Menofia University
Shebin El- Kom
Faculty of Engg.
Final Exam.(2nd term)
Total Mark : 70

Fourth Year
Dep.: Production Engg.
Sub.: Casting of Engg. (PRE 424A)
Time Allowed: 3 hrs.
Date:26/5/2015

This exam. measures ILOs no. (a1, a3, b6, b13, c5, c15 c4, d1, d9)

Note: Any data required, but not given, may be reasonably assumed.

Answer all the following Questions

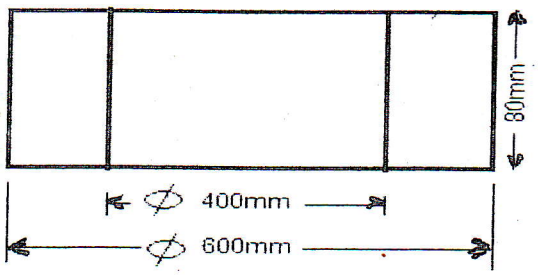
Question(1) (15 Mark)

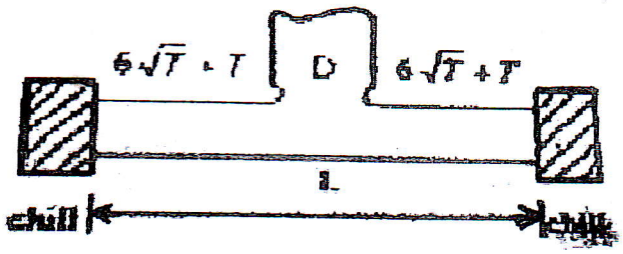
A) Discuss the main function of a gating system, showing the design requirements of proper system. Explain with drawings four different designs of gates.

B) Discuss the use of chills in making castings and show with sketches the effect of chill on feeding distance.

C) Discuss three methods for determining the riser dimensions.

D) Calculate the number of risers needed and the riser dimensions to feed the casting shown in Fig.1. Assume top risers (D = T) with chills in between, volume ratio (Vr / Vc) = 0.75 , and H = 1.5 D





Fig,1

Question(2) (10 Mark)

A) What is a center-line shrinkage and why does it occur?

B) From a metallurgical point of view, the rate at which castings cool during solidification in a mold affects the soundness of the castings. Explain.

C) With the aid of sketches, illustrate some design principles that must be considered to obtain a sound casting.

Question(3) (10 Mark)

A) Calculate the amount of fuel consumption to melt a 50 kg. of the aluminum alloy. Some useful information for the aluminum alloy:

Specific heat = 0.2259 Cal/gr.°C.

Latent heat = 93 Cal/gr.

Melting point = 660 °C.

Temp. losses = 90 °C.

C.V.(fuel calorific value) = 8000 kcal/kg.

Burning efficiency = 25%

The average primary heat amount for the furnace = 15000 kcal.

B) Calculate the fuel cost required to melt one kg of aluminum if the price of kg from fuel is equal 100 P.T.

C) Compare this cost with the melting cost in a similar electric furnace if the price of kg watt from the electric energy is equal 50 P.T. (KWH = 860 kcal).

Question(4) (10 Mark)

A) Discuss the influence of the following in cupola melting:
Coke-bed height, Iron – coke ratio, Air flow rate

B) Differentiate between the following:
Blow holes and pin holes, Cold shuts and misruns, Rate tail and buckle

C) Describe with the help of a neat sketch the various types of die castings machines. State their advantages and limitations.

D) What casting processes will you prefer for the following:
Small zinc castings, Small brass gears.
Aluminum pistons, Turbine blades, Cast iron pipes.

E) What do you understand by continuous casting? Give its few applications.

Question(5) (15 Mark)

You are asked to produce iron casting grade (GG25) with a carbon to silicon ratio of 1.5 and P-content not more than 0.3%.

A) Calculate the carbon index and the chemical composition of the iron needed.

B) Calculate the degree of normality, (RG), the relative hardness, (RH), and the quality index of the iron, if the measured values of the ultimate tensile strength and hardness of the 30 mm. diam. test bar were 30 and 229 kp/mm^2 respectively.

C) Check the deviation in the chemical composition (%C, %Si, %P and % Sc) of the following furnace charge from the right one.

Raw Material	%C	%S_i	%Mn	%P	%S
27 kg Pig Iron	4.23	3.20	0.6	0.4	0.05
120 kg C.I. Scrap	3.50	1.82	0.3	0.25	0.02
3kg Steel Scrap	0.28	0.65	0.2	0.01	0.001

The oxidation losses of C, Si and M_n are 10, 5 and 20% respectively. Before pouring, 0.3% F_eS_i will be added to molten metal in the ladle as a graphitizer.

Question(6) (10 Mark)

A) Show diagrammatically the relation between the green compression strength and the moisture content of the molding sand taking the clay content as a parameter.

B) How can you measure the following properties?
- The expansion stresses of the foundry sand
- The average size and the degree of uniformity of the sand
- The permeability No. of the molding sand

C) The laboratory test results of a certain type of molding sand are found to be as follows:
Sieving test: using a molding sand sample of 50 gr.

Di, mm	0.4	0.3	0.2	0.15	0.10	0.07	0.05	Pan
Fi, gr.	0.2	0.65	1.2	2.25	8.55	11.9	10.9	9.3

Permeability test carried out on a standard test specimen (50 mm dia. and 50 mm length), pressure difference are = 50 mm water, time = 2 min.

The required:
1- The mean grain size and the degree of uniformity of the sand.
2- Calculate the clay content if the sample contains 4.8 water.
3- Calculate the permeability No. of the sand.

Best wishes