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Total number of printed pages – 2

B. TECh  
PCMT 4305

Sixth Semester Regular Examination – 2015

**SOLIDIFICATION AND CASTING**

**BRANCH (S) : MM, MME**

**QUESTION CODE : J 290**

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

*The figures in the right-hand margin indicate marks.*

1. Answer the following questions :

2×10

- (a) Why Base-Centered Tetragonal structure is not possible ?
- (b) Write two eutectic system which form lamellar eutectic and another two eutectic system which form divorce eutectic ?
- (c) State the detriment caused to the mould properties , if the moulding sand contains –
  - (i) too much clay
  - (ii) too much water.
- (d) What is meant by double shrinkage allowance ?
- (e) The size of the gate should neither be small nor too large, justify your answer ?
- (f) Is eutectic freezing slower than peritectic freezing ? Justify your answer.
- (g) Why cold chamber die casting machines are usually preferred for casting of aluminum base alloys ?
- (h) Find out the size of critical nucleus for homogeneous nucleation if the tiny solid formed is a cube? The length of cube is a.
  - (i) Is superheat required for melting ? Justify your answer.
  - (j) What properties are desirable of moulding sand from the stand point of sound casting ?

P.T.O.

2. Derive Scheil equation for alloy solidification and explain the varying composition profile of solute during solidification, assuming no diffusion in solid and complete mixing in liquid. 6+4
3. Describe the industrial melting practices that are adopted for the melting of cast iron. Why investment casting is so versatile as to shapes and produces excellent dimensional controls ? 7+3
4. (a) Estimate the number of crystal like clusters in  $1\text{ mm}^3$  of copper at its melting point for spherical clusters containing 60 atoms. The atomic volume of liquid copper is  $1.6 \times 10^{-29}\text{ m}^3$ ,  $\gamma_{sl}$  (surface energy) =  $0.177\text{ J/m}^2$ ,  $k = 1.38 \times 10^{-23}\text{ JK}^{-1}$ ,  $T_m = 1356\text{ K}$ . 5
- (b) Explain with sketch how very large gray iron pipes are cast using the centrifugal process ? 5
5. (a) In pure metal when a solid growing in to a super cooled liquid dendritic growth occurs. Derive an expression for the velocity (V) of the tip of growing dendrite, assuming the solid is isothermal and the temperature gradient in the liquid is measured in the direction of V. 5
- (b) What is mean by casting yield and what are the methods available to a casting designer to increases the casting yield ? 5
6. (a) What are unique advantages of making casting in permanent moulds ? Explain the cycle of operation a hot chamber die casting machines. 2+4
- (b) For production of sound steel casting risers are required, justify your answer. 4
7. Explain the various casting defects; their causes and remedial measures that should be taken to eliminate/minimize these defects. 10
8. Write short notes any **two** of the following : 5x2
  - (a) Cellular growth
  - (b) Constitutional supercooling
  - (c) Vacuum sealed casting
  - (d) Heterogeneous nucleation.

