

**Name of the Examinations: B.E. METALLURGICAL ENGINEERING THIRD YEAR
SECOND SEMESTER – 2025**

Ref. No.: Ex/Met/PC/B/T/321/2025

Subject: FOUNDRY METALLURGY

Time:3 hrs. Full Marks: 100

Group / Part I (50)

Instructions: Use Separate Answer scripts for each Group / (Attending all the CO is mandatory from part I) *Answer question number 1 is mandatory from part I.

1. I) _____ is responsible for the prevention of erosion and washing away from the sand (CO II)

- A. Risers
- B. Gates
- C. Vents
- D. Sprue Hole

II) Shrinkage allowances also known as (CO II)

- A. Finish allowance
- B. Contraction allowance
- C. Taper allowance
- D. Camber allowance

III) The low permeability in sand can cause which of the following defects in casting (CO I)

- A. Rough surface
- B. Blow holes
- C. hot tears
- D. Drop

IV) Which of the following gating system components is the most critical that controls the rate of entry of metal into the molds? (CO II)

- A) Pouring basin
- B) Sprue
- C) Gate
- D) Runner

V) In centrifugal casting the impurities are (CO I)

- A. Uniformly distributed
- B. Forced outside the surface
- C. Collected in the center of casting
- D. Present in the middle section of casting

[Turn over

VI) If two parts of a mould are not joining properly, the casting may have the following defects (CO I)

- A. Scab
- B. Blowhole
- C. Gas porosity
- D. Flash

VII) Smallest in-gate area in the pressurized gating system causes _____(CO II)

- A. Turbulency
- B. Low velocity
- C. Low viscosity
- D. Smooth running of molten metal

VIII) A jet engine turbine blade is normally manufactured by (CO I)

- A. forging
- B. Shell molding
- C. Investment casting
- D. Pressure die casting

IX) Riser in a casting compensates for (CO II)

- A. Liquid state shrinkage
- B. Solidification shrinkage
- C. Liquid state shrinkage, solidification shrinkage and solid state shrinkage
- D. Liquid state shrinkage and solidification shrinkage

X) ----- is the strength of the sand (of mould cavity) above 100°C (CO I)

- A. Hot strength
- B. Green strength
- C. Dry strength
- D. None of these

CO I (Answer any 2 questions from CO I)

2. Explain the steps of precision casting process. What are the advantages of die casting process?
5+5=10

3. What types of mold can be used for Titanium alloy casting? Explain the ceramic molding process. If very thin walled cylinder is required to produce then what type of casting process is applicable? Explain.

1+4+1+4=10

4. Write down the composition of typical bank sand. What is the composition of fire clay and explain its property? How to measure the Green Compressive Strength (GCS) of molding sand?

1+1+3+5=10

CO II (Answer any 2 questions from CO II)

5. Explain how match-plate is used in the casting process with figure? What are the importance of pattern draft allowances and distortion allowances in casting?

5+5=10

6. What are the purposes of use of core in the casting process? Let's consider a down sprue with the following dimensions: Sprue height (h_2): 180 mm, Basin height (h_b): 60 mm, and Diameter at the top end (d_2): 20 mm. Find the diameter at the lower end (d_3) to avoid aspiration.

5+5=10

7. "The riser requirements depend on the type of metal being poured" explain with suitable examples. Mold has down sprue length 20cm. Cross sectional area of sprue is 1cm^2 . Down sprue feeds a horizontal runner leading into a mold cavity of volume 1000cm^3 . What is the time required to fill the mold cavity?

5+5=10

Name of the Examinations:
B.E. METALLURGICAL ENGINEERING
THIRD YEAR SECOND SEMESTER EXAM 2025
Subject: FOUNDRY METALLURGY

Time: 3hrs.

Full Marks: 100

Part- II (50)

Instructions: Use Separate Answer Scripts for Each Part

Answer all Questions

CO3: Compulsory

1. a) Predict the microstructure of a binary alloy based on its composition and phase diagram?
b) Explain the term "miscibility gap" in case binary solidification?
c) Derive the term "rate of stable nuclei".
d) Why peritectic transformation process is an endless process and draw the suitable diagram if required?
4+4+3+4=15

OR

- a) Draw the suitable diagram and explain briefly the term "temperature effect" on metallic glass solidification.
b) Why do equiaxed grains form?
c) Compare directional solidification with equiaxed solidification.
d) Is directional solidification possible in an annealing furnace?
5+3+4+3=15

2. Predict the microstructure of a binary alloy based on its composition and phase diagram. 10

OR

Describe how dendritic growth forms and how it affects the mechanical properties of a solidified metal.

CO4: Compulsory

3. a) Explain the effect of voltage in an arc furnace.
b) How will you control the cupola furnace for fast smelting requirement in a foundry shop?
c) Explain the term induced current effect for induction furnace.
d) How to control silica in the molten metal of the cupola?
4+4+4+3=15

OR

- a) Why is ADI considered a suitable replacement for steel in certain automotive and defense applications?
b) Why is the cooling rate from the austenitizing temperature to the austempering temperature critical in ADI production?
c) Explain with phase diagram the role of magnesium and silica in ADI.
d) How will you design a suitable grain refiner for Al-Si Alloy?
4+4+4+5=15

4. What role does carbon play in the formation of the graphite structure in cast iron, and how does it affect its properties?
5+5=10

OR

How does the solidification process influence casting defects such as shrinkage or porosity? Describe a procedure to identify whether a defect is mold-related or alloy-related.
6+4=10