Second Semester

Mechanical Engineering

(الهندسة الميكانيكية)

(Questions)





امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

للعام الدراسي ١٤٤٥/١٤٤٦ هـ - ٢٠٢٣ / ٢٠٢٤ م - الفصل الدراسي الثاني - الدور الأول

تنبيه:
- المادة: الهندسة الميكانيكية.
- الأسئلة في (٥) 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.
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- 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.
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- 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** ▭ ◉ ◒ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

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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) Rolling is the most rapid method of forming metal into desired shapes by _____ through compressive stresses using two or more than two rolls.

- ⬭ Elastic deformation
- ⬭ Stress
- ⬭ Plastic defromation
- ⬭ Young modulus

2) In Forging, the parts are shaped by heating them in an open fire or hearth and shaping them through applying _____ forces using hammers.

- ⬭ Tensile
- ⬭ Compressive
- ⬭ Torsional
- ⬭ Bending

3) Arc welding is a fusion-welding process in which joining of the metals is achieved by the heat of an electric arc between an _____ and the work

- ⬭ Metal piece
- ⬭ Engine
- ⬭ Electrode
- ⬭ Plastic brush

4) Brazing is a joining process in which a filler metal is melted and distributed by _____action between the surfaces of the metal parts being joined without melting the base metal.

- ⬭ Stress
- ⬭ Pressure
- ⬭ Negative
- ⬭ Capillary

5) In lapping process a close tolerance level of _____ can be achieved.

- ⬭ 0.05 mm
- ⬭ 0.5 mm
- ⬭ 0.0005 mm
- ⬭ 0.005 mm

6) Which of the following is an example of CNC machine tool?

- ⬭ Slotting machine
- ⬭ CNC bending machine
- ⬭ Drilling machine
- ⬭ Shaping machine

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Extended Questions (7–15) (24 marks)

Answer all the questions in the space provided.

7) Write any two differences between hot and cold working process. (2 marks)

HOT WORKING	COLD WORKING

8) Write in brief about cold rolling process. (2 marks)

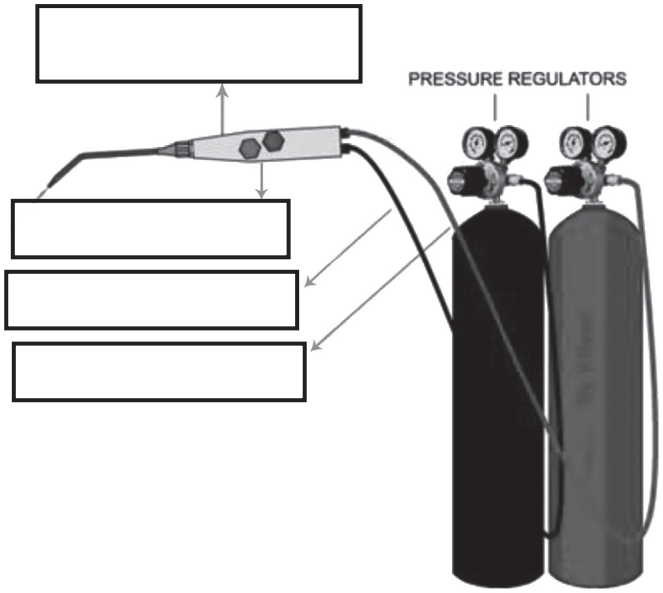
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Extended Questions: continued

9) The figure below shows Gas welding process.
Fill the names of the parts in the space provided in blocks. (2 marks)



10) Define each of the following surface coating processes. (2 marks)

a. Galvanizing.

b. Anodizing.

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Extended Questions: continued

11) Mention names of any four CNC machine tools. (2 marks)

12) List out any two dis-advantages of CNC machines. (2marks)

13) Explain drop forging process with the help of a neat sketch . (4 marks)

The sketch:

The drop forging process:

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Extended Questions: continued

14) Write any two advantages and two disadvantages of brazing process. (4 marks)

a. Advantages of brazing process.

1. _____

_____

2. _____

_____

b. Disadvantages of brazing process.

1. _____

_____

2. _____

_____

15) Write in brief about each of the following processes. (4 marks)

a. Lapping process.

_____

_____

_____

_____

b. Honing process.

_____

_____

_____

_____

[End of Examination]

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امتحان دبلوم التعليم العام
لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)
للعام الدراسي ١٤٤٥ / ١٤٤٦ هـ - ٢٠٢٣ / ٢٠٢٤ م - الفصل الدراسي الثاني - الدور الثاني

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- المادة: الهندسة الميكانيكية.
- الأسئلة في (٨) صفحات.
- زمن الإجابة: ثلاث ساعات.
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ملاحظة: يتم تظليل الشكل (■) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ■ **غير صحيح** ▬ ◉ ◔ ☒ ☑

مُسَوَّدَة، لا يتم تصحيحها

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Section A: Multiple Choice Items (6 marks)

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

1) Metal forming is possible in case of metals or alloys which are sufficiently _____ and ductile.

⬭ Hard ⬭ Malleable

⬭ Rigid ⬭ Brittle

2) Hot rolling is a metalworking process that occurs above the _____ temperature of the material.

⬭ Melting ⬭ Smelting

⬭ Recrystallization ⬭ Decrysatllization

3) Which one of the following is not an advantage of soldering type of metal joining process?

⬭ Low energy input relative to brazing and fusion welding.

⬭ Variety of heating methods available

⬭ Low joint strength

⬭ Easy to repair and rework

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Section A continued

4) Which combination of oxygen and other fuel gases gives the hottest of all the flames used in gas welding process?

- ☐ Oxy- Aceltylene.
- ☐ Oxy – Hydrogen.
- ☐ Oxy – Propone
- ☐ Oxy - Butane

5) A surface finish process in which a thin layer of a metal is deposited on another metal part is called as;

- ☐ Lapping.
- ☐ Honing.
- ☐ Electroplating.
- ☐ Grinding.

6) Which one of the following is ***not an*** advantage of a CNC machine?

- ☐ Less skilled/trained people can operate CNC machines
- ☐ No human errors
- ☐ One person can supervise many CNC machines as once they are programmed
- ☐ CNC machines are more expensive than manually operated machines

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Section B: Extended questions (24 marks)

Answer all the questions in the space provided.

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

a. Bloom.

b. Billet.

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

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Section B continued

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

10) Describe the main features of a lapping process. (2 marks)

11) Mention any two advantages of CNC Machines. (2 marks)

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Section B continued

12) Describe briefly working of a CNC machine. (2 marks)

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Section B continued

13) With the help of neat sketches, explain direct and indirect extrusion process.

(4 marks)

Direct Extrusion

Indirect Extrusion

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Do not write in this space

Do not write in this space

Section B continued

14) With the help of a neat sketch, explain a gas welding process. (4 marks)

Sketch of gas welding process:

Explanation:

Do not write in this space

Section B continued

15) With help of a neat sketch, explain an electroplating process. (4 marks)

Sketch of electroplating process:

Explanation:

[End of Examination]

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امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

للعام الدراسي ١٤٤٤ هـ - ٢٠٢٢ / ٢٠٢٣ م - الدور الأول - الفصل الدراسي الثاني

تنبيه:
- المادة: الهندسة الميكانكية.
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صحيح ▬ **غير صحيح** ▭ ◉ ◒ ☒ ☑

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Section A: Multiple Choice Items (40 marks)

There are 20 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Metal forming is possible in case of metals and alloys which are sufficiently _____.

- ⬭ Malleable and brittle
- ⬭ Malleable and ductile
- ⬭ Brittle and hard
- ⬭ Hard and creep

2) The recrystallization temperatures of metals are normally around _____ times of their melting point.

- ⬭ 1.2 to 1.5
- ⬭ 0.7 to 1
- ⬭ 0.3 to 0.6
- ⬭ None of the above

3) The product of first breakdown of ingot is _____.

- ⬭ Slab
- ⬭ Bloom
- ⬭ Billet
- ⬭ Strip

4) Cold rolling provides with superior surface finish due to _____.

- ⬭ High temperature
- ⬭ Negative temperature
- ⬭ Melting point
- ⬭ Low temperature

5) In closed or impression-die forging, the metal is placed in a die resembling _____.

- ⬭ Box
- ⬭ Mold
- ⬭ Cone
- ⬭ All of the above

6) The accuracy of the hand forged products is _____.

- ⬭ High
- ⬭ Excellant
- ⬭ Less
- ⬭ None of the above

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Section A: continued

7) In drop forging the product is given desired shape by _____ blows.

- ☐ Repeated
- ☐ Without
- ☐ Single
- ☐ Squeezing

8) Extrusion is a _____ process.

- ☐ Tension
- ☐ Shear
- ☐ Compression
- ☐ Breaking

9) In direct extrusion process, metal is extruded through a die opening in the _____ direction.

- ☐ Forward
- ☐ Upward
- ☐ Backward
- ☐ Allof the above

10) Drawing is a metal working process which uses _____ forces to stretch the metal.

- ☐ Bending
- ☐ Compressive
- ☐ Shear
- ☐ Tensile

11) Which one of the following process is used for making accurate and fixed shapes?

- ☐ Hot extrusion
- ☐ Hot rollng
- ☐ Bottoming
- ☐ All of the above

12) Welding process is used for making _____ joints.

- ☐ Tempeorary
- ☐ Permanent
- ☐ Loose
- ☐ Seperate

13) Fusion welding processes use _____ to melt the base metals.

- ☐ Heat
- ☐ Air
- ☐ steam
- ☐ None of the above

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Section A: continued

14) Which one of the following is an example for Solid state welding?

- ☐ Ultrasonic welding
- ☐ Gas welding
- ☐ Arc welding
- ☐ All of the above

15) Soldering is a joining process in which a filler metal with melting point not exceeding _____ °C.

- ☐ 600
- ☐ 450
- ☐ 1000
- ☐ 550

16) Identify the surface finish process from the following:

- ☐ Welding
- ☐ Lapping
- ☐ Molding
- ☐ Brazing

17) In the process of electroplating, a _____ layer of metal is deposited on another metal.

- ☐ Thin
- ☐ Thick
- ☐ No
- ☐ Multiple

18) CAD stands for _____

- ☐ Computer integrated design
- ☐ Computer assisted machining
- ☐ Computer aided design
- ☐ All of the above

19) Identify the advantage of CNC machines from the following:

- ☐ More expensive
- ☐ No human errors
- ☐ More human errors
- ☐ No accuracy

20) G and M codes are used for drives of _____ machines.

- ☐ Drop forging
- ☐ Extrusion
- ☐ Computer numerical control
- ☐ All of the above

Do not write in this space

Section B (60 marks)

There are 10 questions in section B. Each carries 6 marks.
Write your answer for each of the questions in the space provided.

21) Write the six diffrences between hot working and cold working processes. (6 marks)

S.No	Hot working	Cold working
1.		
2.		
3.		
4.		
5.		
6.		

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Section B: continued

22) a. Define the following terminology of rolling process.

(3 marks)

1.	**Bloom:**	
2.	**Slab:**	
3.	**Strip:**	

b. Write in brief about the cold rolling process.

(3 marks)

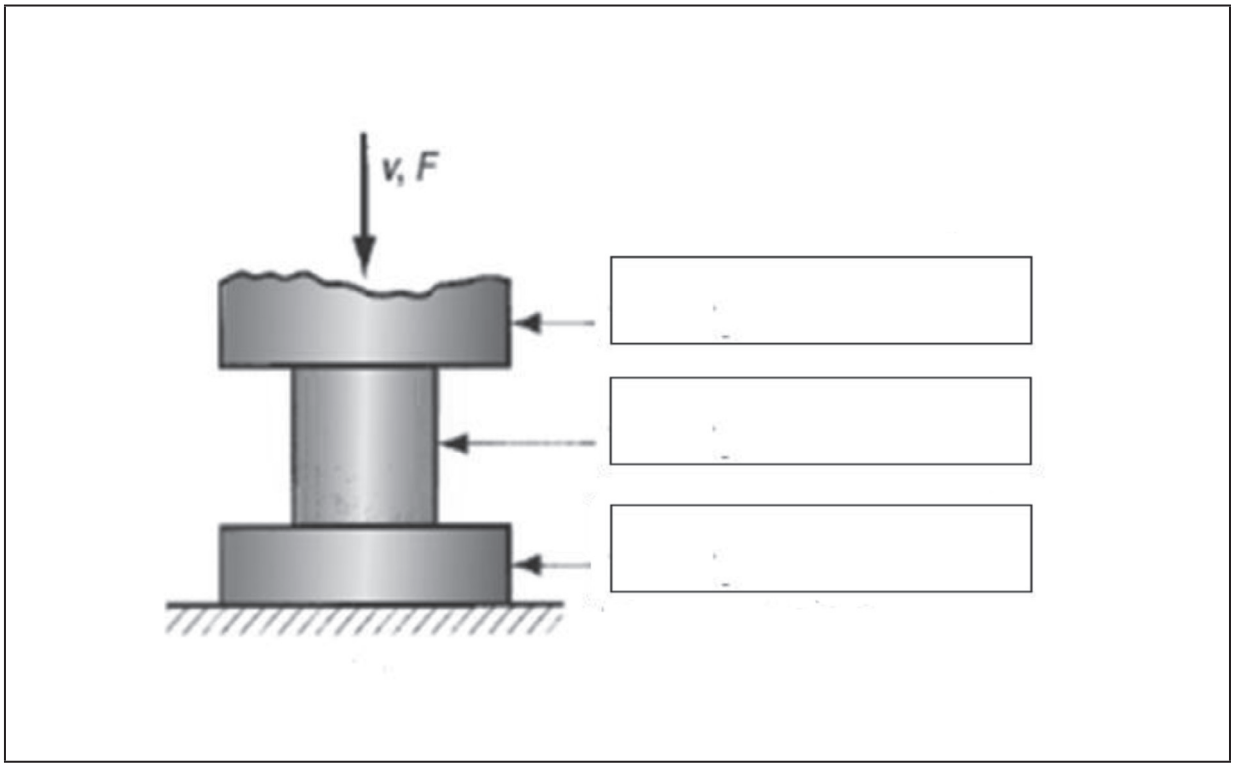
Cold rolling process:

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Section B: continued

23) a. The figure shown below is an open die forging process. Write the appropriate names in the blocks provided.

(3 marks)



b. Define the following forging operations.

(3 marks)

S.No	Name of the forging operation	Definition
1.	Power forging	
2.	Drop forging	
3.	Hand forging	

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Section B: continued

24) a. Define the following extrusion process according to the operating temperature.

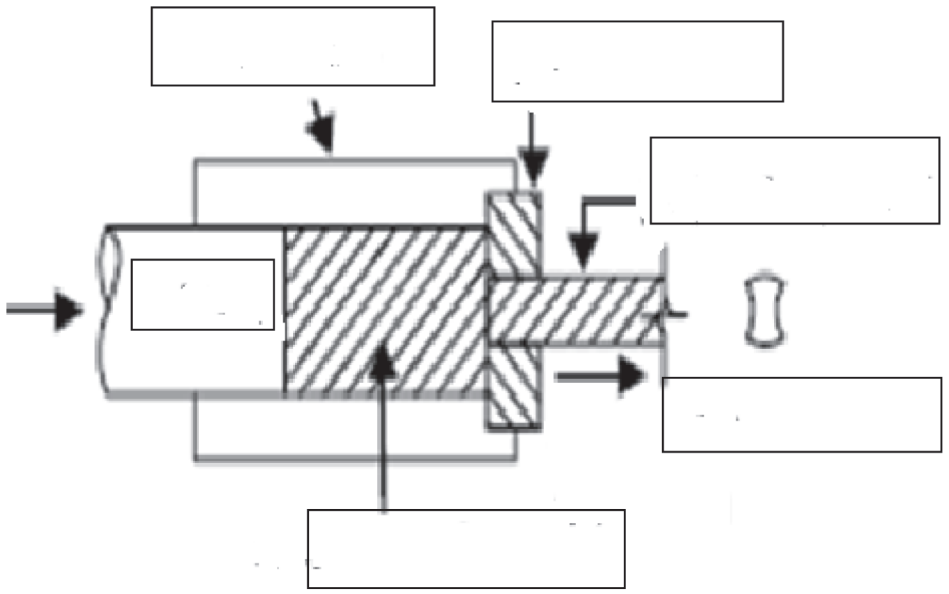
(3 marks)

1. Cold extrusion:

2. Hot extrusion:

b. Write the appropriate names in the blocks of the figure of extrusion process.

(3 marks)



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Section B: continued

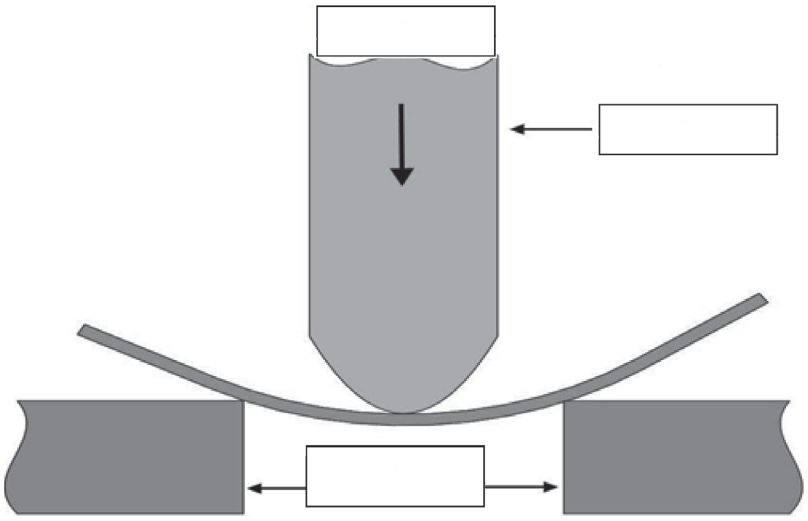
25) a. Define the bending process and also write the types of bending process.

(3 marks)

Bending process:
Types of bending process: **1.** **2.**

b. Air bending process image is shown below. Fill the blocks with suitable names.

(3 marks)



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Section B: continued

26) Write any three features of the following welding processes. (6 marks)

Arc Welding:

1.

2.

3.

Gas Welding:

1.

2.

3.

Do not write in this space

Section B: continued

27) List out the advantages and disadvantages of brazing process. (6 marks)

Advantages:

1.

2.

3.

Disadvantages:

1.

2.

3.

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

28) Write any three features of the following surface finishing operations: (6 marks)

Lapping process:

1.

2.

3.

Honing process:

1.

2.

3.

Do not write in this space

Section B: continued

29) a. Expalin in brief anodizing process.

(3 marks)

Anodizing process:

b. Explain galvanizing process. (3 marks)

Galvanizing process:

Do not write in this space

Do not write in this space

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Section B: continued

30) a. List out any three names of CNC machine tools. (3 marks)

1.

2.

3.

b. Write the three disadvantages of CNC machines. (3 marks)

1.

2.

3.

[End of Examination]

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امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

للعام الدراسي ١٤٤٤ هـ - ٢٠٢٢ / ٢٠٢٣ م - الدور الثاني - الفصل الدراسي الثاني

تنبيه:
- المادة: الهندسة الميكانيكية.
- الأسئلة في (١٤) صفحة.
- 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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Section A: Multiple Choice Items (40 marks)

There are 20 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Metal forming processes, are primary shaping processes in which, mass of metal or alloy is subjected to

- ⬭ Centrifugal forces
- ⬭ Mechanical forces
- ⬭ Gravitational forces
- ⬭ Torsional forces

2) The range of recrystallization temperatures of metals with respect to their melting temperature is;

- ⬭ 0.2 - 0.6 times
- ⬭ 0.3 - 0.6 times
- ⬭ 0.3 - 0.9 times
- ⬭ 0.4 - 0.7 times

3) The Product we get after first stage of rolling process of ingot is called

- ⬭ Billet
- ⬭ Ingot
- ⬭ Plate
- ⬭ Bloom

4) Cold rolling of metal is done by keeping the temperature;

- ⬭ at recrystallization temperature
- ⬭ above recrystallization temperature
- ⬭ below recrystallization temperature
- ⬭ at melting temperature

5) Which one of the following is not a closed die forging operation?

- ⬭ Power forging
- ⬭ Drop forging
- ⬭ Press forging
- ⬭ Hand forging

6) The excess materials in forging, which needs to be trimmed later is called as;

- ⬭ Scale
- ⬭ Flash
- ⬭ Scrap
- ⬭ Chip

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Section A: continued

7) Power forging is done by power _____ and tools.

- ☐ hammer
- ☐ spanner
- ☐ anvil
- ☐ mallet

8) In which of the following forming process a hallow ram is used?

- ☐ Rolling
- ☐ Drop forging
- ☐ Indirect extrusion
- ☐ Direct extrusion

9) Cold extrusion is the process done at

- ☐ Slightly elevated or at room temperature.
- ☐ Very high temperature.
- ☐ More than recrystallization temperature.
- ☐ Sub zero temperature.

10) Drawing is a metal working process which uses _____ forces to stretch metal.

- ☐ compressive
- ☐ tensile
- ☐ bending
- ☐ torsional

11) Which of the following statement refers to a bending process?

- ☐ Metal working process which uses tensile forces to stretch metal.
- ☐ Plastic deformation of the work over an axis, creating a change in the part's geometry.
- ☐ Required shape of the work piece is obtained manually by hammering.
- ☐ A compression process in which the work metal is forced to flow through a die opening.

12) The bending punch touches the work piece and work piece fills the cavity of the bottom die is called as;

- ☐ Bottoming
- ☐ Water bending
- ☐ Air bending
- ☐ Blanking

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Section A: continued

13) In which one of the following metal joining process lower amount of heat is required?

- ☐ Brazing
- ☐ Soldering
- ☐ Gas Welding
- ☐ Arc welding

14) Joining process in which melting point of a filler metal does not exceeds 450°C and below the melting point of the base metals to be joined is called as;

- ☐ Brazing
- ☐ Soldering
- ☐ Arc Welding
- ☐ Gas welding

15) Which one of the following combination cannot be used for gas welding?

- ☐ Oxygen – Acetylene
- ☐ Oxygen – Propane
- ☐ Oxygen – Nitrogen
- ☐ Oxygen – Hydrogen

16) In which one of the welding process filler metal is **not** used?

- ☐ Brazing
- ☐ Diffusion welding
- ☐ Arc Welding
- ☐ Gas welding

17) Finishing the work piece to a tolerance level of 0.0005 mm can be achieved by.

- ☐ Anodizing
- ☐ Electroplating
- ☐ Lapping
- ☐ Galavanizing

18) Which one of the following surface finish operation is suitable for internal cylindrical surfaces?

- ☐ Galvanising
- ☐ Lapping
- ☐ grinding
- ☐ Honing

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Section A: continued

19) The process of coating steel sheets, steel pipes and steel wires with a layer of zinc is called as;

- ☐ Galvanising.
- ☐ electroplating
- ☐ Lapping
- ☐ Etching

20) Which one of the following is **not** a CNC machine?

- ☐ CNC turning center
- ☐ CNC shaping center
- ☐ CNC milling center
- ☐ CNC drilling machine

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Section B (60 marks)

There are 10 questions in section B. Each carries 6 marks.
Write your answer for each of the questions in the space provided.

21) a. Write three differences between hot and cold rolling process (3 marks)

Hot Rolling	Cold Rolling

b. Draw a sketch and state the main feature of a three high rolling mill (3 marks)

Sketch:

Main Feature:

Do not write in this space

Section B: continued

22) a. What is a Forging forming process? (3 marks)

Forging Process:

b. Name the forging operations according to dies and the equipment used. (3 marks)

According to the dies	According to the equipment

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

23) Sketch and explain a drop forging operation. (6 marks)

Sketch:

Explanation:

Do not write in this space

Section B: continued

24) a. What is the main difference between hot and cold extrusion? (2 marks)

Hot Extrusion	Cold Extrusion

b. With the help of a neat sketch explain indirect extrusion process. (4 marks)

Sketch:

Explanation:

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

25) With help a neat sketch explain the working a drawing forming process.

(6 marks)

Sketch:

Explanation:

Do not write in this space

Section B: continued

26) With the help of neat sketches explain the following types of bending processes.

a. Air bending. (3 marks)

Sketch:

Explanation:

b. Bottoming. (3 marks)

Sketch:

Explanation:

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

27) Sketch and explain an arc welding process. (6 marks)

Sketch:

Explanation:

Do not write in this space

Section B: continued

28) a. What is solid state welding? Give two examples for it. (3 marks)

Solid state welding:

Examples:

b. State any three advantages of a brazing process. (3 marks)

Advantages of brazing process:

Do not write in this space

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Section B: continued

29) a. What is a honing process? Give one application of this process. (3 marks)

Honing Process:

Application:

b. Draw the schematic arrangement of an anodizing process. (3 marks)

Schematic arrangement of Anodising process

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Section B: continued

30) a. Name any four CNC machines tools. (2 marks)

CNC machine tools:

b. State any four advantages of CNC Machine. (4 marks)

Advantages

[End of Examination]

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امتحان دبلوم التعليم العام
لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)
للعام الدراسي ١٤٤٣ هـ - ٢٠٢١ / ٢٠٢٢ م - االدور الأول - الفصل الدراسي الثاني

تنبيه:
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- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

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- 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** ▭ ◉ ◔ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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Section A: Multiple Choice Items (40 marks)

There are 20 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Hot working is defined as the forming of metals above their ---------- temperature.

⬭ melting ⬭ freezing
⬭ recrystallization ⬭ all of the above

2) Bloom is a terminology in _____ process

⬭ forming ⬭ rolling
⬭ turning ⬭ drilling

3) Identify from the following the application/ product of rolling process.

⬭ gear ⬭ coupling
⬭ I - section ⬭ all of the above

4) Cold rolling process increases the strength via strain hardening upto _____.

⬭ 30% ⬭ 50%
⬭ 40% ⬭ 20%

5) In air bending process the punch exerts force at the correct spot by bending the sheet between _____ surfaces.

⬭ three ⬭ four
⬭ two ⬭ one

6) In closed die forging process, the excess metal that must be trimmed off later is known as _____.

⬭ fire ⬭ flash
⬭ cavity ⬭ die

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Section A: continued

7) A product of desired shape and size is formed in drop forging by having _____ blows.

- ☐ repeated
- ☐ single
- ☐ excess
- ☐ None of the above

8) Extrusion is a _____ process in which the work metal is forced through a die.

- ☐ tension
- ☐ compression
- ☐ shear
- ☐ bending

9) Drawing is a metal working process which uses _____ forces to stretch the metal.

- ☐ tensile
- ☐ compression
- ☐ torsional
- ☐ buckling

10) In which of the following process the punch touches the work-piece and work-piece fills the cavity of the bottom die?

- ☐ air bending
- ☐ indirect extrusion
- ☐ drawing
- ☐ bottoming

11) Gas welding is a type of _____welding process.

- ☐ TIG
- ☐ MIG
- ☐ fusion
- ☐ all of the above

12) In which one of the welding processes filler metal is **not** used?

- ☐ arc welding
- ☐ solid-state welding
- ☐ soldering
- ☐ brazing

13) Lapping is a final _____ finishing operation that produces dimensional accuracy.

- ☐ abrasive
- ☐ milling
- ☐ turning
- ☐ drilling

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Section A: continued

14) The most common application of honing is on internal _____ surfaces.

- ☐ cylindrical
- ☐ flat
- ☐ conical
- ☐ edge

15) In electroplating process, the part to be plated is the _____ of the circuit.

- ☐ anode
- ☐ cathode
- ☐ pole
- ☐ all of the above

16) Which one of the following gas is used in gas welding process?

- ☐ nitrogen
- ☐ acytelene
- ☐ sulphur
- ☐ none

17) CIM stands for _____.

- ☐ Computer integrated manufacturing
- ☐ Computer aided machining
- ☐ Computer involved moulding
- ☐ Computer interested machining

18) Recrystallization temperatures of metals are usually around _____ times their melting point.

- ☐ 0.8 to 0.9
- ☐ 0.1 to 0.2
- ☐ 0.3 to 0.6
- ☐ 0.7 to 0.75

19) Sheet is a product with a thickness less than _____.

- ☐ 8 mm
- ☐ 6 mm
- ☐ 15 mm
- ☐ 60 mm

20) In which one of the following forging process the shape of the work piece is obtained manually?

- ☐ power forging
- ☐ drop forging
- ☐ hand forging
- ☐ press forging

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Section B (60 marks)

There are 10 questions in section B. Each carries 6 marks.
Write your answer for each of the questions in the space provided.

21) a. Write any six points or features of hot-working process. (3 marks)

1.

2.

3.

4.

5.

6.

b. Define the following terminology of rolling process. (3 marks)

1. Strip:

2. Billet:

3. Slab:

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Section B: continued

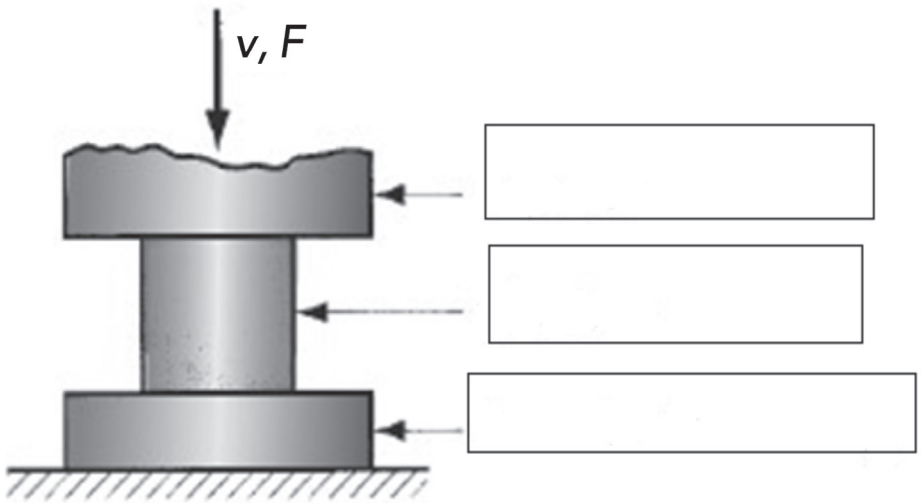
22) a. List out the types of forging processes according to the dies and the equipment.

(3 marks)

According to the dies	According to the equipment

b. Write the part names in the blocks provided of a open die forging process.

(3 marks)



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Section B: continued

23) a. Define the following processes according to the operating temperatures.

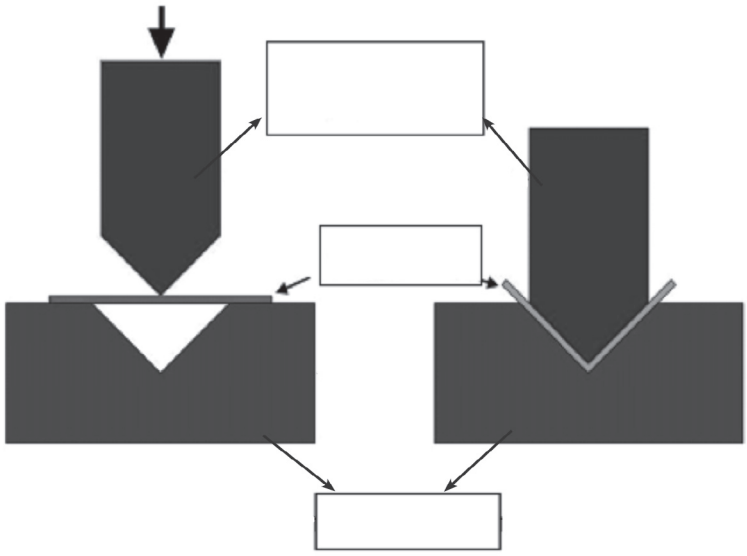
(3 marks)

1. Cold extrusion:

2. Hot extrusion:

b. Write the part names in the blocks provided of a common Die bending process.

(3 marks)



Common Die Bending

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Section B: continued

24) Write three features each for arc welding and gas welding processes. (6 marks)

a. Arc welding:

1.

2.

3.

b. Gas welding:

1.

2.

3.

Do not write in this space

Section B: continued

25) What are the advantages and disadvantages of brazing process? (6 marks)

Advantages:

1.

2.

3.

4.

Disadvantages:

1.

2.

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Section B: continued

26) a. Write in brief about the lapping process. (3 marks)

Lapping process:

b. What is galvanizing process and state its use? (3 marks)

Galvanizing:

Do not write in this space

Section B: continued

27) a. Write any three advantages of CNC machines. (3 marks)

Advantages:
1.
2.
3.

b. List out the names of any three CNC machine tools. (3 marks)

1.
2.
3.

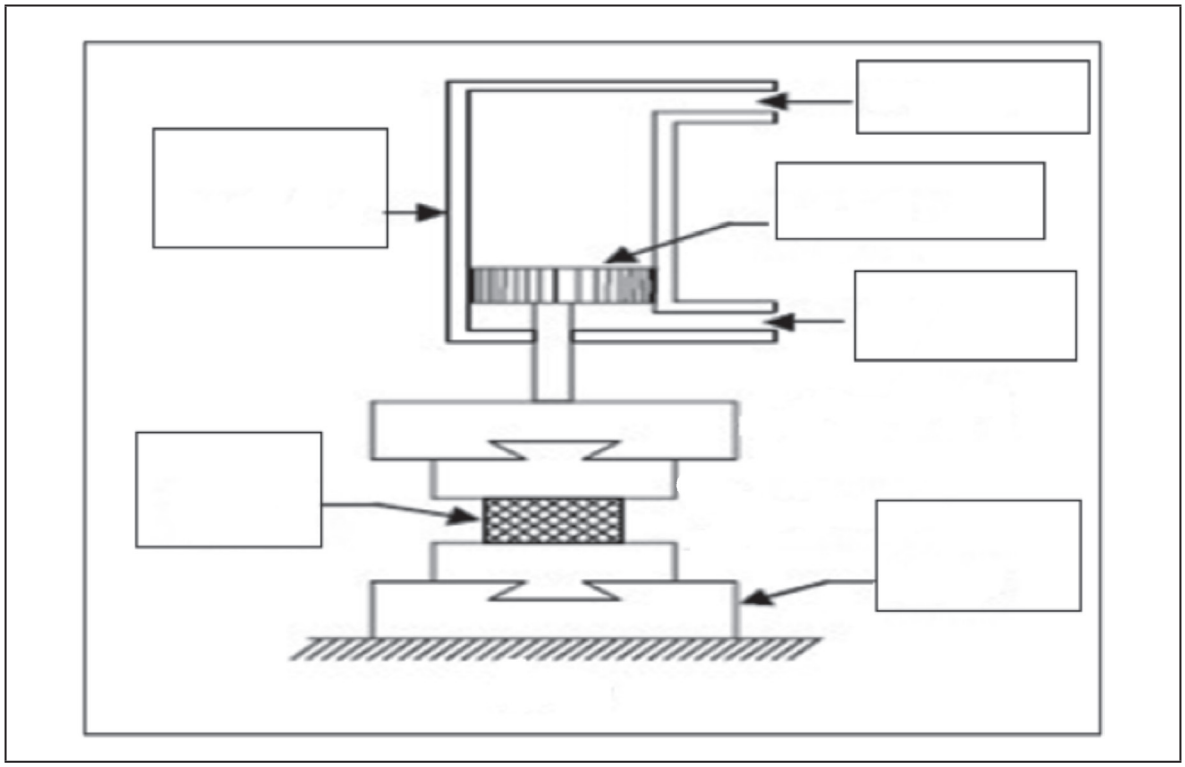
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Section B: continued

28) a. The image of power forging process is as shown below. Fill the blocks with appropriate names of the parts. (3 marks)



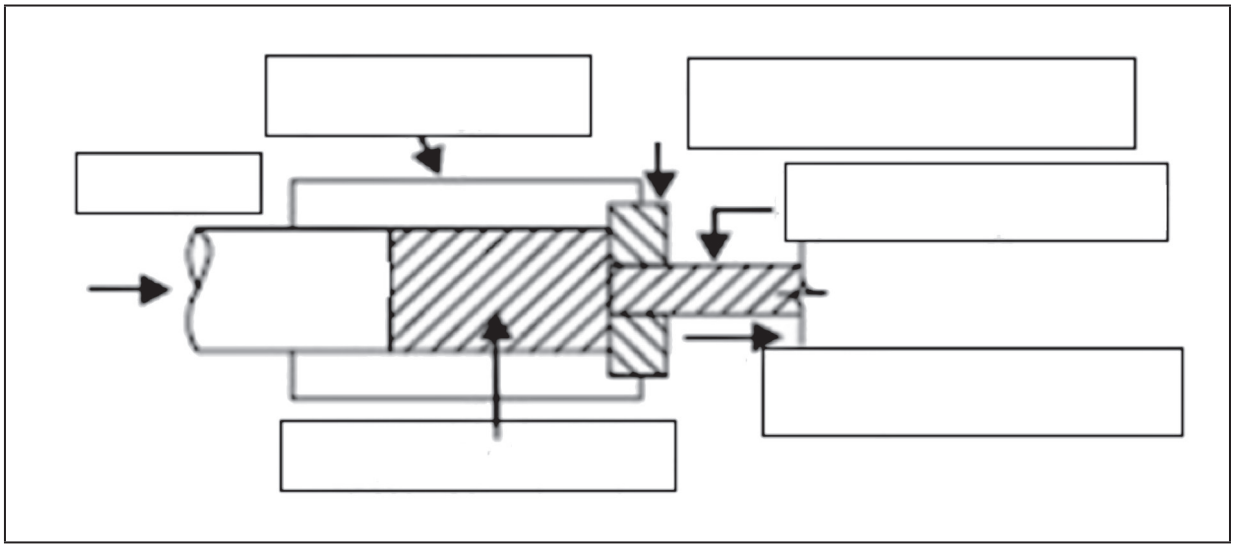
b. Write in brief about Drop forging process. (3 marks)

Drop forging:

Do not write in this space

Section B: continued

29) a. Extrusion process image is as shown below. Write the names of the parts in the blocks provided. (3 marks)



b. Write three features of air bending process. (3 marks)

Air bending process:

1.

2.

3.

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

30) a. What is drawing process and also draw a free hand sketch of the drawing process. (3 marks)

Drawing process:

Sketch:

b. List out any three advantages of soldering process. (3 marks)

1.

2.

3.

[End of Examination]

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سلطنة عمان
وزارة التربية والتعليم

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

امتحان دبلوم التعليم العام
لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)
للعام الدراسي ١٤٤٣ هـ - ٢٠٢١ / ٢٠٢٢ م - االدور الثاني - الفصل الدراسي الثاني

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- 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** ▭ ◉ ◔ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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Section A: Multiple Choice Items (40 marks)

There are 20 multiple-choice items worth two marks each.
Shade in the bubble (⬭) next to the **correct** answer for each of the following items.

1) Metal forming is possible in case of metals or alloys which are sufficiently _____ and ductile.

- ⬭ Hard
- ⬭ Brittle
- ⬭ Malleable
- ⬭ Rigid

2) The range of recrystallization temperatures of metals with respect to their melting temperature is;

- ⬭ 0.2 - 0.6 times
- ⬭ 0.3 - 0.6 times
- ⬭ 0.3 - 0.9 times
- ⬭ 0.4 - 0.7 times

3) Rolling is the most rapid method of forming metal into desired shapes by plastic deformation through _____ stresses using two or more than two rolls.

- ⬭ tensile
- ⬭ torsional
- ⬭ both tensile and compresssive
- ⬭ compressive

4) Cold rolling of metal is done by keeping the temperature;

- ⬭ at recrystallisation temperaure
- ⬭ above recrystallisation temperature
- ⬭ below recrystallisation temperature
- ⬭ at melting temperature

5) Which one of the following is an open die forging?

- ⬭ Power forging
- ⬭ Drop forging
- ⬭ Press forging
- ⬭ Hand forging

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Section A: continued

6) The excess materials in forging, which needs to be trimmed later is called as;

- ☐ Scale
- ☐ Flash
- ☐ Scrap
- ☐ Chip

7) Forging operation in which the product of desired shape and size is formed by having repeated blows is called as;

- ☐ Press forging
- ☐ Press rolling
- ☐ Drop forging
- ☐ Drop rolling

8) In which of the following forming process a hollow ram is used?

- ☐ Rolling
- ☐ Drop forging
- ☐ Indirect extrusion
- ☐ Direct extrusion

9) In which of the following process a metal billet is placed in to the die chamber and the pressure is applied through ram?

- ☐ Deep drawing
- ☐ Rolling
- ☐ Extrusion
- ☐ Bending

10) Drawing is a metal working process which uses _____ forces to stretch metal.

- ☐ compressive
- ☐ tensile
- ☐ bending
- ☐ torsional

11) Which of the following statement refers to a bending process?

- ☐ Metal working process which uses tensile forces to stretch metal.
- ☐ Plastic deformation of the work over an axis, creating a change in the part's geometry.
- ☐ Required shape of the work piece is obtained manually by hammering.
- ☐ A compression process in which the work metal is forced to flow through a die opening.

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Section A: continued

12) The bending process, which does not require a lower die is called as;

- ☐ Bottoming
- ☐ Water bending
- ☐ Air bending
- ☐ Blanking

13) In which one of the following metal joining process lower amount of heat is required?

- ☐ Brazing
- ☐ Gas Welding
- ☐ Soldering
- ☐ Arc welding

14) Joining process in which melting point of a filler metal does not exceed 450°C is called as;

- ☐ Brazing
- ☐ Arc Welding
- ☐ Soldering
- ☐ Gas welding

15) Which one of the following combination cannot be used for gas welding?

- ☐ Oxygen – Acetylene
- ☐ Oxygen – Nitrogen
- ☐ Oxygen – Propane
- ☐ Oxygen – Hydrogen

16) In which one of the welding process filler metal is not used?

- ☐ Brazing
- ☐ Arc Welding
- ☐ Diffusion welding
- ☐ Gas welding

17) Which one of the following is final abrasive finshing operation?

- ☐ Galvanising
- ☐ Anodizing
- ☐ Lapping
- ☐ Electroplating

18) Which one of the following surface finish operation is suitable for internal cylindrical surafaces?

- ☐ Galvanising.
- ☐ Grinding
- ☐ Lapping
- ☐ Honing

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Section A: continued

19) The process of coating steel sheets, steel pipes and steel wires with a layer of zinc is called as;

- ☐ Galvanising
- ☐ Electroplating
- ☐ Lapping
- ☐ Etching

20) Which on of the following is not a CNC machine?

- ☐ CNC turning center
- ☐ CNC shaping center
- ☐ CNC milling center
- ☐ CNC drilling machine

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Section B (60 marks)

There are 10 questions in section B. Each carries 6 marks.
Write your answer for each of the questions in the space provided.

21) a. Mention three differences between hot and cold rolling process. (3 marks)

Hot Rolling	Cold Rolling

b. With the help a neat sketch state main feature of a three high rolling mill.(3 marks)

Sketch:

Main Feature:

Do not write in this space

Section B: continued

22) a. Define Forging process. (3 marks)

Forging Process:

b. Name the forging oprations according to dies and the equipment used. (3 marks)

According to the dies	According to the equipment

Do not write in this space

Do not write in this space

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Section B: continued

23) With the help of neat sketch explain drop forging operation. (6 marks)

Sketch:

Explanation:

Do not write in this space

Section B: continued

24) a. What is the difeerence between hot and cold extrusion? (2 marks)

Hot Extrusion	Cold Extrusion

b. With the help of a neat sketch explain indirect extrusion process. (4 marks)

Sketch:

Explanation:

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

25) Draw the sketch of a drawing process and explain its working. (6 marks)

Sketch:

Explanation:

Do not write in this space

Section B: continued

26) With the help of neat sketches explain the following types of bending processes.

a. Air bending. (3 marks)

b. Bottoming. (3 marks)

a. Air bending.

Sketch:

Explanation:

b. Bottoming:

Explanation:

Do not write in this space

Do not write in this space

Do not write in this space

Section B: continued

27) With the help of a neat sketch explain an arc welding process. (6 marks)

Sketch:

Explanation:

Do not write in this space

Section B: continued

28) a. What is solid state welding? Give two examples for it. (3 marks)

solid state welding:

Examples:

b. State any three advantages of a brazing process. (3 marks)

Advantages of brazing process:

Do not write in this space

Do not write in this space

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Section B: continued

29) a. What is a honing process? Give one application of this process. (3marks)

Honing process:

Application:

b. Draw the schematic arrangement of an anodizing process. (3 marks)

Schematic arrangement of Anodising process

Do not write in this space

Section B: continued

30) a. Name any four CNC machines tools. (2 marks)

CNC machine tools:

b. State any four advantages of CNC Machine. (4 marks)

CNC machine tools:

[End of Examination]

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Second Semester

Mechanical Engineering

(الهندسة الميكانيكية)

(Answers)

GENERAL EDUCATION DIPLOMA EXAMINATION

Royal Guard of Oman Technical College,

Mechanical Engineering

2nd Semester, 1st Session 2023-2024

سلطنة عمان
وزارة التربية والتعليم

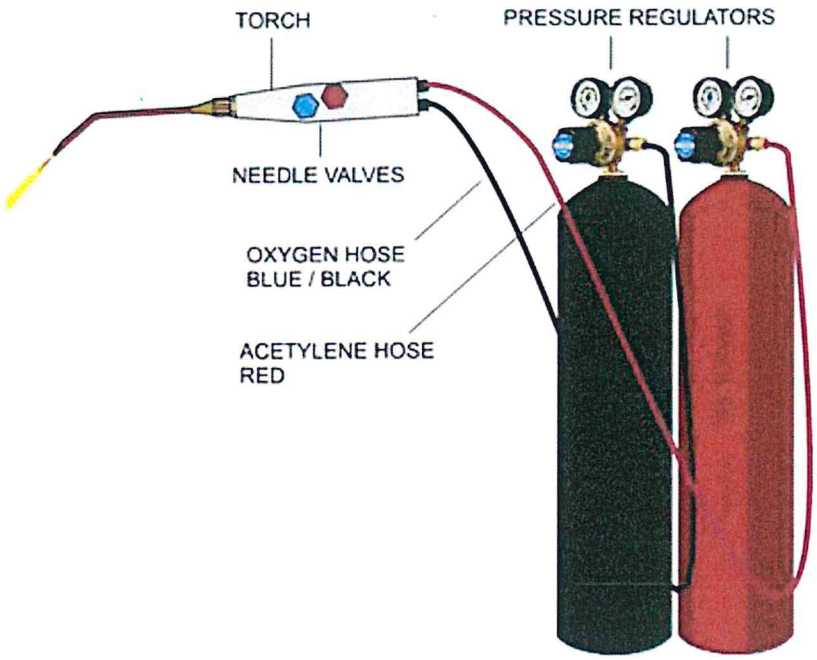
Note: the marking guide in (6) pages **Full marks: (30)**

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(6 marks)

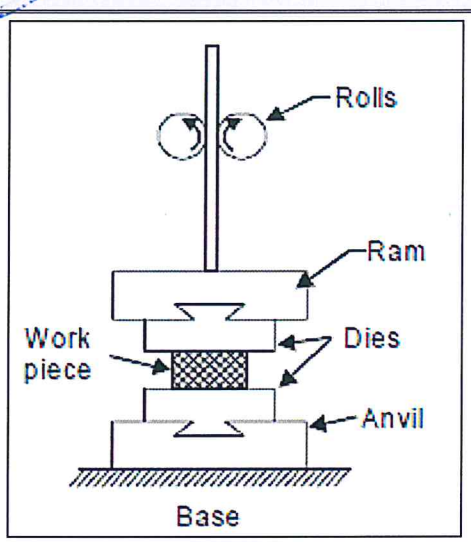
Item	Answer	Answer	Mark	C.L	page
1	C	Plastic defromation	1		
2	b	Compressive	1		
3	C	Electrode	1		
4	d	Capillary	1		
5	c	0.0005 mm	1		
6	b	CNC bending machine	1		

ANSWERS TO EXTENDED QUESTIONS :(24 marks)

<table>
<tr><th>Item</th><th>Answer</th><th>Mark</th><th>C.L</th><th>Page</th></tr>
<tr><td>7</td><td>
<table>
<tr><th>HOT WORKING</th><th>COLD WORKING</th></tr>
<tr><td>Material shape is changed above its recrystallization temperature.</td><td>Material shape is changed below its recrystallisation temperature.</td></tr>
<tr><td>Poor dimensional accuracy.</td><td>Good dimensional accuracy</td></tr>
<tr><td>Results in oxidation and formation of Scales on the surface.</td><td>Good surface finish.</td></tr>
<tr><td>Strength and hardness doesn't improve</td><td>Strength and hardness improves.</td></tr>
<tr><td>More ductility.</td><td>Less ductility.</td></tr>
<tr><td>Less force is required to change shape.</td><td>More force is required to change shape</td></tr>
</table>
<u>Any two from the table above.</u>
</td><td>2</td><td></td><td></td></tr>
<tr><td>8</td><td>Cold rolling occurs with the metal below <u>its recrystallisation temperature (usually at room temperature), which increases the strength via strain hardening up to 20%.</u> Cold rolling <u>provides products with superior surface finish due to low temperature</u>. Better dimensional tolerances compared with hot rolled products due to less thermal expansion. The total reduction achieved by cold–rolling generally will vary from about 50% to 90%</td><td>2</td><td></td><td></td></tr>
</table>

Item	Answer	Mark	C.L	Page
9	 **Each block get ½ mark**	2		
10	1. **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.	1		
	2. **Anodizing:** A 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. 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 oxide layer. 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		

Item	Answer	Mark	C.L	Page
11	• CNC Turning Centers. • CNC Drilling Machines. • CNC Milling Centers. • CNC Grinders. • CNC Bending Machines. **Any four from the above,** **Each get ½ mark**	2		
12	• CNC machines are more expensive than manually operated machines. • Less workers are required to operate CNC machines compared to manually operated machines. Investment in CNC machines can lead to unemployment. • The CNC machine operator only needs basic training and skills, enough to supervise several machines. In years gone by, engineers needed years of training to operate Centre lathes, milling machines and other manually operated machines. This means many of the old skills are being lost. **Any two from the above,** **Each get 1 mark**	2		

Item	Answer	Mark	C.L	Page
13	 **The drop forging process** is an operation in which the product of desired shape and size is formed by having repeated blows. The upper die and ram are raised by friction rolls gripping the board.	2 2		
14	**a- Advantages:** 1. Any metals can be joined, including dissimilar metals. 2. Certain brazing methods can be performed quickly and consistently. 3. Brazing can be applied to join thin-walled parts that cannot be welded. 4. In general, less heat and power are required than in fusion welding. **Any two from the above, Each get 1 mark** **b- Disadvantages:** 1. Joint strength is generally less than that of a welded joint. 2. Color of the metal in the brazed joint may not match the color of the base metal parts, a possible aesthetic disadvantage. **Each get 1 mark**	2 2		

Item	Answer	Mark	C.L	Page
15	a- **Lapping process:** Lapping is a final abrasive finishing operation that produces extreme dimensional accuracy, corrects minor imperfections of shape, refines surface finish and produces close fit between mating surfaces. Finishing the work piece to a tolerance level of 0.0005 mm can be achieved by lapping process.	2		
	b- **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 within less than 0.0001 mm in diameter and maintaining true roundness and straightness	2		

End of Marking Guide

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

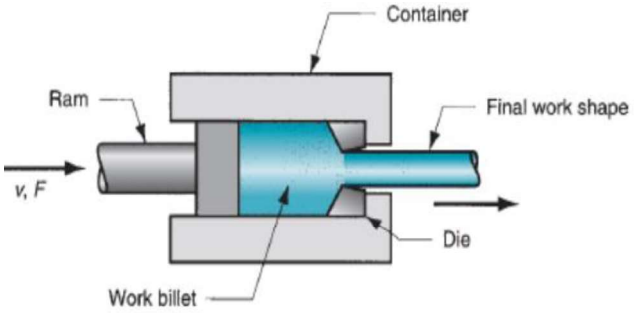
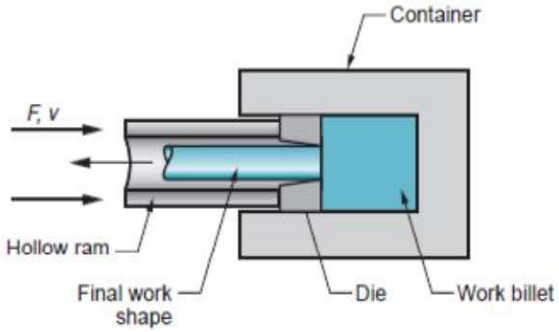
ANSWERS TO MULTIPLE CHOICE QUESTIONS :(6 marks)

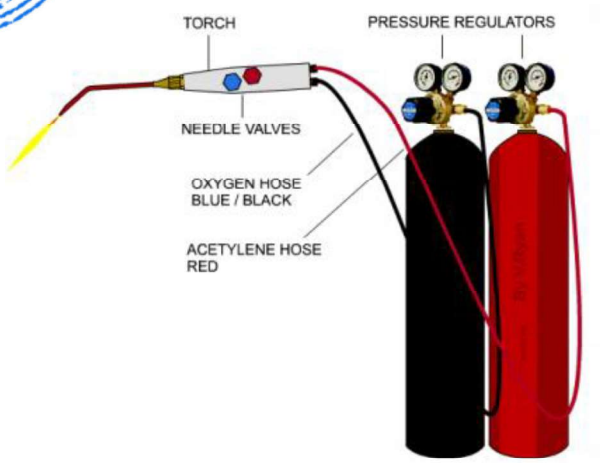
Item	Answer	Answer	Mark	C.L	page
1	b	Malleable	1		
2	c	Recrystallization	1		
3	c	Low joint strength	1		
4	a	Oxy- Aceltylene.	1		
5	c	Electroplating.	1		
6	d	CNC machines are more expensive than manually operated machines	1		

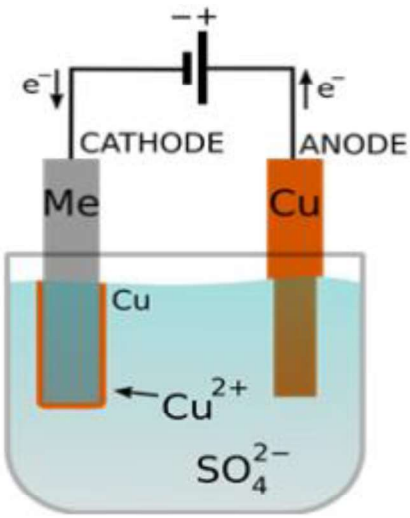
ANSWERS TO EXTENDED QUESTIONS :(24 marks)

Item	Answer	Mark	C.L	Page
7	**a- Bloom**: It is the product of first breakdown of ingot. (Cross sectional area > 230 cm2)	1		
	b- Billet : It is the product obtained from a further reduction by hot rolling. (Cross sectional area > 40 X 40 mm2)	1		
8	Hot rolling is a metalworking process that occurs above the recrystallisation temperature of the material. After the grains deform during processing, they recrystallize, which maintains an equi-axed microstructure and prevents the metal from work hardening.	2		
9	Solid-state welding refers to joining processes in which bonding results from application of pressure alone or a combination of heat and pressure. No filler metal is utilized. For example: DIFFUSION welding, and ULTRASONIC welding.	2		

Item	Answer	Mark	C.L	Page
10	Main features of a lapping process: Lapping is a final abrasive finishing operation that produces extreme dimensional accuracy, corrects minor imperfections of shape, refines surface finish and produces close fit between mating surfaces. Finishing the work piece to a tolerance level of 0.0005 mm can be achieved by lapping process	2		
11	▪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. ▪Less skilled/trained people can operate CNC machines unlike manual lathes / milling machines etc. which need skilled engineers ▪No human errors ▪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 replacing occasionally **Any two from the above,** **Each get 1 mark**	2		
12	**Working of CNC machine**: Computer numerical control (CNC) is a computer "controller" that reads G-code and M-code commands and drives a machine tool, a powered mechanical device typically used to fabricate components by the selective removal of material.	2		

Item	Answer	Mark	C.L	Page
13	**Direct Extrusion**  In this method, the heated metal billet is placed in to the die chamber and the pressure is applied through ram. The metal is extruded through die opening in the forward direction.	1 1		
	Indirect Extrusion:  In indirect extrusion, the billet remains stationary while the die moves into the billet by the hollow ram (or punch), through which the backward extrusion takes place.	1 1		

Item	Answer	Mark	C.L	Page
		2		
14	**Explanation**: A fusion welding process which joins metals, using the heat of combustion of an oxygen and fuel gas (i.e. acetylene, hydrogen, propane or butane) mixture is usually referred as gas welding. Oxy-acetylene flame is the most versatile and hottest of all the flames produced by the combination of oxygen and other fuel gases. A filler metal rod or welding rod is generally added to the molten metal pool to have greater strength of the joint.	2		

Item	Answer	Mark	C.L	Page
15	 In the process of electroplating, a thin layer of a metal is deposited on another metal part. Electroplating is primarily used to change the surface properties of an object (e.g. abrasion and wear resistance, corrosion protection, aesthetic qualities, etc.), but may also be used to build up thickness. 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. Both components are immersed in a solution called an electrolyte that permits the flow of electricity. A power supply supplies a direct current to the anode. Anode will lose ions in the electrolyte (dissolved). The cathode will gain these ions and form a protective film.	2 2		

End of Marking Guide

THE ROYAL GUARD OF OMAN TECHNICAL COLLEGE

PAPER	EXAMINATION	DURATION
FINAL FIRST TERM	*MECHANICAL ENGINEERING*	3 HOURS TOTAL MARKS 100
June 2023	SERIES Technical Education Diploma	

YOU SHOULD HAVE THE FOLLOWING FOR THE EXAMINATION

A NON PROGRAMMABLE CALCULATOR

DRAWING INSTRUMENTS

INSTRUCTIONS TO CANDIDATES:

SECTION A : (OBJECTIVE QUESTIONS – 20 QUESTIONS)

ANSWER ALL THE QUESTIONS IN SECTION A

CIRCLE THE CORRECT ANSWER FROM THE ANSWERS GIVEN

EACH QUESTION CARRIES TWO MARKS IN SECTION A

TOTAL 40 MARKS FOR SECTION A

SECTION B (SHORT ANSWER QUESTIONS - 10 QUESTIONS)

ANSWER ALL THE QUESTIONS FROM SECTION B IN THE SPACE PROVIDED.

EACH QUESTION CARRIES 6 MARKS EACH IN SECTION B.

TOTAL 60 MARKS FOR SECTION B

SECTION A

Shade in the bubble the correct answer for each question

Each Question carries two marks each

A1: Metal forming is possible in case of metals and alloys which are sufficiently ----------

- ☐ Malleable and brittle
- ☐ Brittle and hard
- ■ Malleable and ductile
- ☐ Hard and creep

A2: The recrystallization temperatures of metals are normally around ---------- times of their melting point.

- ☐ 1.2 to 1.5
- ■ 0.3 to0.6
- ☐ 0.7 to 1
- ☐ None of the above

A3: The product of first breakdown of ingot is ----------

- ☐ Slab
- ☐ Billet
- ■ Bloom
- ☐ Strip

A4: Cold rolling provides with superior surface finish due to ----------

- ☐ High temperature
- ☐ Melting point
- ☐ Negative temperature
- ■ Low temperature

A5: In closed or impression-die forging, the metal is placed in a die resembling ----------.

- ☐ Box
- ☐ Cone
- ■ Mold
- ☐ All of the above

A6: The accuracy of the hand forged products is ----------

- ☐ High
- ■ Less
- ☐ Excellant
- ☐ None of the above

A7: In drop forging the product is given desired shape by ---------- blows.

- ■ Repeated
- ☐ Single
- ☐ No
- ☐ Squeezing

A8: Extrusion is a ---------- process.

- ☐ Tension
- ■ Compression
- ☐ Shear
- ☐ Breaking

A9: In direct extrusion process, metal is extruded through die opening in the ---------- direction.

- ■ Forward
- ☐ Backward
- ☐ Upward
- ☐ Allof the above

A10: Drawing is a metal working process which uses ---------- forces to stretch the metal.

- [ ] Bending
- [ ] Shear
- [ ] Compressive
- [x] Tensile

A11: Which one of the following process is used for making accurate and fixed shapes?

- [ ] Hot extrusion
- [ ] Hot rollng
- [x] Bottoming
- [ ] All of the above

A12: Welding process is used for making ---------- joints.

- [ ] Tempeorary
- [x] Permanent
- [ ] Loose
- [ ] Seperate

A13: Fusion welding processes use ---------- to melt the base metals.

- [x] Heat
- [ ] Air
- [ ] steam
- [ ] None of the above

A14: Which one of the following is an example for Solid state welding?

- [x] Ultrasonic welding
- [ ] Gas welding
- [ ] Arc welding
- [ ] All of the above

A15: Soldering is a joining process in which a filler metal with melting point not exceeding ----------^{o}C.

- [ ] 600
- [x] 450
- [ ] 1000
- [ ] 550

A16: Identify the surface finish process from the following:

- [ ] Welding
- [x] Lapping
- [ ] Molding
- [ ] Brazing

A17: In the process of electroplating, a ---------- layer of metal is deposited on another metal.

- [x] Thin
- [ ] Thick
- [ ] No
- [ ] Multiple

A18: CAD stands for ----------

- [ ] Computer integrated design
- [ ] Computer assisted machining
- [x] Computer aided design
- [ ] All of the above

A19: Identify the advantages of CNC machines from the following:

- [ ] More expensive
- [x] No human errors
- [ ] More human errors
- [ ] No accuracy

A20: G and M codes are used for drives of ----------machines.

- [ ] Drop forging
- [ ] Extrusion
- [x] Computer numerical control
- [ ] All of the above

SECTION B

ANSWER THE FOLLOWING QUESTIONS **(6X10 = 60 MARKS)**

B1. Write the six diffrences between hot working and cold working. **(6 marks)**

S.No	Hot working	Cold working
1	Material shape is changed above its recrystallization temperature	Material shape is changed below its recrystallisation temperature
2	Poor dimensional accuracy	Good dimensional accuracy
3	Results in oxidation and formation of Scales on the surface.	Good surface finish.
4	Strength and hardness doesn't improve	Strength and hardness improves
5	More ductility	Less ductility.
6	Less force is required to change shape	More force is required to change shape

B2(a). Define the following rolling process terminology. (3 marks)

1. Bloom: It is the product of first breakdown of ingot. (Cross sectional area > 230cm2)

2.Slab: It is the hot rolled ingot. (Cross sectional area > 100 cm2 and with a width >= 2 times thickness)

3.Strip: It is the product with a thickness < 6 mm and width<600 mm.

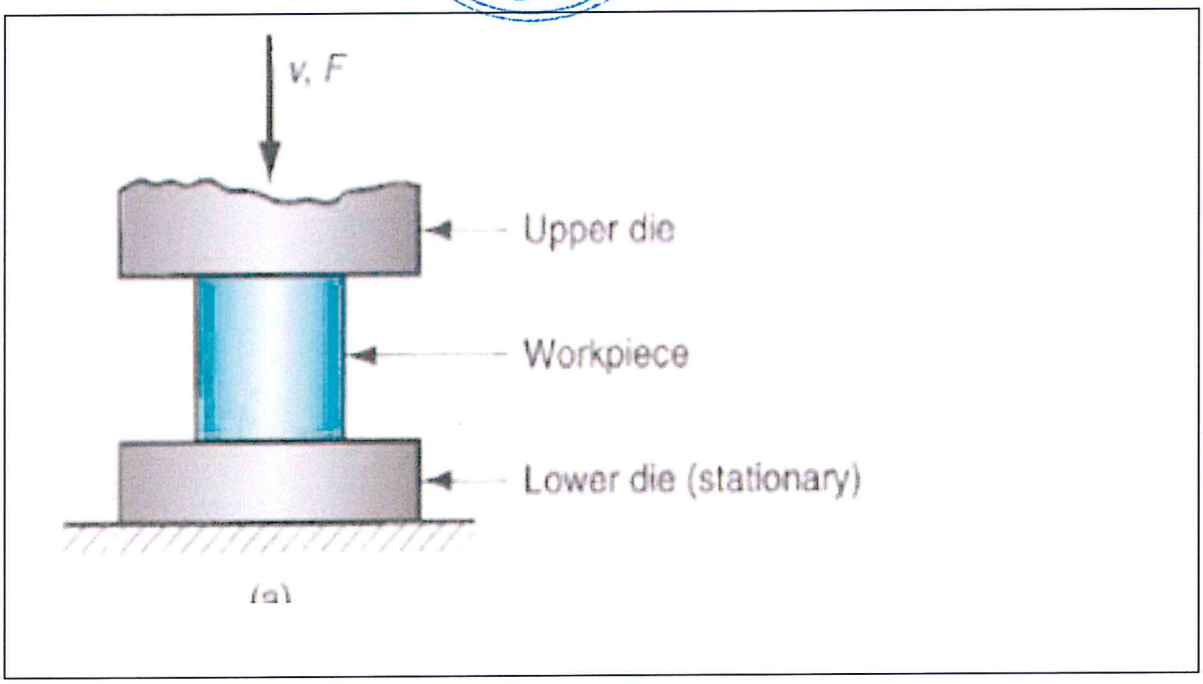
Application / Products of rolling

B2(b). Write in brief about the cold rolling process. (3 marks)

Cold rolling process:

Cold rolling occurs with the metal below its recrystallisation temperature (usuallyat room temperature), which increases the strength via strain hardening up to 20%. Cold rolling provides products with superior surface finish due to low temperature. Better dimensional tolerances compared with hot rolled products due to less thermal expansion. The total reduction achieved by cold–rolling generally will vary from about 50% to 90%

B3(a). The figure shown below is a open die forging process. Write the appropriate names in the blocks provided. **(3 marks)**



B3(b). Define the following forging operations. **(3 marks)**

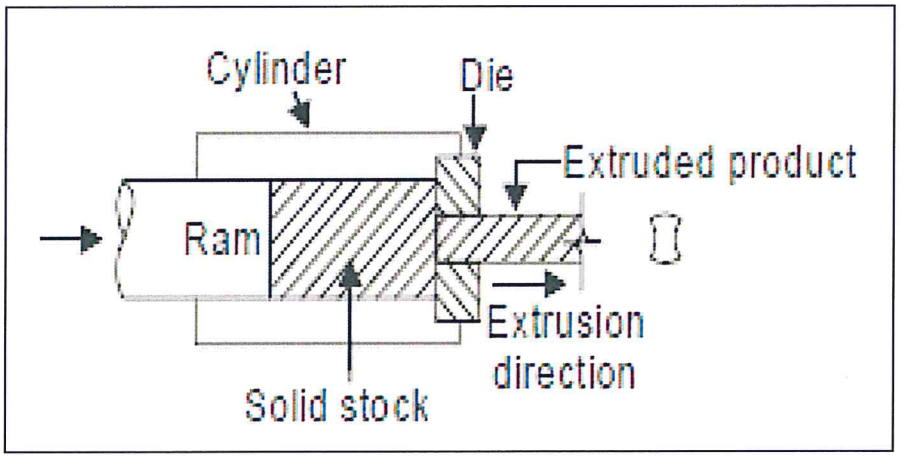
S.no	Name of the forging operation	Definition
1	Power forging	Power forging is done with power hammers and tools which are larger in sizecompared to the hand forging tools. Power is applied either hydraulic press, compressed air or by steam.
2	Drop forging	Drop forging is an operation in which the product of desired shape and size is formed by having repeated blows. The upper die and ram are raised by frictionrolls gripping the board.
3	Hand forging	In this type the required shape of the work piece is obtained manually. Theaccuracy of hand-forged products is less.

B4(a). Define the following extrusion process according to the operating temperature. (3 marks)

1. Cold extrusion: Cold extrusion is the process done at room temperature or slightly elevated temperature.

2. Hot extrusion: Hot extrusion involves prior heating of the billet to a temperature above its recrystallisation temperature. This reduces strength and increases ductility of themetal. The most commonly used extrusion process is the hot direct process.

B4(b): Write the appropriate names in the blocks of the figure of extrusion process. (3marks)



B5(a). Define the bending process and also write the types of bending process.

(3 marks)

Bending process: Bending is the plastic deformation of the work over an axis, creating a change inthe part's geometry.

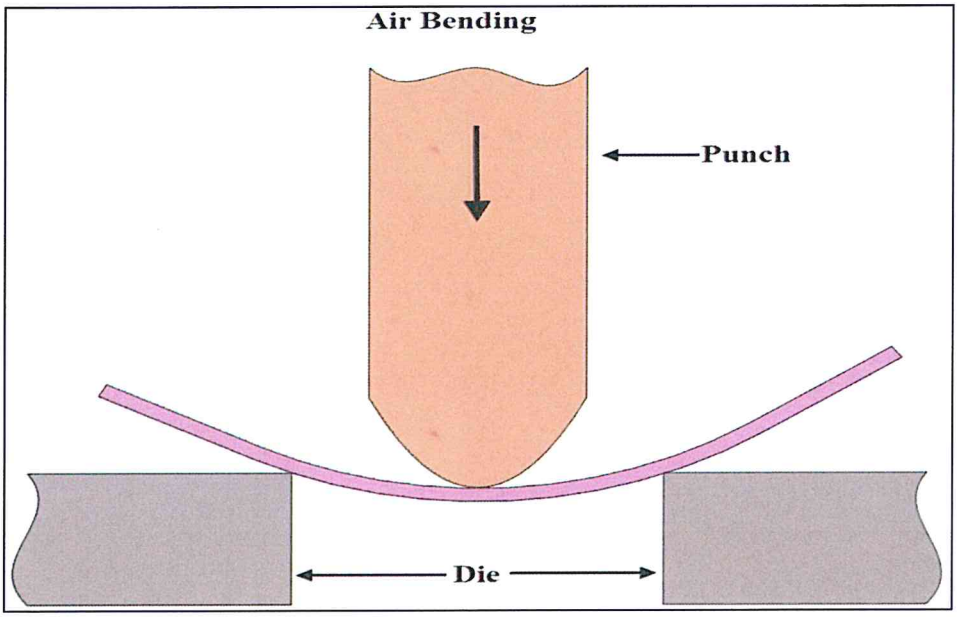
Types of bending process:

1. **Air Bending**

2. **Bottoming**

B5(b). Air bending process image is shown below. Fill the blanks with suitable names.

(3 marks)



B6. Write any three features of the following welding process. **(6 marks)**

Arc Welding:

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. A generic arc welding process. An electric arc is a discharge of electric current across a gap in a circuit. 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. fillermetal is added during the operation to increase the volume and strength of the weld joint.

Gas Welding:

A fusion welding process which joins metals, using the heat of combustion of anoxygen and fuel gas (i.e. acetylene, hydrogen, propane or butane) mixture is usually referred as gas welding. Oxy-acetylene flame is the most versatile and hottest of all the flames produced by the combination of oxygen and other fuel gases. A filler metal rod or welding rod is generally added to the molten metal pool to have greater strength of the joint.

B7. List out the advantages and disadvantages of brazing process. (6 marks)

ADVANTAGES OF BRAZING

Brazing has several advantages compared to welding:

- 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.

DISADVANTAGES OF BRAZING:

- Joint strength is generally less than that of a welded joint
- Color of the metal in the brazed joint may not match the color of the basemetal parts, a possible aesthetic disadvantage.

B8. Write any three features of the following surface finishing operations:

(6 marks)

Lapping process:

Lapping is a final abrasive finishing operation that produces extreme dimensionalaccuracy, corrects minor imperfections of shape, refines surface finish and produces close fit between mating surfaces.

Finishing the work piece to a tolerance level of 0.0005 mm can be achieved bylapping process.

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 withinless than 0.0001 mm in diameter and maintaining true roundness and straightness

B9(a) Expalin in brief anodizing process. **(3 marks)**

Anodizing: A 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. 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 oxide layer. 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.

B9(b).What is Galvanizing process and write the purpose of layer of zinc. **(3 marks)**

Galvanizing: Galvanizing is a process of coating steel sheets, steel pipes and steel wires with alayer of zinc. The layer of zinc protects the steel item from corrosion and rusting by sacrificing itself.

B10(a). List out any three names of CNC machine tools. **(3 marks)**

- CNC Turning Centers
- CNC Drilling Machines
- CNC Milling Centers
- CNC Grinders
- CNC Bending Machines

10(b). Write the three disadvantages of CNC machines. **(3 marks)**

- CNC machines are more expensive than manually operated machines.
- Less workers are required to operate CNC machines compared to manuallyoperated machines. Investment in CNC machines can lead to unemployment
- The CNC machine operator only needs basic training and skills, enough tosupervise several machines. In years gone by, engineers needed years of training to operate Centre lathes, milling machines and other manually operated machines. This means many of the old skills are being lost.

END OF EXAMINATION PAPER

THE ROYAL GUARD OF OMAN TECHNICAL COLLEGE

PAPER	EXAMINATION	DURATION
FINAL SECOND TERM (KEY)	***MECHANICAL ENGINEERING***	3 HOURS TOTAL MARKS 100

JUNE 2022	**SERIES** Technical Education Diploma

YOU SHOULD HAVE THE FOLLOWING FOR THE EXAMINATION

A NON PROGRAMMABLE CALCULATOR

DRAWING INSTRUMENTS

INSTRUCTIONS TO CANDIDATES:

SECTION A : (OBJECTIVE QUESTIONS – 20 QUESTIONS)

ANSWER ALL THE QUESTIONS IN SECTION A

CIRCLE THE CORRECT ANSWER FROM THE ANSWERS GIVEN

EACH QUESTION CARRIES TWO MARKS IN SECTION A

TOTAL 40 MARKS FOR SECTION A

SECTION B (SHORT ANSWER QUESTIONS - 10 QUESTIONS)

ANSWER ALL THE QUESTIONS FROM SECTION B IN THE SPACE PROVIDED.

EACH QUESTION CARRIES 6 MARKS EACH IN SECTION B.

TOTAL 60 MARKS FOR SECTION B

SECTION A

Shade in the bubble the correct answer for each question

Each Question carries two marks each

A1: Hot working is defined as the forming of metals above their ---------- temperature.

- ☐ melting
- ☐ freezing
- ■ recrystallization
- ☐ all of the above

A2: Bloom is a terminology in ---------- process

- ☐ forming
- ■ rolling
- ☐ turning
- ☐ drilling

A3: Identify from the following the application/ product of rolling process.

- ☐ gear
- ☐ coupling
- ■ I - section
- ☐ all of the above

A4: Cold rolling process increases the strength via strain hardening upto ----------.

- ☐ 30%
- ☐ 50%
- ☐ 40%
- ■ 20%

A5: In air bending process the punch exerts force at the correct spot by bending the sheet between ---------- surfaces.

- [ ] three
- [ ] four
- [x] two
- [ ] one

A6: In closed die forging process, the excess metal that must be trimmed off later is known as ----------.

- [ ] fire
- [x] flash
- [ ] cavity
- [ ] die

A7: A product of desired shape and size is formed in drop forging by having ---------- blows.

- [x] repeated
- [ ] single
- [ ] excess
- [ ] None of the above

A8: Extrusion is a ---------- process in which the work metal is forced through a die.

- [ ] tension
- [x] compression
- [ ] shear
- [ ] bending

A9: Drawing is a metal working process which uses ---------- forces to stretch the metal.

- [x] tensile
- [ ] compression
- [ ] torsion
- [ ] buckling

A10: In which of the following process the punch touches the work-piece and work-piece fills the cavity of the bottom die.

- [ ] air bending
- [ ] in direct extrusion
- [ ] drawing
- [x] bottoming

A11: Gas welding is a type of ----------welding process.

- [ ] TIG
- [ ] MIG
- [x] fusion
- [ ] all of the above

A12: In which one of the welding process filler metal is **not** used?

- [ ] arc welding
- [x] solid-state welding
- [ ] soldering
- [ ] brazing

A13: Lapping is a final ---------- finishing operation that produces dimensional accuracy.

- [x] abrasive
- [ ] milling
- [ ] turning
- [ ] drilling

A14: The most common application of honing is on internal ---------- surfaces.

- [x] cylindrical
- [ ] flat
- [ ] conical
- [ ] edge

A15: In electroplating process the part to be plated is the ---------- of the circuit.

- [ ] anode
- [x] cathode
- [ ] pole
- [ ] all of the above

A16: Which one of the following gas is used in gas welding process?

- [ ] nitrogen
- [x] acytelene
- [ ] sulphur
- [ ] none

A17: CIM stands for ----------.

- [x] Computer integrated manufacturing
- [ ] Computer aided machining
- [ ] Computer involved moulding
- [ ] Computer interested machining

A18: Recrystallization temperatures of metals are usually around ---------- times their melting point.

- [ ] 0.8 to 0.9
- [ ] 0.1 to 0.2
- [x] 0.3 – 0.6
- [ ] 0.7 to 0.75

A19: Sheet is a product with a thickness less than ----------.

- [ ] 8 mm
- [x] 6 mm
- [ ] 15 mm
- [ ] 60 mm

A20: In which one of the following forging process the shape of the work piece is obtained manually?

- [ ] power forging
- [ ] drop forging
- [x] hand forging
- [ ] press forging

SECTION B

ANSWER THE FOLLOWING QUESTIONS **(6X10 = 60 MARKS)**

B1(a). Write any six points or features of hot-working process. **(3 marks)**

1. Material shape is changed above its recrystallization temperature.
2. Poor dimensional accuracy.
3. Results in oxidation and formation scales on the surface.
4. Strength and hardness doesn't improve.
5. More diificulty.
6. Less force is required to change shape.

Q1(b). Define the following terminology of rolling process. **(3 marks)**

1. Strip: It is the product with a thickness less than 6 mm and less than 600 mm.
2. Billet: It is the product obtained from a further reduction by hot rolling.
3. Slab: it is the hot rolled ingot.

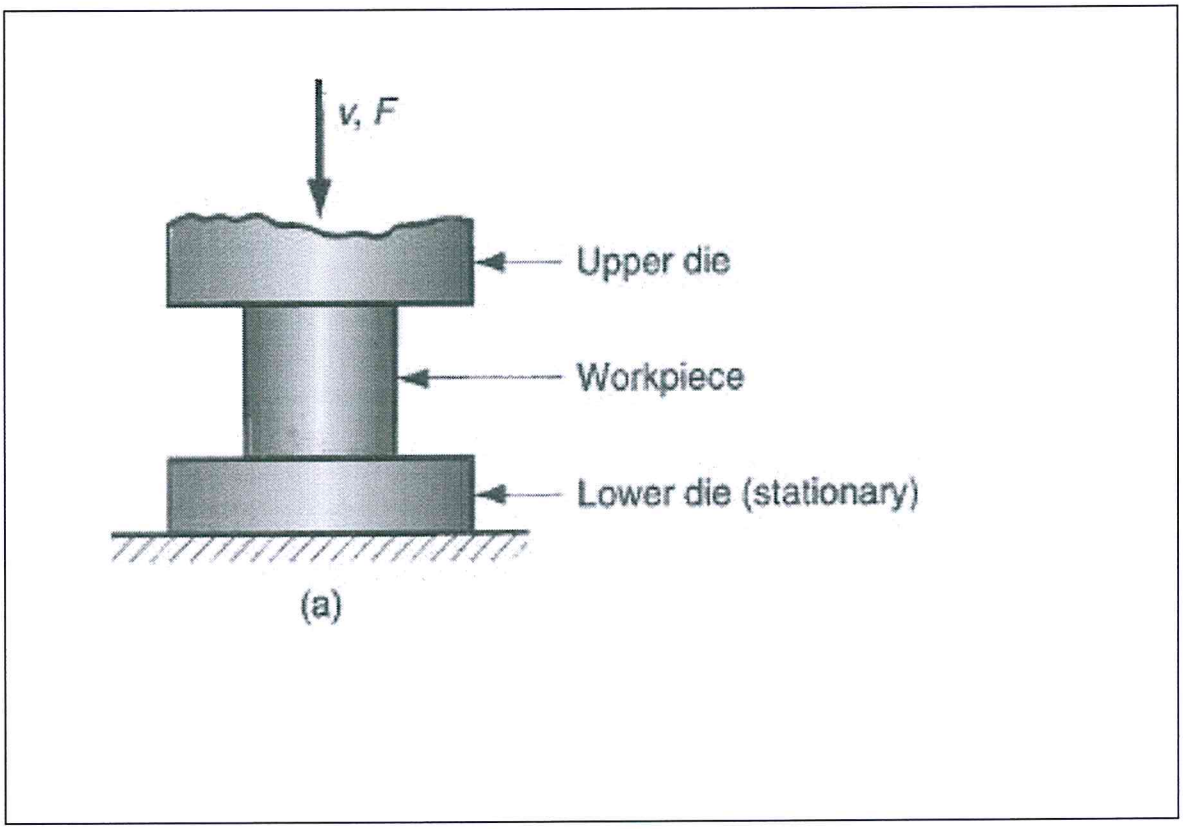
B2(a). List out the types of forging process according to the dies and the equipment.

(3 marks)

According to the dies	According to the equipment
Open die forging	Hand forging
Closed / Impression die forging.	Power forging
	Drop forging
	Press forging

B2(b). Write the parts names in the blocks provided of a open die forging process.

(3 marks)



B3(a). Define the following processes according to the operating temperatures.

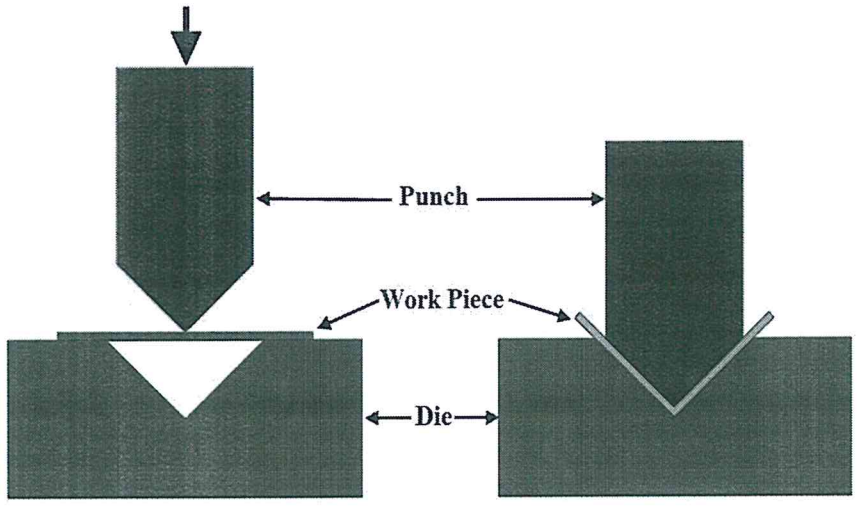
(3 marks)

1.Cold extrusion: Cold extrusion is the process done at room temperature or slightly elevated temperature.

2. Hot extrusion: Hot extrusion involves prior heating of the billet to a temperature above its recrystallization temperature. This reduces strength and increases ductility of the metal. The most commonly used extrusion process is the hot direct process.

B3(b). Write the parts names in the blocks provided of a common Die bending process.

(3 marks)



Common Die-Bending

B4.Write any three features of arc welding and also for gas welding process. (6 marks)

1. Arc welding:

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. A generic arc welding process. An electric arc is a discharge of electric current across a gap in a circuit. 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. filler metal is added during the operation to increase the volume and strength of the weld joint

2. Gas welding:

A fusion welding process which joins metals, using the heat of combustion of an oxygen and fuel gas (i.e. acetylene, hydrogen, propane or butane) mixture is usually referred as gas welding. Oxy-acetylene flame is the most versatile and hottest of all the flames produced by the combination of oxygen and other fuel gases. A filler metal rod or welding rod is generally added to the molten metal pool to have greater strength of the joint.

B5. What are the advantages and disadvantages of brazing process? **(6 marks)**

Advantages:

- **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.**

Disadvantages:

- **Joint strength is generally less than that of a welded joint**
- **Color of the metal in the brazed joint may not match the color of the base metal parts, a possible aesthetic disadvantage.**

B6(a). Write in brief about the lapping process. **(3 marks)**

Lapping is a final abrasive finishing operation that produces extreme dimensional accuracy, corrects minor imperfections of shape, refines surface finish and produces close fit between mating surfaces.

Finishing the work piece to a tolerance level of 0.0005 mm can be achieved by lapping process.

B6(b). What is galvanizing process and what is Zinc layer protecting? **(3 marks)**

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.

B7(a). Write any three advantages of CNC machines. **(3 marks)**

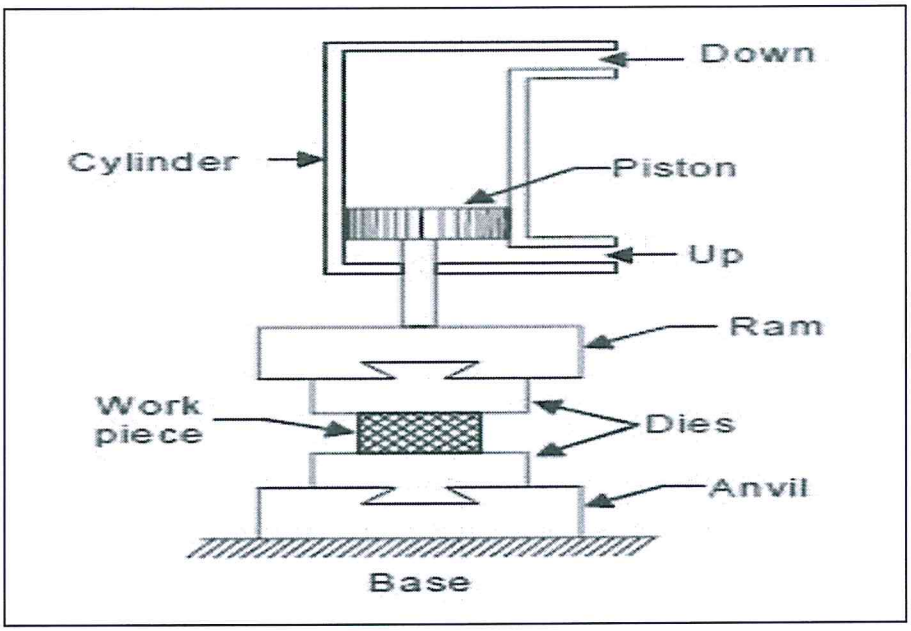
Advantages:

- 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.
- Less skilled/trained people can operate CNC machines unlike manual lathes / milling machines etc. which need skilled engineers.
- No human errors
- 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 replacing occasionally.

B7(b). List out the names of any three CNC machine tools. **(3 marks)**

- CNC Turning Centers
- CNC Drilling Machines
- CNC Milling Centers
- CNC Grinders
- CNC Bending Machines

B8(a). The image of power forging process is as shown below. Fill the blocks with appropriate names of the parts. (3 marks)

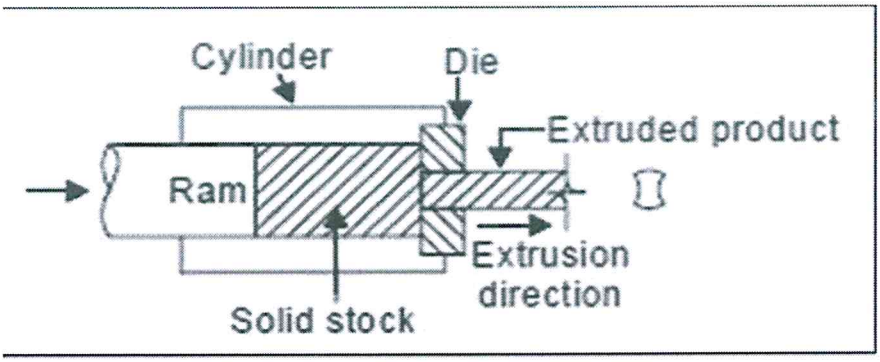


B8(b). Write in brief about Drop forging process. (3 marks)

Drop forging:

Drop forging is an operation in which the product of desired shape and size is formed by having repeated blows. The upper die and ram are raised by friction rolls gripping the board.

B9(a). Extrusion process image is as shown below. Write the names of the parts in the blocks provided. **(3 marks)**



B9(b). Write the three features of air bending process. **(3 marks)**

Air bending process:

Air bending is a simple method of creating a bend without the need for lower die geometry.

The sheet metal is supported by two surfaces at a certain distance apart.

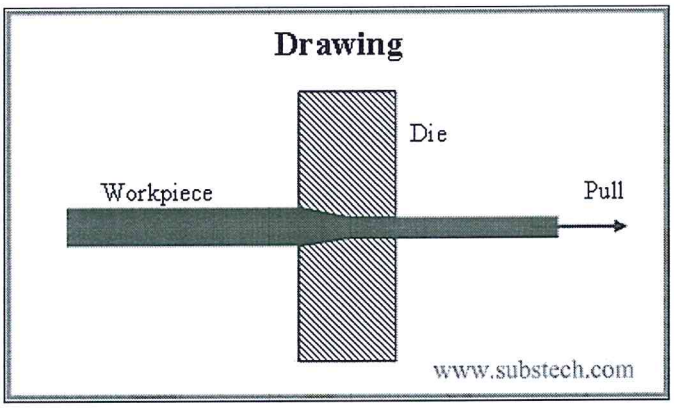
A punch exerts force at the correct spot, bending the sheet metal between the two surfaces.

B10(a). What is drawing process and also draw a free hand sketch of the drawing process. **(3 marks)**

Drawing process:

Drawing is a metal working process which uses tensile forces to stretch metal. As the metal is drawn (pulled), it stretches thinner, into a desired shape and thickness

Sketch:



B10(b). List out any three advantages of soldering process. **(3 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.**

END OF EXAMINATION PAPER