AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA
LEAVING CERTIFICATE EXAMINATION, 2000

ENGINEERING – MATERIALS AND TECHNOLOGY

(Higher level - 300 marks)

THURSDAY 22 JUNE – AFTERNOON, 2.00 – 5.00

Answer **Question 1, Sections A and B**, and **Four** other questions

1. **(100 marks)**

SECTION A - 50 marks

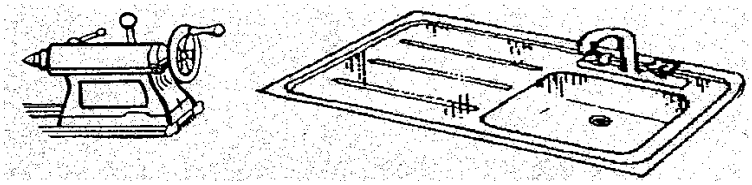
Give brief answers to any ten of the following:

(a) Describe the purpose of **any one** of the labels shown:

(b) Differentiate between pyrometallurgy and hydrometallurgy.

(c) Identify and explain **any one** common type of lattice defect in metals.

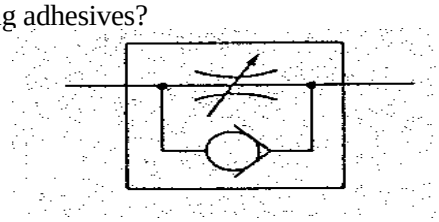
(d) Describe the basic principles used to manufacture **any one** of the items opposite.



(e) State **two** ways of minimising corrosion in metals.

(f) What factors should be considered when joining materials using adhesives?

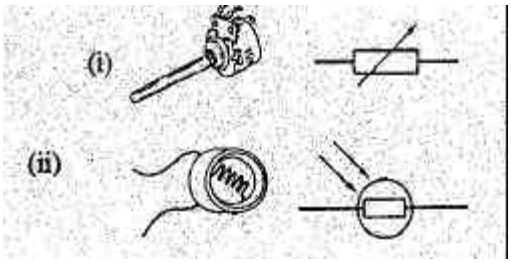
(g) Identify the pneumatic symbol shown:



(h) Name **any three** methods employed in the disposal of waste plastics.

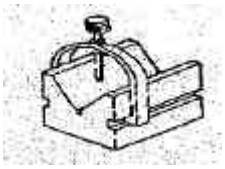
(i) What is meant by the term *metal fatique*?

(j) Two electronic components are shown as pictorial sketches and in symbolic form. Name **one** component and outline its purpose.



(k) Explain **one** of the following computer terms:
(i) Random access memory (RAM); (ii) Central processing unit (CPU);
(iii) Read only memory (ROM).

(l) Outline a function of the Vee block shown.



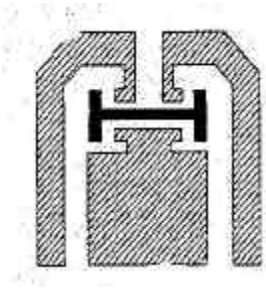
(m) What contribution did **any one** of the following make to technology:
(i)Blaise Pascal; (ii) Dugald Clerk; (iii) Leo Baekeland.

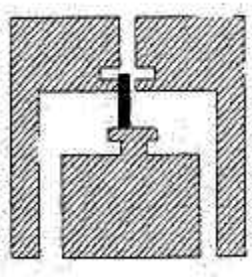
SECTION B - 50 marks

Answer **all** of the following:

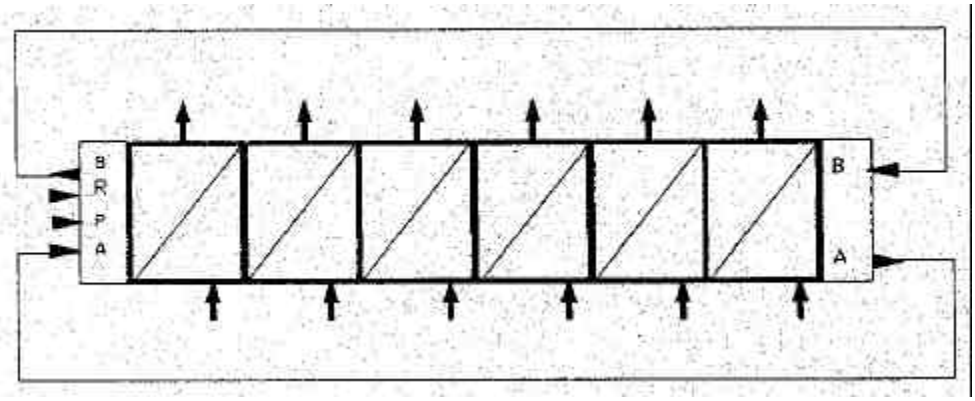
(n) Outline the advantages of using modular pneumatic sequencers.

(o) Using the diagrams below, outline the operation of the "AND" logic block **and** the "OR" block.

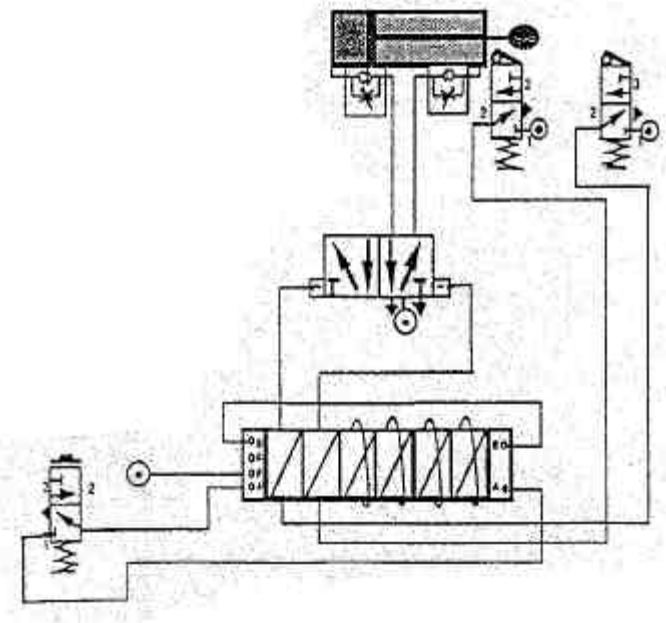




(p) Name the three main parts of the pneumatic sequencer shown below.



(q) Describe the operation of the simplified circuit shown.



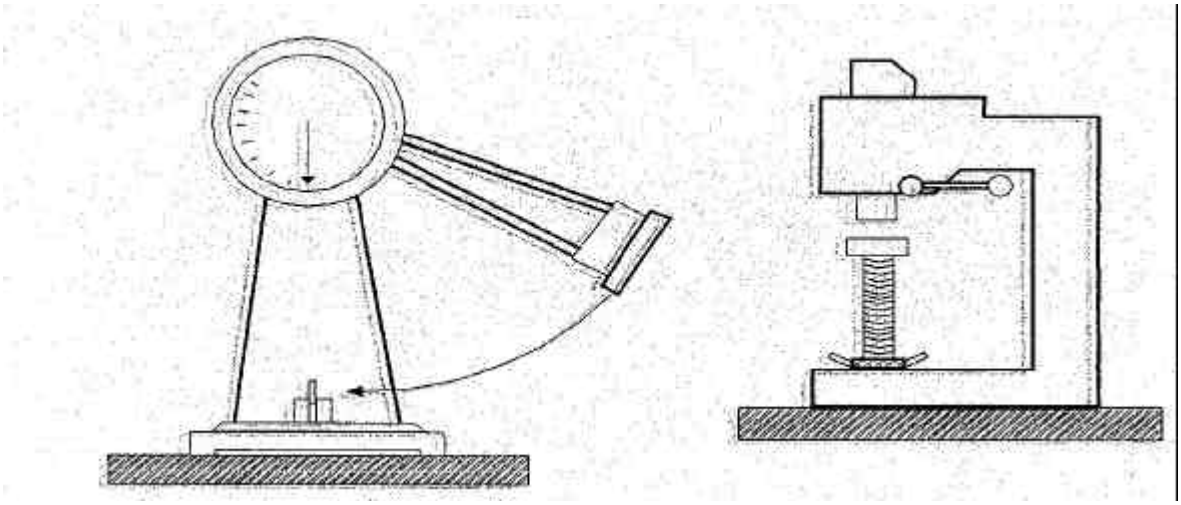
(r) Using the same circuit, identify the input, control and output stages of the circuit.

OVER ®

2. **(50 marks)**

(a) **(i)** State **three** reasons for testing materials mechanically.

(ii) Outline the principles of **any one** test associated with **one** of the testing machines shown below.



(b) The following data was obtained in a tensile test on a specimen of 12 mm diameter and of 50 mm gauge length.

Load (kN)	20	65	90	110	128	147	183	197	194	180
Extension (mm)	0.10	0.30	0.40	0.50	1.00	2.00	5.00	8.00	11.5	14.0

Plot the load / extension graph and determine:

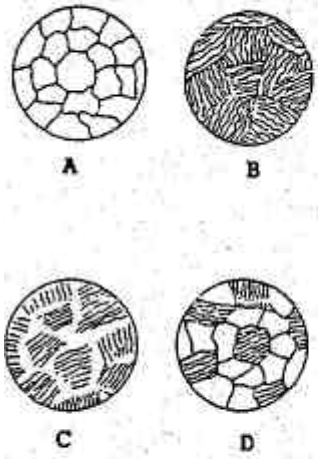
(i) The tensile strength.

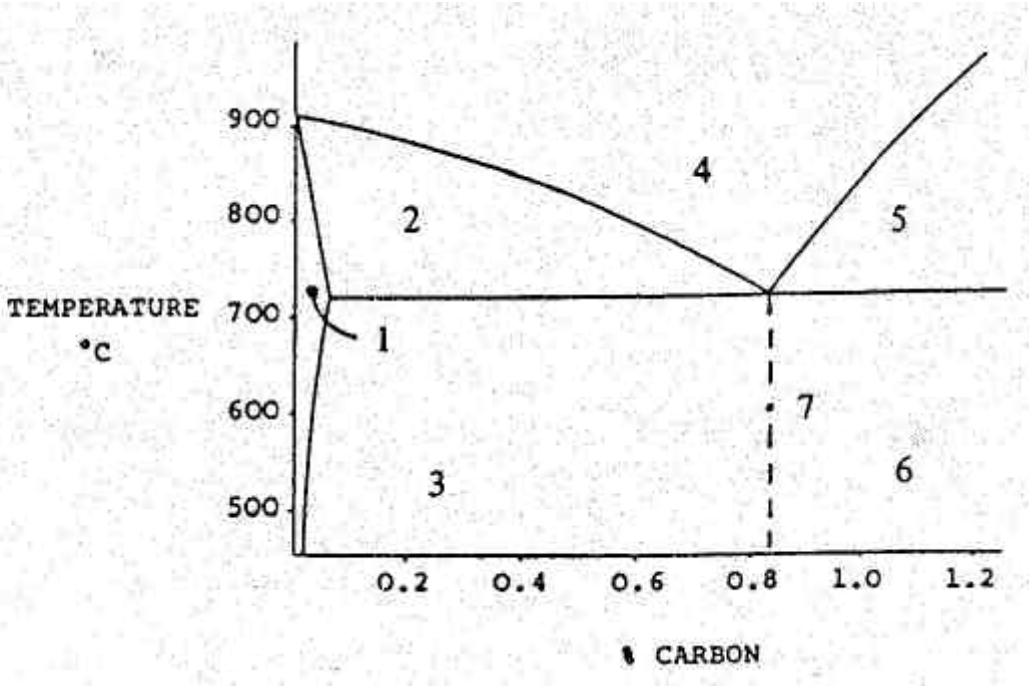
(ii) The 0.1% proof stress.

(c) Explain why non-destructive tests are needed in industry.
Describe briefly **one** non-destructive test you have studied.

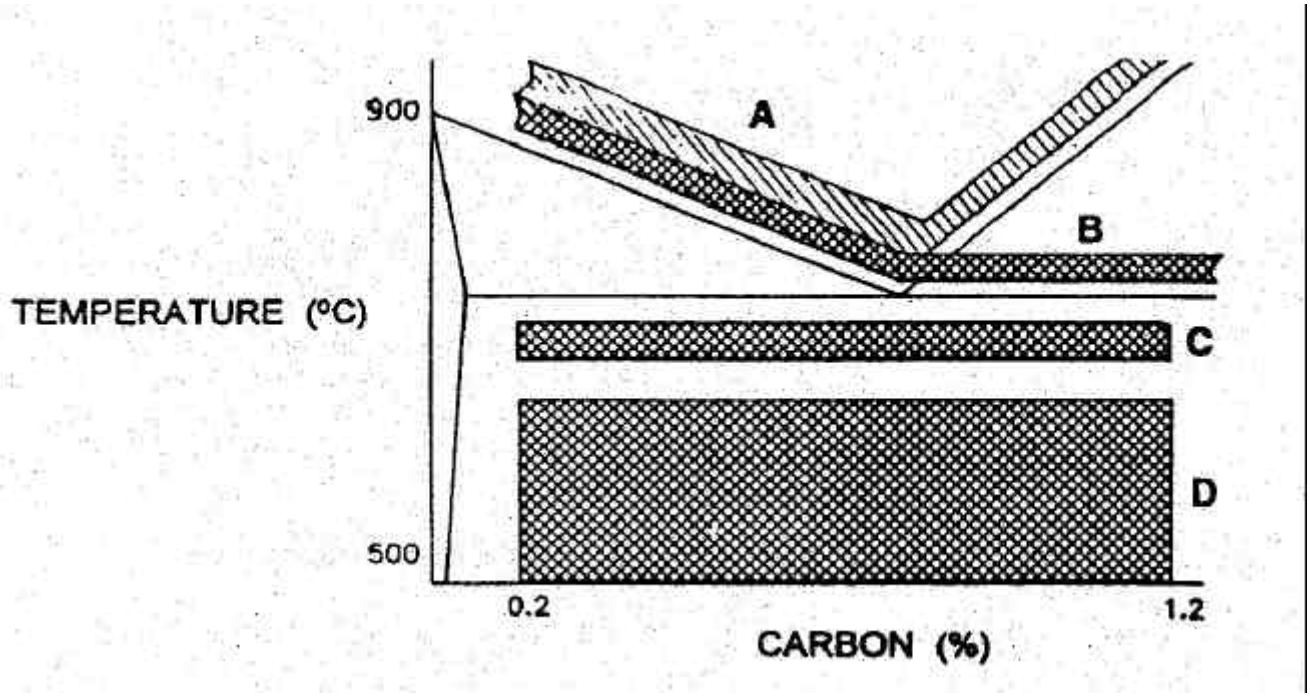
3. **(50 marks)**

(a) Various microstructures of carbon steel are marked A, B, C and D as shown below.
Relate **each** microstructure to the most suitable numbered position on the given equilibrium diagram and name these **four** microstructures.





(b) Temperature zones for various heat-treatment processes for carbon steel are marked A,B,C and D as shown below. Select **any two** zones and explain the heat treatment processes that are represented.



(c) Outline the principles of induction hardening **or** the flame hardening process.

OVER ®

4. **(50 marks)**

(a) Select **any two** of the following terms and give a definition for each selected:

(i) Eutectic Alloys;

(ii) Solid Solution;

(iii) Partial solubility.

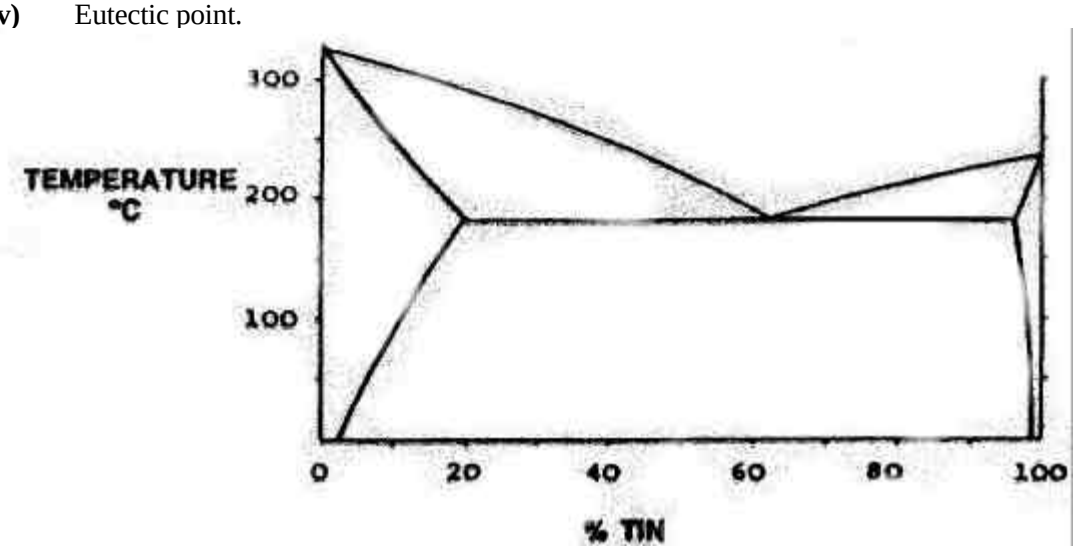
(b) Transfer the Lead – Tin equilibrium diagram, given below, into your answer book and identify and explain each of the following terms:

(i) Liquidus;

(ii) Solidus;

(iii) Solvus;

(iv) Eutectic point.



(c) Describe, with the aid of diagrams, **any three** of the following terms:

(i) Dislocation;

(ii) Vacancy;

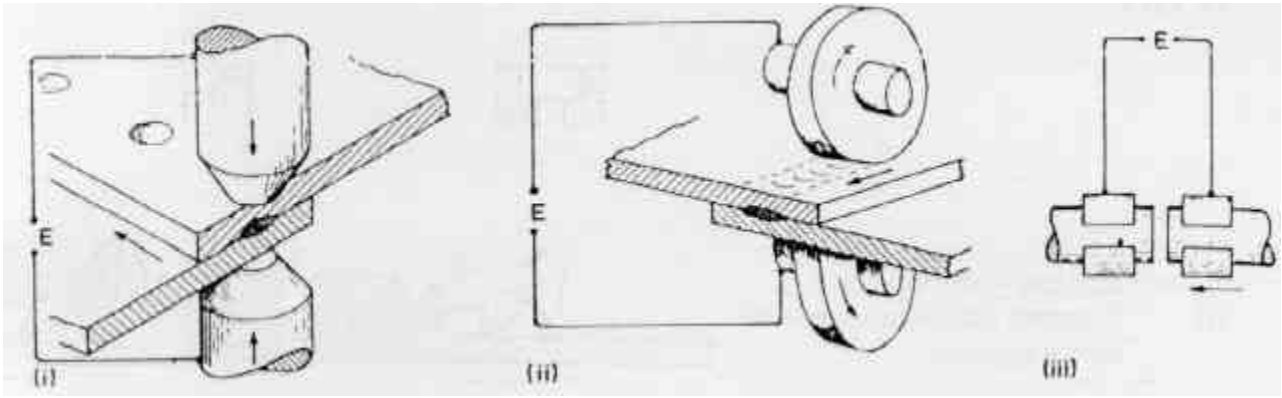
(iii) Substitutional alloy;

(iv) Interstitial solid solution.

5. **(50 marks)**

(a) Three forms of resistance welding are shown in the diagrams below. Select **one** and describe the process using the following guidelines:

(i) Name and operation;
(ii) Applications.



(b) Describe the function of a (i) transformer, (ii) rectifier and (iii) capacitor in arc welding.

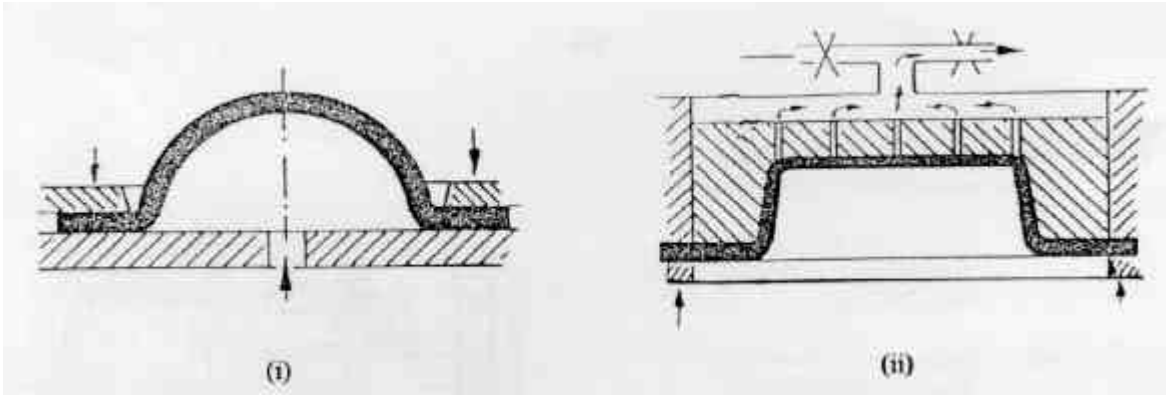
(d) Describe, with the aid of a diagram, the main features of **one** of the following processes:
(i) Electro-slag welding;
(ii) Submerged-arc welding.

OR

(c) Outline the advantages of using robots in industry.

6. **(50 marks)**

(a) Two methods of forming plastics using air are shown diagrammatically below.
Name and compare both methods.



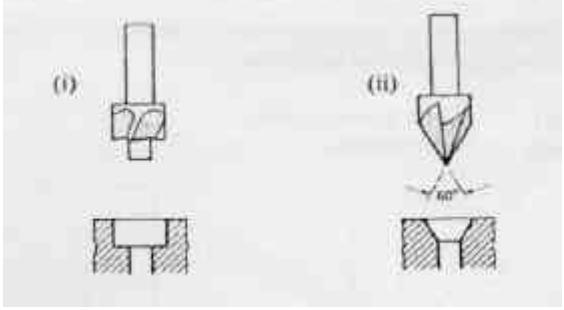
(b) Describe with the aid of diagrams the process of *addition polymerisation*.

(c) Explain **any three** of the following terms:

(i) Copolymer;
(ii) Amorphous;
(iii) PVC;
(iv) GRP.

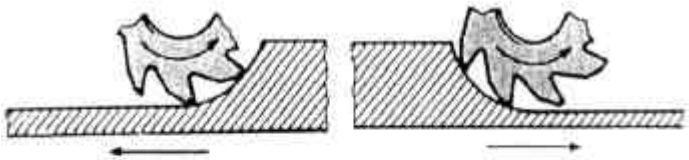
7. **(50 marks)**

(a) Distinguish between the drilling operations shown at (i) and (ii) and outline an application for **each**.

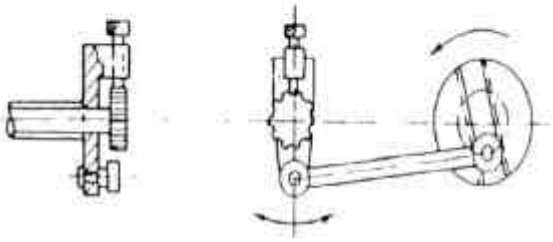


(b) Answer **any two** of the following:

(i) Compare the milling operations shown opposite;



(ii) Identify and briefly explain the operation of the feed mechanism shown opposite;



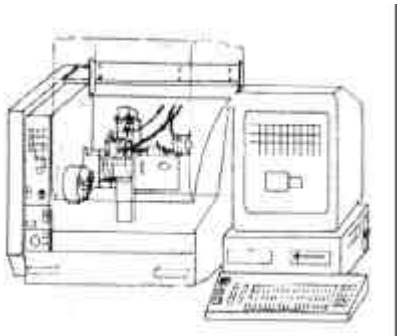
(iii) Compare gauging with direct measurement;

(iv) Name **three** types of cutting chip formed in machining.

(c) Explain how surfaces are machined by (i) forming and (ii) generating.

OR

(c) With reference to CNC machine shown, answer **three** of the following:



(i) Outline any **five** safety precautions incorporated in a CNC lathe;

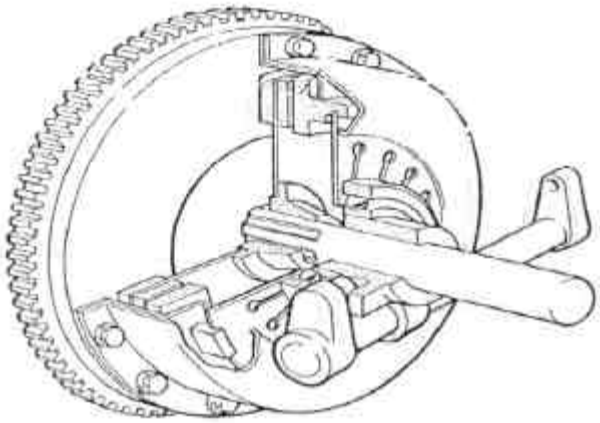
(ii) Explain, with the aid of a diagram, the difference between incremental dimensioning and absolute dimensioning;

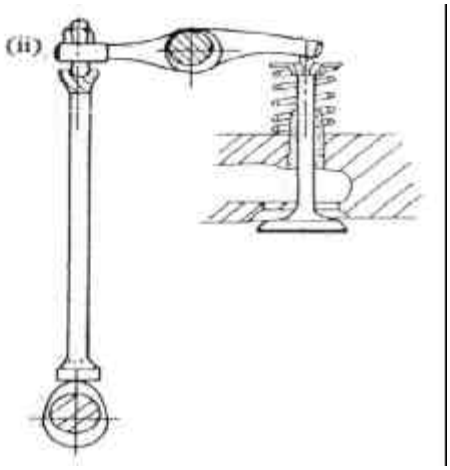
(iii) What is the meaning of simulation in CNC machining?

(iv) How is the position of the cutting tool determined in CNC machining?

8. **(50 marks)**

(a) Identify **any one** of the devices shown below and explain how it functions:



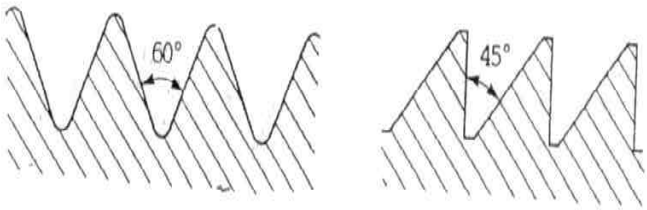


(b) Answer **any two** of the following:

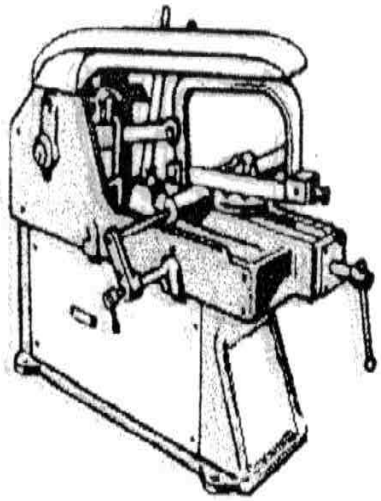
(i) Briefly outline the function of a *Dividing Head;*

(ii) Outline the advantages helical gears have over spur gears;

(iii) Distinguish between the **two** thread forms shown and outline an application for each.



(c) Outline the working principles of the power hacksaw shown opposite.



OR

(c) Explain the operation of the electronic circuit shown and suggest an application for its use.