

Department of Mechanical Engineering
Birla Institute of Technology and Science, Pilani, Pilani campus
ME F112: Workshop Practice
Comprehensive Examination (20/12/2023)

Time: 3 hours

Max. Marks: 90

Note to Students:

1. There are **Three** parts in this question paper. Start each Part from a fresh page and attempt all questions of a Part together.
 2. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
 3. This is a **CLOSED BOOK** examination. Only the use of the calculator is allowed.
 4. All questions carry sufficient information until instructed.
 5. **Assumptions** made, if any, should be stated clearly at the beginning of your answer.
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[PART – A]

1. Explain metal forming process? What are its advantages over other manufacturing processes? Give some examples of application of forming process. (2+2+1)
2. Explain with a schematic, manufacturing of a toothpaste tube using a suitable process. (5)
3. Explain the similarities and differences between soldering and brazing. (2.5 + 2.5)
4. What are the different types of flames in gas welding? Explain any two of them. (1+2+2)
5. What is green compact in powder metallurgy? Discuss the steps for fabricating a green compact of Aluminium. (2+3)
6. Discuss the different steps involved in building a 3D printed part. (5)
7. Explain the principle of additive manufacturing? What are the essential conditions that an additive manufacturing process must satisfy? (2+3)

[PART – B]

8. Explain the process of rolling with a suitable schematic. What do you understand by the following terms? (a) Ingot (b) Bloom (c) Billet (d) Slab (e) Plate, Sheet & Strip. Explain their significance in rolling process. (3+5+2)
9. What is arc welding? Explain the principle of arc welding with an appropriate schematic. What do you understand by straight and reverse polarity in arc welding? (2+6+2)
10. What is sintering process? Why is it required in powder metallurgy? Discuss the principle of sintering of metallic particles. Explain various steps required to sinter a green compact with appropriate schematic diagram. (1+2+3+4)

11. Classify different additive manufacturing process and discuss each additive manufacturing process with appropriate schematic diagrams. (10)

[PART – C]

12. Two pipes of inner diameter 200 mm and outer diameter 210 mm each joined by flash butt welding using 30 V power supply. At the interface, 2 mm of the material melts from each pipe which has a resistance of 42.4Ω . If the unit melt energy is 64.4 MJm^{-3} and thermal efficiency of the welding process is 40%, then find out the time required for welding in seconds. (5)
13. A rolling mill is used to reduce the thickness of a plate from 80 mm to 25 mm. The roll diameter is 500 mm and the coefficient of friction at the roll work interface is 0.15. The draft in each pass will remain same. Assuming no front and back tensions, estimate the minimum number of passes required in the rolling process? (5)
14. A $200 \text{ mm} \times 150 \text{ mm} \times 100 \text{ mm}$ part is to be additively manufactured. The thickness of a layer is 0.1 mm. The 3D printing needs to be done using the cross-section $150 \text{ mm} \times 100 \text{ mm}$ as a base. Time required for deposition of a layer is 3 seconds. Find out –
- a. Total number of layers to be deposited for building the part. (1)
 - b. Total time required for building the part. (1)
 - c. Total cost of 3D printing if one layer printing cost is Rs. 150. (1)
 - d. Percentage of time saving/wastage if the part is build using the cross section $200 \text{ mm} \times 100 \text{ mm}$ and $200 \text{ mm} \times 150$ as a base. (2)

---- All the Best ----