



امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي - الأول الدور الأول - للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الهندسة الميكانيكية.
- الأسئلة في (٦) صفحات.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (▭) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

▭ القاهرة ▭ الدوحة

■ مسقط ▭ أبوظبي

ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▭ ◉ ◒ ☒ ☑

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Multiple Choice Items (1–6) (6 marks)

Shade in the bubble the correct answer for each question.
Each Question carries one mark each.

1) Acidity is one of the qualities of _____ properties.

- ○ Mechanical
- ○ Electrical
- ○ Chemical
- ○ Thermal

2) In which of the following test a diamond pyramid is pressed into the material under a set load and the indentation is measured.

- ○ Rockwell test
- ○ Compression test
- ○ Brinell test
- ○ Vickers test

3) Polymers are formed by a _____ reaction.

- ○ Polymerization
- ○ Characterization
- ○ Pollination
- ○ Elimination

4) Identify the application of Elastomers from the following.

- ○ Cable covers
- ○ Furniture
- ○ Automobile tubes
- ○ Switches

5) Some material gets hard while machining, which is known as _____.

- ○ Turning
- ○ Work hardening
- ○ Tempering
- ○ Metal forming

6) In the micro-structure of grey cast iron the white phase is called as _____.

- ○ Pearlite
- ○ Graphite flakes
- ○ Martensite
- ○ Ferrite

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Question two: Extended questions (7–15) (24 marks)

Answer all the questions in the space provided

7) Define the following hardness tests. (2 marks)

a. Brinell test:

b. Rockwell test:

8) Write any four important characteristics of Aluminum. (2 marks)

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Extended Questions: continued

9) Write about the following engineering ceramics. (2 marks)

a. Oxides:

b. Nitrides:

10) Write in brief about Composites. (2 marks)

11) State four advantages of annealing process. (2 marks)

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Extended Questions: continued

12) Write in brief about metallography. (2 marks)

13) Define the non-ferrous metals and state the main characteristics. (4 marks)

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Extended Questions: continued

14) a. Write the formulae(rules) for the following. (2 marks)

i) Young Modulus:

ii) Percentage elongation:

b. Define the following mechanical properties in brief. (2 marks)

i) Malleability:

ii) Plasticity:

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Extended Questions: continued

15) **a**. Mention any two advantages and disadvantages of the hardening process. (2 marks)

Advantages:

1.

2.

Disadvantages:

1.

2

b. What is tempering process. Explain in brief the process. (2 marks)

[End of Examination]

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GENERAL EDUCATION DIPLOMA EXAMINATION

Royal Guard of Oman Technical College,

Mechanical Engineering

First semester, 1st Session, 2024/2025

Note: the marking guide in (6) pages | Full marks: (30)

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(6 marks)

Item	Answer	Answer	Mark	C.L	page
1	c	Chemical	1		
2	d	Vickers test	1		
3	a	Polymerization	1		
4	c	Automobile tubes	1		
5	b	Work Hardening	1		
6	d	Ferrite	1		

ANSWERS TO EXTENDED QUESTIONS :(24 marks)

Item	Answer	Mark	C.L	Page
7	Brinell test: a) **Brinell Test:** A hard steel ball is pressed into the material under a set load and the indentation is measured.	1		
	b) **Rockwell test:** A diamond or tungsten carbide ball is pressed into the material under a set load and the indentation is measured.	1		
8	• Lightweight (one-third the weight of steel) • High thermal and electrical conductivity • Excellent corrosion resistance • Non-toxic • Soft and ductile Note: The student can answer any of the four characteristics.	2		

Item	Answer	Mark	C.L	Page
9	a) Oxides: Alumina has high thermal and electrical resistance used as a cutting tool and high quality thermal and electrical insulation.	1		
	b) Nitrides: Silicon nitrides and boron nitrides used in engine parts and cutting tools	1		
10	Composites: A composite material is made from two or more materials with significantly different physical or chemical properties that, when combined, produce a material with characteristics different from the individual components. In composites, the different materials remain separate throughout the processing cycle.	2		
11	Advantages of annealing process: • Material becomes soft and uniform grain structure. • Material becomes easy to cut. • Material Internal stresses become less. • Material Ductility improves	2		

Item	Answer	Mark	C.L	Page
12	Grey Cast iron: The white phase is called Ferrite and the black phase is graphite flakes. Grey cast Iron is self-lubricating material because of the presence of graphite flakes in its structure. Graphite acts like oil (lubricant) hence no oil is required to lubricate it when there are contact surfaces. It is one of the reasons why grey cast iron is suitable for making machine tool beds.	2		
13	Nonferrous metals contain a metal other than iron as their main constituent, e.g. copper, aluminum, lead, magnesium, and nickel. Their main characteristics are: · Light-weight · High thermal and electrical conductivity · Excellent corrosion resistance · Non-toxic · Soft and ductile for ease of fabrication	2 2		

Item	Answer	Mark	C.L	Page
14a.	**Young Modulus:** $\frac{\text{Stress}}{\text{Strain}}$ $E = \frac{\sigma}{\varepsilon}$ **Elongation Percentage:** $\varepsilon\ (\%) = \frac{L_f - L_0}{L_0} x100$	2		
14b.	1. Malleability: Materials that can change shape under a compressive force (e.g. being hammered) are malleable materials.	1		
	2.Plasticity: If the value of stress is more than a set limit, the material will not regain its original shape and size on removal of stress or force. This type of behavior is known as plasticity.	1		

Item	Answer	Mark	C.L	Page
15	Advantages: • Hardness improves • Strength improves Disadvantages of hardening: • More inside stresses. • More brittleness. • Cracks form.	2		
16	Tempering: After the hardening treatment is applied, steel is often harder than needed and is too brittle for most practical uses. Also, severe internal stresses are set up during the rapid cooling from the hardening temperature. To relieve the internal stresses and reduce brittleness, the steel should be tempered after it is hardened.	2		

End of Marking Guide





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الفصل الدراسي الأول - الدور الثاني - للعام الدراسي ١٤٤٦ / ١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

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● مسقط ○ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ▭ ◉ ◒ ✗ ✓

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Section A: Multiple Choice Items (6 marks)

There are 6 multiple-choice items worth one mark each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1. Which one of the following qualities is classified under electrical properties?

- ⬭ Toughness.
- ⬭ Alkalinity.
- ⬭ Density.
- ⬭ Resistivity.

2. Which one of the following hardness test refers to using Brinell hardness test equipment?

- ⬭ A hard steel ball is pressed into the material under a set load and the indentation is measured.
- ⬭ A diamond pyramid is pressed into the material under a set load and the indentation is measured.
- ⬭ A diamond or tungsten carbide ball is pressed into the material under a set load and the indentation is measured.
- ⬭ A diamond or tungsten carbide pyramid is pressed into the material under a set load and the indentation is measured.

3. Which one of the following is **not** a ferrous alloy?

- ⬭ Plain carbon steel.
- ⬭ Grey cast iron.
- ⬭ Copper.
- ⬭ Alloy steel.

4. Automobile body parts are usually made from:

- ⬭ Low carbon steel.
- ⬭ Medium carbon steel.
- ⬭ High carbon steel.
- ⬭ High speed steel.

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5. Which one of the following does **not** refer to the objectives of the heat treatment process?

- ☐ Increase strength, hardness and wear resistance.
- ☐ Decrease ductility and softness.
- ☐ Increase toughness.
- ☐ Remove internal stresses induced.

6. In _____ steel both Ferrite content and Pearlite content is equal.

- ☐ High carbon.
- ☐ Low carbon.
- ☐ Medium carbon.
- ☐ High speed.

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Section B: Extended questions (24 Marks)

Answer all the questions in the space provided.

7) What is tensile strength? Which apparatus is used to measure tensile strength? (2 marks)

8) Define the following properties of material. (2 marks)

a. Elasticity.

b. Malleability.

9) What is cast iron? Mention four classifications of cast iron. (2 marks)

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Extended Questions: continued

10) Write any four main characteristics of non – ferrous metals. (2 marks)

11) What is work hardening? Which heat treatment process is used to overcome this problem. (2 marks)

12) Describe the microstructure of grey cast iron. (2 marks)

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Extended Questions: continued

13) **a.** Draw stress strain curve diagram and locate the following points on it.

1. The upper yield stress point.

2. The lower yield stress point.

3. Ultimate stress point.

4. Breaking or rupture point. (2 marks)

b. What is the toughness of a material? Name any two tests to measure the toughness of material. (2 marks)

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Extended Questions: continued

14) a. Name any two copper alloys with their combinations and mention any two of their applications. (2 marks)

b. What are carbon fibers? Mention their properties. (2 marks)

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Extended Questions: continued

15) a. What is an annealing process? (2 marks)

b. Write any two advantages and disadvantages of hardening process. (2 marks)

[End of Examination]

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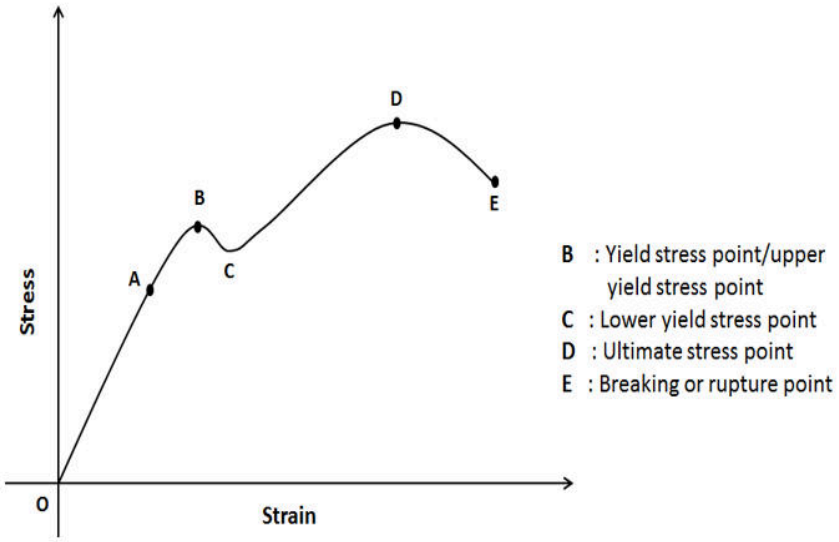
Note: the marking guide in (6) pages **Full marks: (30)**

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(6 marks)

Item	Answer	Answer	Mark	C.L	page
1	d	Resistivity	1		
2	a	A hard steel ball is pressed into the material under a set load and the indentation is measured.	1		
3	c	copper.	1		
4	a	Low carbon steel	1		
5	b	decrease ductility and softness	1		
6	c	Medium carbon steel.	1		

ANSWERS TO EXTENDED QUESTIONS :(24 marks)

Item	Answer	Mark	C.L	Page
7	It can be described as resistance of material to fracture during tension. Tensile test is performed on a Universal Testing machine (UTM).	2		
8	a. lasticity: Defined as property of the material to regain its original shape and size after deformation when the external forces are removed.	1		
	b. Malleability: Materials that can change shape under a compressive force (e.g. being hammered) are malleable materials.	1		
9	Ferrous alloys with greater than 2% carbon are called as Cast Iron. Classification of cast irons: 1. Gray iron 2. Ductile iron 3. White iron 4. Malleable iron	2		
10	1. Lightweight 2. High thermal and electrical conductivity 3. Excellent corrosion resistance 4. Non-toxic 5. Soft and ductile for ease of fabrication **(any Four from above)**	2		

Item	Answer	Mark	C.L	Page
11	Some material gets hard while working on them e.g. (when machining). This is known as **work hardening.** The material at this stage cannot be worked on as they hard and brittle so they can break easily. In order to continue working on the material it must go through annealing process to be ductile again.	2		
12	The white phase is called Ferrite and the black phase is graphite flakes. Grey cast Iron is self-lubricating material because of the presence of graphite flakes in its structure. Graphite acts like oil (lubricant) hence no oil is required to lubricate it.	2		
13		2		

Item	Answer	Mark	C.L	Page
14	The toughness of a material is its ability to absorb energy before fracturing. It is also the resistance of shock loading. The toughness of materials can be measured using. 1. Izod Test 2. Charpy Test	2		
15	**a.** The important copper alloys are: 1. Brass (copper-zinc alloy) 2. Bronze (copper-tin alloy) 3. Gun-metal (copper-tin-zinc alloy) Applications: 1. power cables, 2. motor windings, 3. printed circuit boards (PCB), 4. cooking utensils.	2		

Item	Answer	Mark	C.L	Page
15	**b.** The carbon fibers are made by heating man - made fibers (polyacrylonitrile) to high temperatures that then turn into carbon. These fibers have high strength but need to be made into composite with resin to give rigidity and other properties. Properties of Carbon fiber: 1. High strength 2. Low weight 3. Fire resistance 4. Corrosion resistance	2		
16	**a.** It is a softening process in which iron base alloys are heated above the transformation range, held there for a certain time and then cooled slowly. The cooling method depends on the metal and the properties desired. Some metals are furnace cooled, and others are cooled by burying them in ashes, lime, or other insulating materials	2		

Item	Answer	Mark	C.L	Page
16	**b.** Advantages of hardening: 1. Hardness improves 2. Strength improves Disadvantages of hardening: 1. More inside stresses. 2. More brittleness	2		

End of Marking Guide