Bachelor of Engineering in Metallurgical Engineering Examination, 2018
Third year (2nd Semester)
Foundry Metallurgy

Time: Three Hours   Full Marks: 100

Answer Question No.1 and any Five from the rest

1. Answer with one liner explanations: (Twenty (20) only)   1 X 20

   i.   Name two alloy systems where eutectics can be modified.
   ii.   Suggest an element in C.I. which helps nodularization.
   iii.   Suggest an element within C.I. which facilitates easy graphitization.
   iv.   Name one important peritectic alloy where transformation gets almost completed.
   v.   Name the phase that causes Gray Cast irons to be used as machine base.
   vi.   Name two types of sand other than Silica sand.
   vii.   State two advantages supporting Ultrasonic Testing of casting.
   viii. What is the use of Phos-copper during Copper melting?
   ix.   State the condition for developing Metallic Glass.
   x.   Name a casting process in which almost globular grains are manufactured in alloys.
   xi.   Name a casting process by which unmachinable parts can be produced.
   xii.   Name two types of Die casting process.
   xiii. Name a sand casting process where gasifiable patterns are used.
   xiv.   Which parameter, ΔG_{Volume} or $\gamma_{surface}$ is inhibitor during phase change?
   xv.   Which types of atmosphere is preferable during melting of non-ferrous alloys?
   xvi.   What good effects can be attributed to Chlorine during Al-melting?
   xvii. What are the drawbacks in Radiographic testing?
   xviii. Why is the optimum height of Coke bed maintained during Cupola melting?
   xix.   Why S.G. iron cannot be easily produced in Cupola?
   xx.   Does Chilled iron and White Iron have the same material composition?
   xxi.   What is the basic signature of cast structure?
   xxii. What benefits can be availed from heterogeneous nucleation during solidification?
   xxiii. Which casting defects can easily originate due to high pouring temperature?
   xxiv. Can the melting coke of Cupola be responsible for brittleness in Gray Iron?

2. Define with an example (Any Sixteen (16) only)   1 x 16

(i)Sand slinging, (ii) No-bake Binder, (iii) Sweep pattern, (iv) Match Plate Pattern (v) Wood flour, (vi) Clay micelle, (vii) Crucible number, (viii) Jobbing Foundry, (ix) Flow-Off, (x) Blind Riser (xi) Scab defect (xii) Casting Modulus (xiii) Vena Contracta (xiv) Cell Dendrites (xv) Sprue, (xvi) Core Print (xvii) Centrifuging, (xviii) Venting.

3. Describe two types of (Any eight (8) only)   2 x 8

(i) Foundry Sand Properties, (ii) Bonding mechanism, (iii) Pattern Allowances, (iv) Gating laws (v) Risers,(vi) Directional solidification mechanism techniques, (vii) Machine Molding, (viii) Peritectic cast alloy, (ix) Metal solidification,(x) Graphite in C.I.

4. Derive: (Any eight (8) only)   2 x 8

(i)Top Gating Filling time, (ii) Permeability Index, 3000/t (iii) Determination of GFN, (iv) $r \propto (1/\Delta T)$ (v) Modulus of a Plate (vi) Aspiration correction of Sprue (vii) Up-thrust of a Plate shape Casting (viii) Solidification time for Castings (ix) Coke bed Weight for Cupola (x) Liquidus Point of Alloy .

5. Justify: (Any eight (8) only)   2 x 8

(i) Mold Dilation, (ii) Mold Hardness,(iii) Growth of Cast Iron, (iv) 'P' in Gray C.I. (v) Modification of Silumin alloys (vi) CO_2 mold, (vii) Molasses in sand molding (viii) Hot Tearing (ix) Coring.

6. Explain: (Any eight (8) only)   2 x 8

(i)What is the importance of Coke Bed height? (ii) What is a Divided Blast in Cupolas? Why is it advantageous? (iii) Why SG iron is produced in Electric Arc F/c? (iv)What is Chilled Iron and how Chilled iron chemistry is decided and achieved? (v)What is Nodule Count and how it controls mechanical properties in SG irons? (vi) Why Centrifugal casting process cannot replace Die casting process?(vii)Why steel casting needs low GFN sand?(viii) How Continuous casting process helps in fine grained steel production?(ix) Without Si can Graphitic Cast irons be produced increasing C-content? (x) Why 60/40 brass casting is so popular?

7. Solve the following: (Any four (4) only)   4 x 4

(i) (a) A sample of clay weighing 10 g has been put into a beaker of water. The resultant solution was found to neutralize 15 ml. of $(\frac{N}{10})$ HCl solution. Calculate Base Exchange capacity of the clay. (b)A Permeability test uses 2100 cc of air to pass through a Standard AFS sand sample under a pressure of 9.0 g/cm2 for 28 sec. Calculate the Permeability and comment its suitability.

(ii) A steel plate casting holds blue print dimensions of 24 mm x 800 mm x 1500 mm. Estimate the pattern dimensions if cast in sand molds.

(iii) A cylindrical Bush of size 200 mm I.D and 300 mm O.D with 850 mm length is to be made of Brass. Estimate the pattern and core dimensions if it is designed to be cast horizontally.

(iv)Pattern dimensions of bush 155 mm I.D x 185 mm O.D x 615 mm long has to be directionally solidified. Design a proper estimate of riser size and riser placement, if cast horizontally.

(v)A 20 mm steel plate weighing 150 kg casting has to be gated unpressurized in sand mold. Design the gating system with Sprue, runner and gates assuming necessary requirement.

8. Briefly describe the following: (Any four (4) only)   4 x 4

(i) Dendritic Structure in Cast alloys (ii) Melting Furnaces. (iii) Operation of a standard Cupola (iv) ADI production (v) Turbine blade Casting.

9. Write notes on: (Any two (2) only)   8 x 2

(i) NDT methods, (ii) Foundry Equipment (iii) Non-ferrous Alloy Melting.