 12;	1
Finding root diameter and drawing corresponding plan	0.5
Drawing major diameter and its corresponding plan; award even if the thread drawn is a vee thread	0.5
Drawing four LH helices on root diameter; drawing four LH helices on major	2

diameter; If helices are wrong but their hand is correctly LH, award 1 mark.	
Lining in only those parts of the helices that show	2

Internal 2-start LH square thread

Side zigzag arranged to take mating external thread	2
Using square cross-section of 12 x 12;	1
Dividing 48 mm into 12 parts; award even if the thread drawn is a vee thread	1
Using pitch of helix = 48; award even if the thread drawn is a vee thread	1
Drawing four LH (appearing as RH) helices on root diameter; drawing four LH (appearing as RH) helices on major diameter	2
Lining in only those parts of the helices that show	2
Hatching nut material	1

Plan of threaded block

Drawing inner solid circle	1 mark
Drawing outer broken circle	1 mark

Question 4 – Oblique plane VTH

Part (a)

(i)

Copying the given VTH and line projections	1 mark
Converting the oblique plane into a perpendicular inclined plane Angle with HP = 63º	1 mark

(ii)

Locating AB on aux elvn; AB intersects with plane; Locating BC on aux elvn; BC does not intersect with plane;	1 mark 1 mark

Part (b)

Lining in AC in elvn and plan	1 mark
Locating AC on aux elvn; AC intersects with plane.	1 mark
Line of intersection found in plan	1 mark
Line of intersection found in elvn	1 mark

Part (c)

Putting in D and representing tetrahedron in elvn and plan	2 mark
Representing tetrahedron in aux elevation (1.5 mark) ; one edge is hidden (0.5 mark)	2 marks
Deriving plan corresponding to lower part of tetrahedron	4 marks
Deriving the front elevation corresponding to the plan	4 marks

Question 5 – Gears

Working out $t = 8$	1 mark
Working out $m = 8 \quad (16)$	2
Working out $pcd_w = 96mm \quad (192)$	0.5
Working out $pcd_p = 64mm \quad (128)$	0.5
Drawing the pitch circles	1

Addendum $= m = 8mm \quad (16)$	0.5
Drawing tip circles	0.5
Dedendum = $1.157m$ ($\approx$9mm) or $1.25m$ ($\approx$10mm) (18) or (20)	0.5
Drawing root circles	1
Drawing line of action at 20°	0.5
Finding base circle radii using any method. Popular methods include: • Sliding a set square along the line of action. • Setting out line through pinion centre at 20° to the vertical. • Constructing semicircle having distance between pitch point and gear centre as diameter.	1
Drawing the base circles	0.5
Drawing involutes on base circles	3
Drawing involute tooth faces using true involutes	2
Drawing tooth flanks	0.5
Evaluating tooth thickness = 12.56mm and measuring it off 12 (24)	0.5
Drawing other symmetrical tooth sides	1
Working out *root fillet radius* $= \frac{m\pi}{10} = 0.8\pi \approx 3mm$ (6)	0.5
Drawing root fillet radii	1
Drawing another tooth on each gear	2

Question 6 – Graphical Statics

Part (i)

Copying beam using requested space scale	0.5 mark
Use of Bow's notation; if notation is applied to unbroken udl, award only ½ mark.	1 mark
Constructing force diagram representing the equilibrium of 12kN/m, 10kN/m, 24kN, and equilibrant; if correct method is applied to unbroken udl award	2 marks

only 1 mark	
Use of pole and construction of polar diagram; if udl is not broken award ½ mark	1 mark
Construction of funicular diagram; if unbroken udl award only 1 mark	2 marks
Transfer of closer onto polar diagram	0.5 mark
RR≈61kN; RL≈27kN 0.5 mark x 2	1 mark

Part (ii)

Projecting horizontally levels from force diagram into respective spaces	1 mark
Joining line segments to form shear force diagram	1 marks
Distinguishing between +ve shear and –ve shear areas	2 marks

Part (iii)

Funicular diagram as bending moment diagram, not necessarily drawn w.r.t. a zero line	2 marks
Distinguishing between +ve BM and –ve BM	2 marks

Part (iv)

BM scale 25kNm/cm; Max BM at RR = 84kNm	3 marks
Nature of max BM = hogging	1 marks

Graphical Communication

Paper II

Question 1 – Estimated perspective drawing-Entrance hall.

Part (i)

Typical sketches would be generated by:

Start by taking HL in the middle of the height, VP in the middle resulting in balanced emphasis	1 mark
Taking HL shifted up, emphasising more the floor area, VP moved to the right. This is preferred to represent the spaciousness of the layout.	1 mark
Taking HL shifted down, drawing more attention to the areas in the upper half height of the room.	1 mark

Part (ii)

Representing room proportions	3
Representing viewing direction	3
Good use of paper space	3
Constructing a grid that respects the laws of perspective	6 marks
Representing the stairs	2
Representing the piano & stool	2
Representing the table	1
Representing the frames and mirror	1
Representing the doorway	2
Representing the chest of drawers	1
Representing the plant pot	1

Part (iii)

Use of a suitable colour scheme	2
Use of tone/texture	2
Suggesting sample materials	2 marks

Question 2 – Design process applied to the depiction of a set of instructions.

Part (i)

Two valid keywords/phrases are required for leaflet section 2 x 0.5 mark	1 mark
Two valid keywords/phrases are required for step 2 2 x 0.5 mark	1 mark
Two valid keywords/phrases are required for step 3 2 x 0.5 mark	1 mark
Two valid keywords/phrases are required for step 4 2 x 0.5 mark	1 mark

Part (ii)

Sketches in respect of leaflet layout	2 mark
Sketches in respect of step 2	2 marks
Sketches in respect of step 3	2 marks
Sketches in respect of step 4	2 marks

Part (iii)

Any method of effective identification is accepted	1 mark

Part (iv)

How effective is the design to convey the message	3 marks
For the use of simple quality linework	3 marks
For the use of colour, tone and texture	3 marks

Question3 – Design process applied to the production of ideogrammatic images

Part (i)

Six valid keywords/phrases are required to award full marks 6 x 0.5 marks	3 marks

Part (ii)

Minimum of 3 sketches are required	3 x 2 marks	6 marks

Part (iii)

Any method of effective identification is accepted	1 mark

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Part (iv)

How effective is the design to convey the message	4 marks

For the use of simple quality linework	4 marks
For the use of colour, tone and texture	4 marks

Question 4 – Comparison and representation of data

Part (i) 3D representation

Representing the theme of Backpacks	2 marks
Representing holding volume and its data values	2 marks
Representing no.of compartments and its data values	3 marks
Representing cost and its data values	2 marks
For the effective use of colour • Using contrasting colours for adjacent models • Using the same colour for different aspects of the same model	3 marks

Part (ii) 2D comparison

Representing the theme of Backpacks	2 marks
Representing fabric quality and its data values	2 marks
Representing shoulder strap quality and its data values	2 marks
Representing rear panel quality and its data values	2 marks
For the effective use of colour • Using contrasting colours for adjacent models • Using the same colour for different aspects of the same model	2 marks

Question 5 - Design of touristic symbols and leaflet front page

Part (a)

For each of the eight activities:

For preliminary sketch: 0.5 mark For final symbol: How effective is the symbol to represent the feature — 0.5 mark For the use of simple quality linework — 0.5 mark For the use of colour, tone and texture — 0.5 mark 8x 2 marks	16 marks

Part (b)

For front page design: How suitable and effective is the design — 3 mark For the use of simple quality linework — 1 mark For the use of colour, tone and texture — 2 mark	6 marks

Engineering Drawing

Paper II

Question 1 – Machine drawing – Tailstock

Part (i) Sectional front elevation

+ Tailstock body	
Drawing body outline	3
Hatching all,	2
Except hole in base for bolt to secure tailstock to lathe bed	1
Except webs parallel to cutting plane	1
+ Barrel	
Drawn at the correct position, 12mm from front edge of tailstock body	1
Hatching all (opposite direction),	1
Except inner bore	1
Except keyway all along the barrel	1
+ Endcap	
Hatching all (may be opposite to that on tailstock body) + outline	1
Line to represent external thread on endcap body; reptg u'cut	1
Remaining part of female matching thread in body (hatched)	1
+Bush in endcap	

Hatching all (opposite direction to that of endcap),	1
+ Handwheel	
Hatching hub area (direction opposite to that of endcap)	1
Except unfilled parts of keyway	1
Hatching cross-section of rim	1
Not hatching spokes	1
Not hatching remote rim profile	1
+ Key in leadscrew	
Key left unhatched and showing in full within local section	1
Use of curved polyline representing local section + hatching between polyline and key	2
+ Special key blocking rotation of barrel	
Key left unhatched	1
Two small sidelines inline with outermost cylindrical generators reptg bore. The space between these lines and the key is an airspace and is left unhatched.	1
+ Conical headed threaded pin	
Space must show between underside of head and surface of boss in tailstock body	1
Threaded length	1
Cupped end thrusting on special key	1
Conical head	1

<table>
<tr><td>Use of curved polyline representing local section + hatching between polyline and combination of female/male threads</td><td>1</td></tr>
<tr><td>Male thread filling female thread in pin</td><td>2</td></tr>
<tr><td>Short unfilled length of female thread must be hatched</td><td>1</td></tr>
<tr><td></td><td></td></tr>
<tr><td>+ Dead centre</td><td></td></tr>
<tr><td>Drawing dead centre unhatched</td><td>1</td></tr>
<tr><td>Aligning vertical plane C with face B of barrel</td><td>1</td></tr>
<tr><td></td><td></td></tr>
<tr><td>+ Locking handle</td><td></td></tr>
<tr><td>Drawing shank and end cup left unhatched</td><td>1</td></tr>
<tr><td></td><td></td></tr>
<tr><td>+ Leadscrew</td><td></td></tr>
<tr><td>Drawing it as outside view:
<table><tr><td>Bevelled end touching centre</td><td>1</td></tr><tr><td>Threaded length</td><td>1</td></tr><tr><td>Undercuts on either side of disc</td><td>1</td></tr><tr><td>Disc + plain length till handwheel is reached</td><td>1</td></tr><tr><td>Right (smaller dia) threaded part beyond nut</td><td>1</td></tr></table></td><td>5</td></tr>
<tr><td></td><td></td></tr>
<tr><td>+ Hexagonal nut</td><td>2</td></tr>
<tr><td>Washer</td><td>1</td></tr>
<tr><td></td><td></td></tr>
</table>

(45 marks)

Part (ii) Half left-end elevation

+ Tailstock body	
Body outline + boss at top	2
Horizontal line reptg top edge of base plate	1
First inner circle reptg corner between front face and curved profile	1
+ Barrel	
2nd inner circle reptg outside dia	1
Rectangle reptg lower half of square key	1
+ Dead centre	
Circle reptg base of conical form	1
+ Conical headed threaded pin	
Drawing lower rectangle	1
Drawing conical top	1
Showing thread extending in airspace	1
+ Locking handle	
Drawing shank and rounded form of spherical end	1
+ Handwheel	
Two concentric circles reptg rim	1
Two lines and fillets reptg spoke	1

+ General	
Vertical centreline + drawing elements projecting slightly beyond	1
Use of two sets of two horizontal lines to represent symmetrical view	1

(15 marks)

(60 marks total)

Question 2 – Limits and fits

Part (i)

Answering that such quality is achieved using systems of limits and fits	1 mark

Part (ii)

(a)	
Answering that the fact that hole tolerances sit on the zero line means that system is hole-based. In other words the lower limit of size of the hole is the basic size itself.	1 mark
(b)	
The zero line represents the hole basic size and the lower limit hole size	1 mark
(c)	
In each case the hole fundamental deviation used is the H fundamental deviation. An H fundamental deviation means a fundamental deviation of zero, such that the lower limit hole size is the basic size itself.	1 mark

Part (iii)

(a)	
Answering that H7/k6 is a transition fit	1 mark

(b)	
Getting the following limits of size:	
Hole (keyseat width)	
Max size = 5.012mm	0.5 mark
Min size = 5mm	0.5 mark
Shaft (key width)	
Max size = 5.009mm	0.5 mark
Min size = 5.001mm	0.5 mark
(c)	
Evaluating max interference = 5.009-5= 0.009mm	1 mark
Evaluating max clearance = 5.012- 5.001= 0.011mm	1 mark
Suitable sketch supporting above calculations	2 mark
Verbally, H7/k6 may be described as a 'push fit'	1 mark

Part (iv)

Evaluating 0.046mm max clearance for H8/f7	1 mark
Evaluating 0.010mm min clearance for H8/f7	1 mark
Evaluating 0.024mm max clearance for H7/g6	1 mark
Evaluating 0.004mm min clearance for H7/g6	1 mark
For choosing H8/f7	2 marks
Suitable sketch supporting above calculations	2 marks

(20 marks total)

Question 3 – Welding symbols

Figure 3.3

Drawing the following parts of the answer

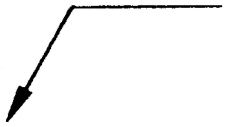
	1 mark
	0.5 mark
	0.5 mark
	1 mark
	0.5 mark
	0.5 mark

Figure 3.4

Drawing the following parts of the answer

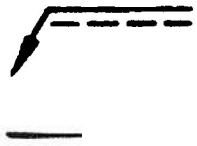
	1 mark
	2 mark

Figure 3.5

Drawing the following parts of the answer

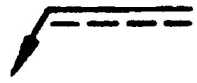
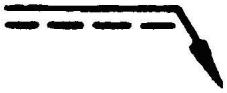
	0.5 mark
	1 mark
 with top fillet	0.5 mark
	1 mark

Figure 3.6

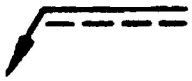
At corner 1

Drawing the following parts of the answer

	0.5 mark
	0.5 mark
	0.5 mark

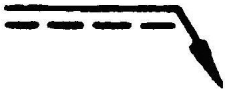
At corner 2

Drawing the following parts of the answer

	0.5 mark
 	1 mark
 with top fillet	0.5 mark

At corner 3

Drawing the following parts of the answer

	0.5 mark
	1 mark
 with top fillet	0.5 mark

At corner 4

Drawing the following parts of the answer

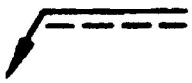
	0.5 mark
	0.5 mark
	0.5 mark

Figure 3.7

Drawing the following parts of the answer

	0.5 + 0.5 mark
	1 + 1 mark

(20 marks total)

Question 4 – Sectional views

(i) Half-section

Key features must include:

Half external view/ half in section (+ hatching)	1
A centerline must separate the two halves	1

(ii) Part section

Use of curved boundary line to define extent of local section	1
Inner details in section (+hatching)	1

(iii) Revolved section

Drawing of centerline at the point of cut	1
Whatever shows at cut is rotated through 90º and pasted at point of cut on external view (+ hatching)	1

If lines from the original external view pass through the section these should be removed for the lengths affected.	1

(iv) Section staggered across parallel planes

Lines resulting from corners of staggered cutting plane are not represented (+ hatching)	1
Corners of staggered cutting plane should be drawn in double thickness	1
Part sections resulting from different parts of the cutting plane are aligned in one plane.	1

(v) Sections bent through an angle

Line resulting from bent form of cutting plane is not represented (+ hatching)	1
Areas cut by bent part of cutting plane are first swung onto the vertical plane and then projected normally	2
Corners of bent cutting plane should be drawn in double thickness	1

Proper drawing of ends of cutting planes	2
Proper hatching at 45º at proper spacing	2
Proper use of centrelines	2

(20 marks total)