City & Guilds

9210-132
Level 6 Graduate Diploma in Engineering
Manufacturing technology

Sample Paper

You should have the following for this examination
- one answer book
- non-programmable calculator
- pen, pencil, ruler

The following data is attached
- G code list
- M code list

General instructions
- This examination paper is of **three** hours duration.
- This paper consists of **eight** questions.
- Answer any **five** questions.
- All questions carry equal marks. The maximum marks for each section within a question are given against that section.
- An electronic, non-programmable calculator may be used but candidates **must** show sufficient steps to prior to obtaining final numerical values.
- Drawings should be clear, in good proportion and in pencil. Do not use red ink.

1 a) List **five** casting defects and briefly explain them. (10 marks)

b) What is meant by directional solidification in metal casting? (2 marks)

c) Write short notes on, (4 marks)

i) role of riser in sand casting

ii) role of chaplets in sand casting.

d) Briefly Explain the following terms. (4 marks)

i) Internal chill.

ii) External chill.

2 a) Write **two** difficulties of conventional machining processes when applied to machining the harder materials. (2 marks)

b) List **four** conventional methods of machining. (4 marks)

c) Write down **three** finishing operations, which are used in gear manufacturing. (3 marks)

d) Write down **four** significant advantages of cold working (cold forming) compared to hot working (hot forming). (4 marks)

e) List **three** limitations of cold working. (3 marks)

f) How and why are directional properties obtained in a forged component? Discuss advantages, disadvantages and applications of forging processes. (4 marks)

3 a) In metal cutting processes, tool wear is inevitable. Write down **three** significant mechanisms that cause tool wear. (3 marks)

b) Explain **three** modes of cutting tool failure. (6 marks)

c) A steel ring of outside diameter 600 mm and inside diameter 200 mm is being faced on a lathe machine. The machine is capable of maintaining a constant surface speed, as the face of the ring is being machined and the feed rate is set to 0.25 mm/rev. From tests when V = 50 m/min and n = 0.3 the tool life is 60 minutes. Given Taylor's empirical tool life relationship, $VT^n = C$ (standard notations) for a tool life of 50 minutes.

i) Determine the cutting speed (V). (4 marks)

ii) Calculate the time required for a single workpiece to be machined by the tool. (5 marks)

iii) Determine the number of components that can be machined. (2 marks)

4 a) Given in Figure Q4 is a typical drilling machine. Identify the indicated parts of the machine and label them. (6 marks)

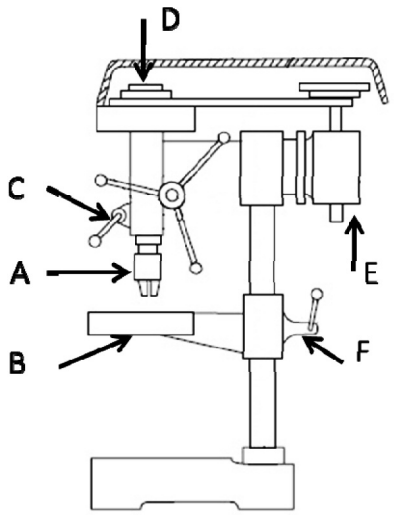

Figure Q4

b) Describe the drilling operation. (2 marks)

c) Write down **four** operations except drilling which can be carried out on drilling machines and describe them. (8 marks)

d) A drilling operation is carried out with a 12 mm diameter drill and it runs at 250 rpm. Calculate the cutting speed. (4 marks)

5 a) Write down the definition of a manufacturing system. (2 marks)

b) Write down **four** common characteristics of a manufacturing system. (4 marks)

c) There are **two** basic categories of manufacturing systems, as discrete part manufacturing and continuous process manufacturing. Describe them. (4 marks)

d) A small shaft is produced using a CNC machine. The machine operator's hourly rate is £8.30. The time taken to machine the shaft is 15 min. The steel billet used for manufacturing the shaft costs £1.67 per unit including chuck allowance and scrap. There are additional direct expenses of £560 for special tooling for many 1500 units. Calculate the following for a lot of 1500 units.

i) The direct labour cost of producing the shaft. (3 marks)

ii) The direct material cost. (3 marks)

iii) The prime cost (sum of the direct costs is known as the prime cost). (4 marks)

6 a) Describe the roles of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) systems in the product cycle. (6 marks)

b) What are the **three** modelling modes offered by CAD/CAM systems? (3 marks)

c) Write down **three** coordinate systems used in CAD systems and explain them. (9 marks)

d) Objects and their geometric models can be classified into **three** types from a geometric construction point of view. **Two** of them are 2 1/2D (two and half), 3D (three). Describe them. (2 marks)

See next page

7 a) The Programmable logic controller (PLC) is widely used in automation because of several of its advantages. Write down **four** advantages and describe them. (4 marks)

b) Write down **four** requirements that a modern manufacturing facility has to meet when considering the competition in the global market. (4 marks)

c) Write short notes on the followings.

i) Flexible manufacturing cells. (2 marks)

ii) Gantry for loading and unloading. (2 marks)

iii) Flexible transfer lines. (2 marks)

iv) Flexible machining systems. (2 marks)

d) List **four** benefits of Flexible Manufacturing System. (4 marks)

8 a) Briefly describe the followings.

i) Canned cycles. (2 marks)

ii) Tool offset/Tool compensation. (2 marks)

b) Figure Q8 shows a component to be machined on a 3-axis CNC milling machine. Tools to be used for machining are also shown in the figure. Write the part program for machining the component including a short description of the meaning against each program block. A list of G codes and M codes is attached. Tool and work materials are H.S.S. and mild steel respectively. The program should incorporate appropriate speeds and feeds. (16 marks)

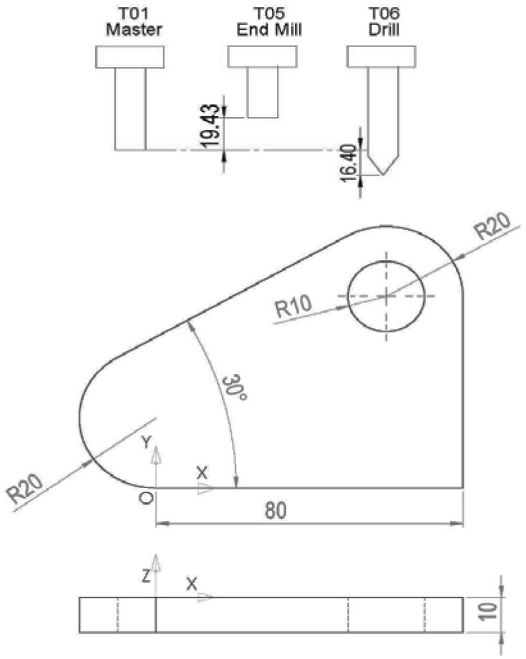

Figure Q8