University of Ruhuna- Faculty of Technology

Bachelor of Engineering Technology Honours Degree
Level 1 (Semester I) Examination, December 2025
Academic year 2024/2025

Course Unit: ENT1111 Basic Manufacturing Technology (Written)
Duration: 1 hour

- All symbols have their usual meanings.
- Answer all questions.
- The paper consists of 20 multiple-choice questions (MCQs) and one essay-type question. Underline the most suitable answer for the MCQ questions on the printed paper itself, and attach it to your answer booklet.
- Add captions that are relevant and accurate for the figures.

PART I – Multiple-Choice Questions (MCQs)

Underline the most suitable answer for the given question.

1. Which statement best defines the economic view of manufacturing?

   a) It is the process of using the cheapest materials available.

   b) It is the transformation of materials into items of greater value through processing or assembly.

   c) It is the mass production of goods regardless of quality.

   d) It is the handcrafting of unique artistic items.

2. The "neutral axis" in a sheet-metal bending operation is defined as:

   a) The line where the bending force is applied.

   b) The layer within the material that experiences neither tension nor compression.

   c) The outer surface that gets stretched the most.

   d) The centerline of the bending die.

3. You need to create an internal M10 × 1.5 thread in a blind hole. Which tool set and sequence is correct?

   a) Drill the correct clearance hole size, then use a thread-forming tap (roll tap) with a ratchet handle, followed by a spiral-point tap for finishing.

   b) Drill the correct tapping size, then use taps in sequence: taper (starter) tap → plug (intermediate) tap → bottoming (finishing) tap with a tap wrench.

   c) Drill the tapping-size hole, then use taps in this order: bottoming tap first to reach depth, followed by plug tap to widen, and taper tap to finish.

   d) Drill a pilot hole, then use a single adjustable round split die with a die stock, turning it clockwise and counterclockwise until full threads are formed.

4. A welder is joining two thick steel plates end-to-end in a single plane. The joint preparation involves beveling the edges to form a V-groove. What is this joint type called?
   a) Lap joint
   b) Tee joint
   c) Corner joint
   d) Butt joint

5. Using a vernier caliper (least count = 0.02 mm), you take a measurement. The main scale reads 41 mm, and the 25th vernier division aligns perfectly with a main-scale line. What is the total reading?
   a) 41.25 mm
   b) 41.50 mm
   c) 41.05 mm
   d) 41.025 mm

6. For a sheet metal bend with a 90° angle ($\theta = 90°$), bend radius $R = 4\ mm$, material thickness $t = 2\ mm$, and $K - factor = 0.33$, what is the bend allowance (B)? Use $B = (\pi/180) \times \theta \times (R + K \cdot t)$.
   a) Approximately 5.8 mm
   b) Approximately 7.3 mm
   c) Approximately 9.4 mm
   d) Approximately 12.6 mm

7. You need to file a soft aluminum workpiece to a smooth finish. Which file type and cut would be MOST appropriate to avoid clogging and to achieve a good finish?
   a) A bastard-cut, single-cut hand file
   b) A smooth-cut, double-cut flat file
   c) A second-cut, double-cut file
   d) A rasp file

8. Why is a "neutral" flame preferred for welding mild steel with oxy-acetylene?
   a) It is the coolest flame and prevents warping.
   b) It has a balanced gas mix that does not chemically alter the weld metal.
   c) It adds carbon to strengthen the weld.
   d) It is the easiest flame to adjust and see.

9. What is a key ADVANTAGE of Gas Metal Arc Welding (GMAW/MIG) over Shielded Metal Arc Welding (SMAW/Stick)?
   a) GMAW equipment is significantly cheaper and more portable.
   b) GMAW produces no heat, so there is no risk of burns.
   c) GMAW uses a continuous wire feed, allowing for longer, faster welds with fewer stops.
   d) GMAW does not require any shielding gas, making it ideal for outdoor use.

10. A major DISADVANTAGE of using hand tools like files and hacksaws for production work is:
    a) They provide the highest possible accuracy.
    b) They are low-cost and easily replaced.
    c) They cause high operator fatigue and are relatively slow.
    d) They can only be used on very small parts.

11. Which manufacturing process would be most suitable for producing high-volume, complex-shaped engine blocks from molten iron?
    a) Forging
    b) Powder metallurgy
    c) Machining from a solid block
    d) Casting

12. To quickly and permanently join two thin steel sheets in an overlapping configuration on an assembly line, which process is often used?

a) Oxy-acetylene welding

b) Shielded metal arc welding (stick)

c) Resistance spot welding

d) Threaded fasteners

13. You measure a shaft with a micrometer that has a negative zero error of 0.02 mm. The micrometer reads 15.45 mm. What is the true dimension of the shaft?

a) 15.47 mm

b) 15.45 mm

c) 15.43 mm

d) 15.65 mm

14. In metrology, if repeated measurements of the same part give very similar values but all are consistently 0.1 mm smaller than the part's known standard size, this indicates:

a) High precision and high accuracy.

b) High precision but low accuracy.

c) Low precision but high accuracy.

d) Low precision and low accuracy.

15. What is a critical safety practice when using a cold chisel?

a) Always wear gloves to get a better grip.

b) Grind off any "mushroom" (deformed) head that forms to prevent fragments from flying.

c) Use the largest hammer you can find for maximum force.

d) Hold the chisel at a very steep angle (near 90°) to the workpiece.

16. When using a hacksaw, the blade should be installed with the teeth pointing:

a) Towards the handle for easier cutting.

b) Away from the handle.

c) It doesn't matter as long as it's tight.

d) Upwards if cutting vertically.

17. Why is heat treatment classified as a "property-enhancing" operation rather than a "shaping" operation?

a) It changes the color of the metal.

b) It improves hardness or toughness without changing the part's overall geometry.

c) It is always performed before any shaping is done.

d) It removes material from the surface.

18. In Submerged Arc Welding (SAW), the granular flux serves a primary purpose similar to which element in Shielded Metal Arc Welding (SMAW)?

a) The electrode's metal core

b) The flux coating on the stick electrode

c) The welder's helmet lens

d) The grounding clamp

19. The core principle of an electric arc welding process involves:

a) Using a laser beam to melt the metal.

b) Generating intense heat from an electric arc struck between an electrode and the workpiece.

c) Applying high pressure to forge the parts together.

d) Using chemical reactions to fuse the metals.

20. The term "Least Count" of a measuring instrument refers to:

a) Its total measurement range.

b) Its purchase cost.

c) The smallest increment it can reliably read.

d) The number of scales it has.

(50 Marks)

PART II – Essay Questions

You are the production engineer for a company manufacturing a new product line requiring process selection, precision measurement, and assembly planning.

a) Manufacturing Processes - Classification and Selection

i. Define "Manufacturing" from a technical perspective, discussing physical and chemical transformations of materials.

[3 marks]

ii. Define "Manufacturing" from an economic perspective, discussing value addition through processing.

[3 marks]

iii. A cylindrical component (50 mm diameter, 150 mm length) can be produced by sand casting followed by machining, or by machining from solid round bar stock. Compare these two methods in terms of material waste.

[4 marks]

iv. For the same component in part (iii), recommend which manufacturing method would be better for producing 5 prototypes. Justify your recommendation.

[4 marks]

v. For the same component, recommend which manufacturing method would be better for producing 10,000 units. Justify your recommendation.

[4 marks]

b) Precision Measurement System

i. A vernier caliper has 1 Main Scale Division (MSD) = 1 mm, and 25 vernier divisions equal to 24 main scale divisions. Calculate the least count of this vernier caliper. Show all steps clearly.

[4 marks]

ii. When the jaws of the caliper are fully closed, the 3rd vernier division aligns with a main scale line. Calculate the zero-error value in mm and state whether it is positive or negative.

[3 marks]

iii. Using this caliper, you measure the internal diameter of a hollow shaft. The Main Scale Reading (MSR) is 48 mm and the 14th vernier division aligns with a main scale line. Calculate the observed reading.

[4 marks]

iv. Apply the zero-error correction from part (ii) to the observed reading in part (iii) and calculate the true internal diameter of the shaft.

[3 marks]

v. You suspect the shaft is not perfectly round. Name one measuring instrument that could be used to check roundness and briefly describe how it detects out-of-roundness.

[3 marks]

c) Assembly and Joining Technology

i. Compare welded joints and bolted joints in terms of joint strength. Which provides higher strength and why?

[3 marks]

ii. Compare welded joints and bolted joints in terms of ease of disassembly for maintenance purposes. Which is more suitable and why?

[3 marks]

iii. For permanent assembly of a pressure vessel, which joining method (welding or bolted joint) would be better? Provide two reasons for your choice.

[3 marks]

iv. A product requires joining a thin 2 mm aluminum sheet to a steel frame. Traditional fusion welding is problematic for this application. Suggest one alternative joining method suitable for this aluminum-to-steel combination.

[3 marks]

v. For the alternative joining method you suggested in part (iv), explain why it is suitable for joining dissimilar metals like aluminum and steel.

[3 marks]

.....End of the paper.....