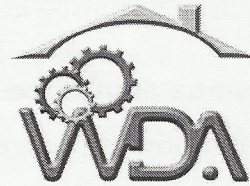


**CEL 2 & ETL 2 :
Technical Drawing and
Knowledge of Materials**

T097

**Tuesday, 05/11/2013
1:30 - 4:30 PM**

WORKFORCE DEVELOPMENT AUTHORITY



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**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2013,
TECHNICAL AND PROFESSIONAL TRADES**

**EXAM TITLE : Technical Drawing and Knowledge of
Materials**

OPTIONS:

- Computer Electronics (CEL)
- Electronics and Telecommunication (ETL)

DURATION: 3 hours

INSTRUCTIONS:

The paper contains **three (3)** sections :

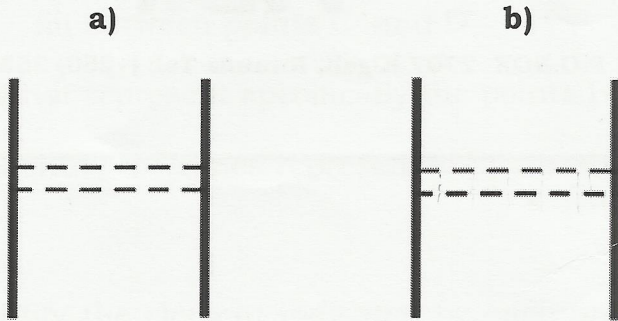
Section I: Sixteen (16) questions, all **Compulsory**; **55marks**

Section II: Five (5) questions, **Choose any three (3)**; **45marks**

Section III: Two (2) questions, **choose any ONE (1)** **15marks**

Section I: Attempt all the 12 questions 55marks

- 01. An object placed in natural position, which side of that object is preferred for the front view? **1mark**
- 02. How dimensions should be placed on isometric drawing? **2marks**
- 03. Which of the following representation is correct and why? **2marks**



- 04. Where should the left side view be placed with reference to the front view? **2marks**
- 05. Describe steel materials. **2marks**
- 06. Identify different factors affecting material properties. **3marks**
- 07. Identify different types of metal and non-metallic materials. **4marks**
- 08. Identify different types of Steel. **4marks**
- 09. Identify four (4) the main alloying elements in cast irons. **4marks**
- 10. Given the standard size of A0 drawing sheet in mm (1189X841) find quickly the size of A1, A2, A3 and A4. **4marks**
- 11. Identify different types of cast iron. **5marks**
- 12. Identify five (5) different physical properties of materials. **5marks**
- 13. Identify five (5) different mechanical properties of materials. **5marks**
- 14. How does a working drawing differ from a picture drawing of an object? **6marks**
- 15. Determine the correct and incorrect dimensioning in the following: **6marks**

d)	
e)	
f)	
a)	
b)	
c)	

Handwritten calculations for question 10:

$$\begin{array}{r} 1189 \\ 841 \\ \hline 348 \end{array}$$

$$11 \begin{array}{r} 71310 \\ 841 \\ \hline 348 \\ \hline 493 \end{array}$$

1189 x 841
840 x 493
492 x

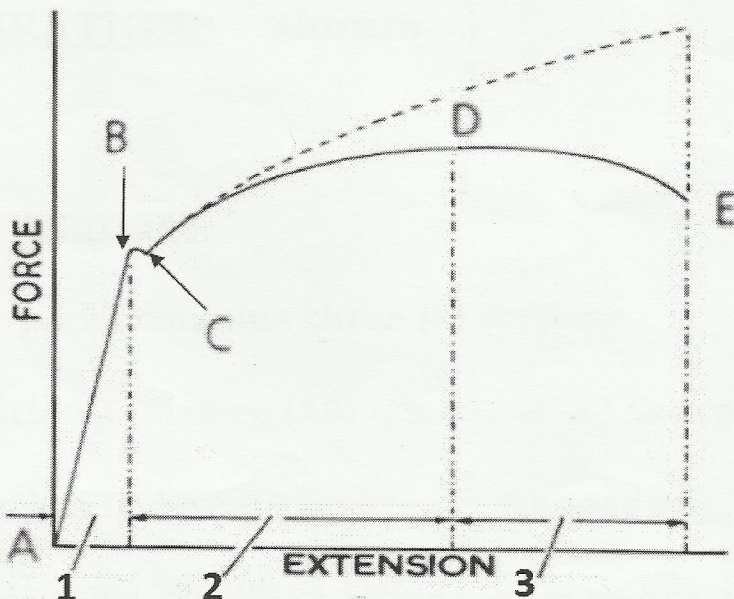
Section II: Choose and Answer any three (3) questions 30marks

16. Calculate the modulus of elasticity (in GPa) for a material which produces the following data when undergoing test : Applied load = 50 kN, Cross-sectional area = 25mm², Gauge length = 20 mm, Extension = 0.2 mm. **10marks**
17. a) What is stainless steel? **2marks**
b) Describe the characteristics of different types of stainless steels? **8marks**
18. Identify plastics in the following list of materials : **10marks**
Polyethylene, carbon fibre, polypropylene, polyvinyl chloride, porcelain, epoxies, alkyds, glass, polyesters, nylon, concrete, acrylic, Bakelite, PTFE, GRP.
19. a) Define corrosion and identify factors on which it depends. **6marks**
b) Identify four (4) different types of protection from corrosion. **4marks**
20. a) Determine the drawing instrument used to perform the following tasks : **4marks**
i) To draw lines at 30°, 60° and 45° to the vertical and horizontal.
ii) To mark or measure angles between 0 and 360°.
iii) To fix the Drawing sheet on the Drawing board.
iv) To draw circles and arcs of circles.
- b) Identify the characteristics of the most used type of projection in technical drawing. **6marks**



Section III : Choose and Answer any one (1) question 15marks

21. Consider the following Load-extension curve for X metal and answer to the questions:



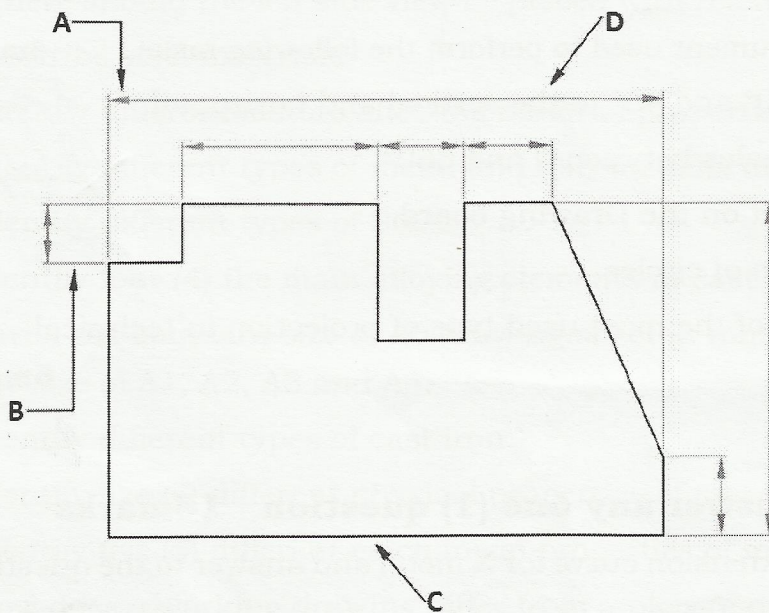
a) Describe briefly the behavior of the metal X by specifying the relationship between extension and load, corresponding property and the behavior of X if the load is removed : **8marks**

- i) Between points A and B
- ii) Between points B and C
- iii) Between points C and D

b) What represent specifically the points B, C, D and E? **4marks**

c) Identify the zones represented by numbers 1, 2 and 3 on the curve. **3marks**

22. Identify the element indicated by each one of letter A, B, C and D on the drawing bellow and give for each element its characteristics. **15marks**



SECTION I

Do not
write in
this margin

- (1) It is the side that shows clearly the most detail for the front view. 1
-
- (2) Dimensions on isometric drawing should be placed so as to read from left to right or from bottom to up. 2
-
- (3) The correct is (b). 1
Because the stocks of parallel hidden lines relatively close should be staggered. 2
-
- (4) * The left side view is placed directly opposite and in line with the front view.
* The ~~left~~ side In the first angle projection, the left side view is placed on the right side from front view. 2
* In the third angle projection, the left side view is placed the left side from the front view.
-
- (5) Steel is alloy of iron and carbon, containing up to 1.5% of carbon. 2
-
- (6) Factors affecting material properties = 3
- Heat treatment 1
- Processing 1
- Environment reaction 1
-
- (7) Metal materials 4
* Ferrous metals 1
* ~~Natural~~ Nonferrous metals 1
Non metallic materials =
* Synthetic materials 1
* Natural materials 1

(8) Types of steel:

- Carbon steel (low) 1
- Carbon steel (medium) 1
- Carbon steel (high) 1
- Carbon steel (alloy) 1
- Carbon steel (extra high) 1
- Carbon steel (Very Low) 1

check only 4

4

(9) Main alloying element in cast irons:

- Nickel 1
- Chromium 1
- Copper 1
- Vanadium 1
- Molybdenum 1

check only 4

4

(10) $A_0: 1189 \times 841$ (Given)

The big size of A_1 is the half of big size of A_0 ,
and so on.

$$A_1: 841 \times 594 \text{ A}$$

$$A_2: 594 \times 420 \text{ A}$$

$$A_3: 420 \times 297 \text{ A}$$

$$A_4: 297 \times 210 \text{ A}$$

4

(11) Types of cast iron:

- Grey cast iron 1
- White cast iron 1
- Malleable cast iron 1
- High-duty cast iron 1
- Alloy cast iron 1

5

(12) Physical properties of materials

- Density 1
- Electrical conductivity 1
- Melting temperature 1
- Thermal conductivity 1
- Fusibility 1
- Reluctance or magnetic properties 1
- Temperature stability 1

choose only 5

5

(13) Mechanical properties of materials

- Tensile strength (TS) 1
- Toughness 1
- Malleability 1
- Hardness 1
- Ductility 1
- Stiffness 1
- Brittleness 1
- Elasticity 1
- Plasticity 1

choose only 5

5

(14) Working drawing of an object picture drawing of an object

- | | |
|---|--|
| <ul style="list-style-type: none"> - Object is viewed from many points - All parts (edges, surfaces...) are shown in their true shape and size 1 - We have many views 1 - Technical drawing type 1 - Use drawing instruments 1 | <ul style="list-style-type: none"> - Object is viewed from one point - Different parts (edges, surfaces...) are not shown in their true shape, proportion or relative size 1 - We have one view 1 - Artistic drawing type 1 - Use free hand or model drawings 1 |
|---|--|

choose 3 point on each side

6

- (15)
- (a) Incorrect 1
 - (b) Correct 1
 - (c) Incorrect 1
 - (d) Correct 1

- (e) Incorrect 1
- (f) Correct 1

6

SECTION II

Do not
write in
this margin

(16) Given data:

- Applied load: 50kN
- Cross-sectional area: 25 mm²
- Gauge length = 20 mm
- Extension = 0.2 mm

$$E = \frac{\text{Stress}}{\text{Strain}} \quad 1$$

$$\text{Where, Stress } (\sigma) = (\text{load} / \text{cross-sectional area}) \quad 1$$

$$= \frac{50\text{kN}}{25\text{mm}^2} \quad 1$$

$$= 50 \times 10^3 / 25 \times 10^{-6} \text{ m}^2 \quad 1$$

$$= 2 \text{ GPa} \quad 1$$

$$\text{Strain } (\epsilon) = (\text{Extension} / \text{original length}) \quad 1$$

$$= (0.2\text{mm} / 20\text{mm}) \quad 1$$

$$= 0.01 \quad 1$$

$$\text{Thus, } E = (2\text{GPa} / 0.01) \quad 1$$

$$= 200\text{GPa} \quad 1$$

(17)(A) stainless steel: Alloy steel in which the alloy element (chromium) exceeds 12%

(B)

Type of stainless steel	Characteristics
- Ferritic stainless steels	- Contain between 12-25% of chromium - Less than 0.1% of Carbon
- Martensitic stainless steel	- Contain between 12-18% of Chromium - Carbon from 0.1 to 1.5%
- Contain Austenitic steel	- Contain both chromium and Nickel

(18) Plastic materials:

- Polyethylene 1
- Polypropylene 1
- Polyvinyl chloride 1
- Epoxies 1
- Alkyds 1
- Polyesters 1
- Nylon 1
- Acrylic 1
- Bakelite 1
- PTFE 1

10

If he tries to check all 5 marks

(19) (A)

* Corrosion: Is the slow but continuous eating away of metallic components by chemical or electrochemical attack

* Corrosion depends on:

- The metal from which the component is made
- The protective treatment the component surface receives
- The environment in which the component is kept

10

(B) Types of the protection from corrosion

1. Use of a metal or alloy which is inherently corrosion resistant 1
 2. Protection by metallic coatings 1
 3. Protection by other non metallic coating 1
 4. Protection by oxide coating 1
 5. Cathodic protection 1
- Choose only 4

(20) (A) 1. Set squares 1

2. Protractor 1

3. Drawing pins and clips 1

4. Compass 1

(B) The most used type of projection in technical drawing is orthographic projection

Its Characteristics are:

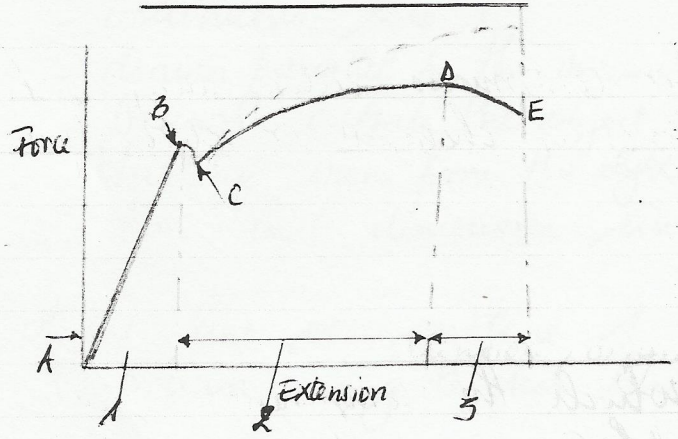
- help to record the shapes of objects of exactly and completely.
- is a two dimensional (2-D) drawing.
- It shows only one side of an object and two of its overall dimensions.
- A minimum of two views is required to show the three dimensions of any object and describe its shape completely.
- All views are drawn separately.

10

Check only 4

SECTION III

(21)



(A) 1. Between A and B

- Extension is proportional to the applied load.
- If the load is removed the specimen returns to its original length.
- The material is showing elastic properties.

(2) Between B and C

- The metal extends with no increase in load.
- If the load is removed at this point the metal will not spring back to its original length.

15

(3) Between C and D

- The extension is no longer proportional to the load.
- If the load is removed, little or no spring back will occur.
- The material is showing plastic properties.

(B) Different points:

- (B) represent the limit of proportionality
- C = is called yield point
- d) = is represent ultimate tensile strength.

E: at point E the metal breaks

- (C) Zones: (A) represent elastic zone
(B) represent the uniform plastic elongation
(C) represent the necking zone

(22) (A) Arrow head 1

- must be 3mm long and 1mm wide 1
- Can be open or solid 1
- Must always touch the extension line 1

(B) Extension line 1

- continuous line 1
- drawn parallel to the measurement shown 1
- Drawn outside the object 1
- starting 1mm from the object and extending 2mm from the last dimension line 1

15

(C) object line or outline 1
- drawn using thicker line 1

(D) Dimension line 1

- Thin continuous line 1
- drawn 10mm from the object line 1
- All dimensions should be readable in only two dimensions 1