



امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي الثاني - 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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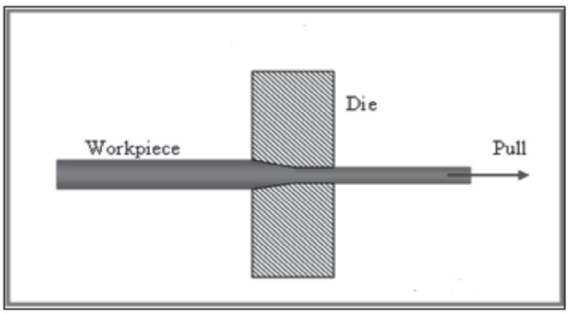
Multiple Choice Items (1–6) (6 marks)

Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Generally, the recrystallization temperatures of metals are around _____ times their melting point temperature.

⬭ 0.1 to 0.2
⬭ 0.3 to 0.6
⬭ 0.8 to 0.9
⬭ 0.9 to 1.0

2) What is the name of the process shown in the figure below?



⬭ Air bending
⬭ Rolling
⬭ Hot forging
⬭ Drawing

3) Which of the following processes is used for the joining of dissimilar metals?

⬭ Brazing
⬭ Soldering
⬭ Welding
⬭ Turning

4) Which one of the following is an example of fusion welding?

⬭ Extrusion
⬭ Arc and Gas welding
⬭ Brazing
⬭ Soldering

5) The tolerance level of _____ can be achieved by the lapping process.

⬭ 0.05 mm
⬭ 0.0005m
⬭ 0.0005mm
⬭ 0.5cm

6) Which of the following is an advantage of CNC machines?

⬭ More expensive
⬭ Human errors
⬭ Highly skilled people required
⬭ One person can supervise many CNC machines once they are programmed.

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Extended Questions (7–15) (24 marks)

Answer all the questions in the space provided.

7) Define the following terminology related to rolling process. (2 marks)

a. Bloom: _____

_____

b. Billet _____

_____

8) Write briefly about closed or impression die forging. (2 marks)

_____

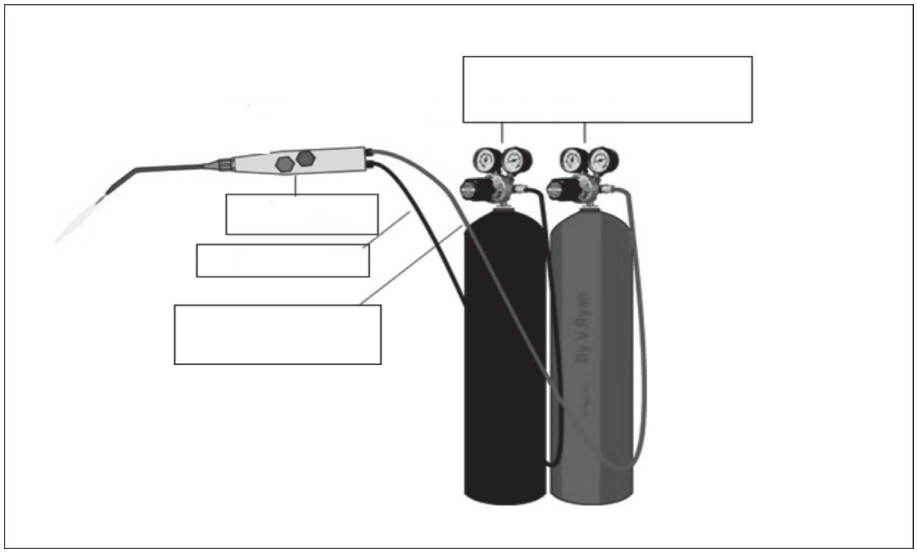
_____

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_____

_____

9) Identify the names of the parts in the blocks provided for the Gas welding process shown below. (2 marks)



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Extended Questions: continued

10.) Identify and explain briefly the process which increases the thickness of the natural oxide layer of metals. (2 marks)

11) Write briefly the information about computer numerical control (CNC) machines and give names of any two CNC machine tools. (2 marks)

12) Write two advantages of CNC machines. (2 marks)

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Extended Questions: continued

13) Explain the classification of rolling mills based on the number of rolls and their arrangement. (4 marks)

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Extended Questions: continued

14) Explain briefly soldering and brazing processes and write two advantages of soldering and brazing processes. (4 marks)

	Soldering processes	Brazing processes
Brief explanation		
Advantages	1- 2 -	1- 2 -

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Extended Questions: continued

15. Describe the following surface finishing processes: (4 marks)

a. Galvanizing process:

b. Honing process:

[End of Examination]

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GENERAL EDUCATION DIPLOMA EXAMINATION

Royal Guard of Oman Technical College,

Mechanical Engineering

2nd Semester, 1st Session 2024-2025

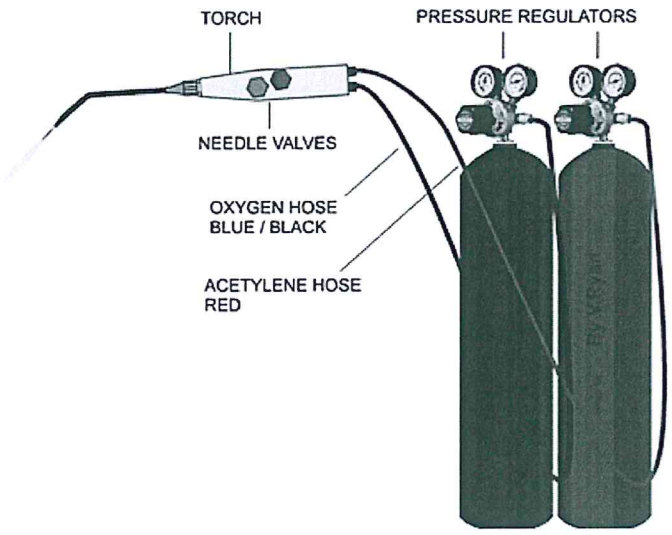
سلطنة عمان
وزارة التربية والتعليم

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

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(6 marks)

Item	nswer	Mark	C.L	page
1	0.3 to 0.6	1		3
2	Drawing	1		18
3	Brazing	1		27
4	Arc and Gas welding	1		22
5	0.0005mm	1		29
6	One person can supervise many CNC machines once they are programmed.	1		34

ANSWERS TO EXTENDED QUESTIONS :(24 marks)

Item	Answer	Mark	C.L	Page
7	**Bloom**: It is the product of the first breakdown of ingot. (Cross sectional area > 230 cm2) **Billet**: It is the product obtained from further reduction by hot rolling. (Cross sectional area> 40 X 40 mm2)	1 1		5 and 6
8	In closed or impression-die forging, the metal is placed in a die resembling a mold, which is attached to an anvil. Hammer is dropped on the workpiece, causing the metal to flow and fill the die cavities. Flash is an excess metal that must be trimmed off later.	2		11
9	 **½ marks each**	2		24

Item	Answer	Mark	C.L	Page
10	**Anodizing is the process which increases the thickness of the natural oxide layer of metals.** Increasing the layer will cause an increase in corrosion resistance, wear resistance and better surface to be painted. **OR** Aluminium is ideally suited to anodizing, although other nonferrous metals, such as magnesium and titanium, also can be anodized.In this process metal is coated with an oxide layer. **OR** Aluminium is put in the sulfuric acid solution. Then DC current is allowed to flow.At this point Aluminium oxide layer forms on the surface.	1 1		32
11	**COMPUTER NUMERICAL CONTROL (CNC) MACHINES** Computer numerical control (CNC) is a computer "controller" that reads G-code and M-code commands and drives a machine tool, a powered mechanical devicetypically used to fabricate components by the selective removal of material. **Some of the CNC machine tools are:** **(any two each ½ marks)** • CNC Turning Centers • CNC Drilling Machines • CNC Milling Centers • CNC Grinders • CNC Bending Machines	1 1		33

	Answer	Mark	C.L	Page
12	1. CNC machines are programmed with a design which can then be manufactured hundreds or even thousands of times. Each manufactured product will be the same. 2. Less skilled/trained people can operate CNC machines unlike manual lathes / Milling machines etc. which need skilled engineers. 3. No human errors 4. One person can supervise many CNC machines as once they are programmed; they can usually be left to work by themselves. Sometimes only the cutting tools need replacement occasionally. **(Any two from the above 1 mark each)**	2		34
13	Rolling mills can be classified, based on the number of the rolls and their arrangement to: ▪ **Two–high rolling mill:** consists of two opposing rolls. These rolls may rotateonly in one direction (non-reversing) or in two directions (reversing). ▪ **Three–high rolling mill:** allows a series of reductions without the need tochange the rotational direction of the rolls ▪ **Four–high rolling mill:** Using small rolls reduces power consumption butincreases ▪ **Cluster rolling mill:** In a cluster rolling mill, each working roll is backed upby two large back-up rolls giving more support and rigidity to the workingrolls.	1 1 1 1		8

Item	Answer	Mark	C.L	Page
14	**Soldering:** Soldering is a joining process in which a filler metal (solder) with melting point notexceeding 450 oC is melted and distributed between the surfaces of the metal parts being joined. Though soldering obtains a good joint between the two plates,the strength of the joint is limited by the strength of the filler metal used. In this method, there is no melting of the base metals occurs, but the filler metal wets and combines with the base metal to form a metallurgical bond. **ADVANTAGES OF SOLDERING: (any two each ½ marks)** • Low energy input relative to brazing and fusion welding • Variety of heating methods available • Good electrical and thermal conductivity in the joint • Easy to repair and rework. **BRAZING PROCESS:** Brazing is a joining process in which a filler metal is melted and distributed by capillary action between the surfaces of the metal parts being joined without melting the base metal. Filler material (brazing metal) used for brazing has a melting temperature above 450°C and below the melting point of the base metalsto be joined. Dissimilar metals, such as stainless steel to cast iron can be joined bybrazing. **ADVANTAGES OF BRAZING: (any two each ½ marks)** • Any metals can be joined, including dissimilar metals • Certain brazing methods can be performed quickly and consistently. • Brazing can be applied to join thin-walled parts that cannot be welded. • In general, less heat and power are required than in fusion welding	1 1 1 1		26,27

Item	Answer	Mark	C.L	Page
15	**Galvanizing:** Galvanizing is a process of coating steel sheets, steel pipes and steel wires with a layer of zinc. The layer of zinc protects the steel item from corrosion and rusting by sacrificing itself. **Honing process:** Honing is a low velocity abrading process. Material removal is accomplished at lower cutting speeds than in grinding. Therefore, heat and pressures are minimized, resulting in excellent size and geometry control. The most common application of honing is on internal cylindrical surfaces. Machining a hole to less than 0.0001 mm in diameter and maintaining true roundness and straightness.	2 2		32

End of Marking Guide





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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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Section A: Multiple Choice (Items 1 - 6) (6 Marks)

Shade in the bubble (⬭) next to the correct answer for each of the following items.

1) The forming process in which two rolls are arranged one above the other, rotating in opposite directions is called:

⬭ Cluster rolling mill
⬭ Tandem rolling mill
⬭ Two-high rolling mill
⬭ Four-high rolling mill

2) What is the joining process which uses filler metal that melts below 450°C?

⬭ Brazing
⬭ Welding
⬭ Soldering
⬭ Arc welding

3) The surface finishing method which deposits a thin metal layer using electricity is called:

⬭ Honing
⬭ Lapping
⬭ Grinding
⬭ Electroplating

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Section A continued

4) Which of the following is a disadvantage of CNC machines?

- ☐ Reduced human errors
- ☐ Higher operational cost
- ☐ Uniformity in production
- ☐ Mass production capability

5) Which bending process forms a bend without the punch touching the bottom die?

- ☐ Bottoming
- ☐ Air bending
- ☐ Press forging
- ☐ Drop forging

6) What is the key advantage of brazing over welding?

- ☐ Stronger joints
- ☐ Use of mechanical fasteners
- ☐ Ability to join dissimilar metals
- ☐ Lower melting temperature than soldering

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Section B: Extended Response (Items 7-15) (24 Marks)

Answer all the questions in the space provided.

7) State the main difference between hot and cold working in metal forming. (2 marks)

8) Describe in brief a rolling process. (2 marks)

9) What is the difference between soldering and brazing? (2 marks)

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Section B continued

10) What is solid state welding? (2 marks)

11) What is the honing process? State **ONE** application of it. (2 marks)

12) State **TWO** advantages of a CNC machine. (2 marks)

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Section B continued

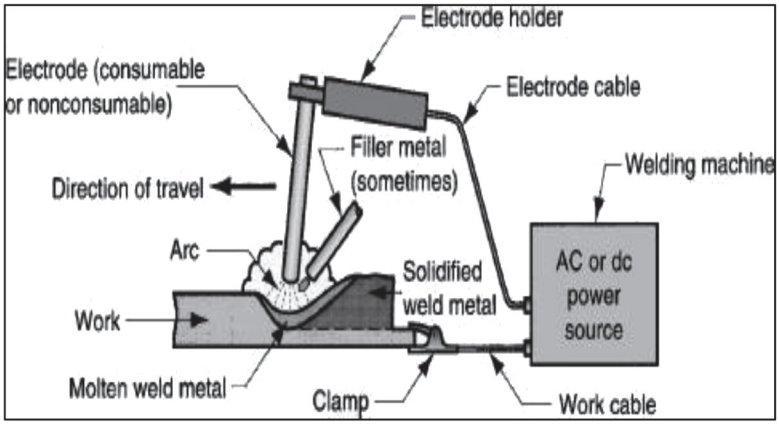
13) Explain the differences between hot rolling and cold rolling processes. (4 marks)

Hot rolling processes	
Cold rolling processes	

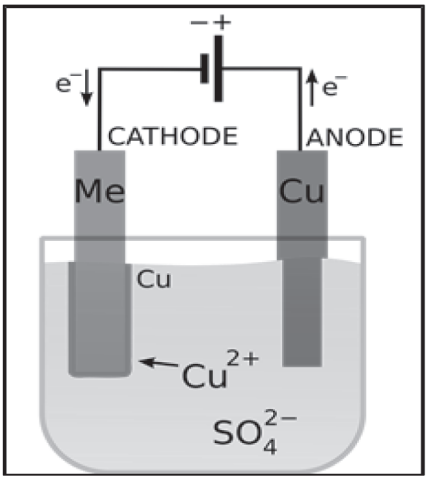
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Section B continued

14) With the help of the below neat sketch. explain an arc welding process. (4 marks)



15) With the help of the below neat sketch. explain an electroplating process. (4 marks)



[End of Examination]

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مركز القياس والتقويم التربوي
The Center for Educational Assessment and Measurement (CEAM)

GENERAL EDUCATION DIPLOMA EXAMINATION

Royal Guard of Oman Technical College,

Mechanical Engineering

2nd Semester, 2nd Session 2024-2025

سلطنة عمان
وزارة التربية والتعليم

Note: the marking guide in (4) pages **Full marks: (30)**

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(6 marks)

Item	answer	Mark	C.L	page
1	Two-high rolling mill	1		3
2	Soldering	1		18
3	Electroplating	1		27
4	Higher operational cost	1		22
5	Air bending	1		29
6	Ability to join dissimilar metals	1		34

ANSWERS TO EXTENDED QUESTIONS :(24 marks)

Item	Answer	Mark	C.L	Page
7	• Hot working is done **above** the recrystallization temperature; cold working is done **below** it. • **(Cold working** gives a better surface finish.	2		5 and 6
8	Rolling is the most rapid method of forming metal into desired shapes by plastic deformation through compressive stress using two or more than two rolls.	2		11
9	Soldering uses filler metal below 450°C; brazing uses filler metal above 450°C without melting the base metal.)	2		24
10	Solid-state welding refers to joining processes in which bonding results from application of pressure alone or a combination of heat and pressure. No fillermetal is utilized. For example: DIFFUSION welding, and ULTRASONIC welding.	2		32
11	Honing is a low velocity abrading process. Material removal is accomplished at lower cutting speeds than in grinding. Therefore, heat and pressures are minimized, resulting in excellent size and geometry control. The most common application of honing is on internal cylindrical surfaces.	2		33

Item	Answer	Mark	C.L	Page
12	1. CNC machines are programmed with a design which can then be manufactured hundreds or even thousands of times. Each manufacturedproduct will be the same. 2. Less skilled/trained people can operate CNC machines unlike manual lathes/ milling machines etc. which need skilled engineers. 3. No human errors 4. One person can supervise many CNC machines as once they are programmed, they can usually be left to work by themselves. Sometimesonly the cutting tools need replacing occasionally. **(any two from above)**	2		26
13	• **Hot Rolling:** o Hot rolling occurs above the recrystallization temperature. o After grains deform, they recrystallize, maintaining an equi-axed microstructure. o Hot rolling results in oxidation and formation of scales on the surface. o Products include plates, sheets, rods, bars, and pipes. • **Cold Rolling:** o Cold rolling occurs below the recrystallization temperature, usually at room temperature. o Increases the strength of the metal by strain hardening up to 20%. o Provides better surface finish and superior dimensional tolerances. o The total reduction achieved by cold rolling generally varies from 50% to 90%.	2 2		8

Item	Answer	Mark	C.L	Page
14	1. Arc welding is a fusion-welding process in which joining of the metals is achieved by the heat of an electric arc between an electrode and the work. 2. A generic arc welding process. An electric arc is a discharge of electric current across a gap in a circuit. 3. To initiate the arc in an arc welding process, the electrode is brought into contact with the work and then quickly separated from it by a short distance. 4. fillermetal is added during the operation to increase the volume and strength of the weld joint	1 1 1 1		24
15	1. In the process of electroplating, a thin layer of a metal is deposited on another metal part. 2. Electroplating is primarily used to change the surface properties of an object but may also be used to build up thickness 3. In this process the part to be plated is the cathode of the circuit. The anode is made of the metal to be plated on the part. 4. Both components are immersed in a solution called an electrolyte that permits the flow of electricity. 5. A power supplysupplies a direct current to the anode. Anode will lose ions in the electrolyte (dissolved). 6. The cathode will gain these ions and form a protective film.	1 1 1 1		27

End of Marking Guide