I.I.T., Delhi
MEL 232 Casting, Welding and Forming
Major test – May 2007

Time 2 hr **Max. marks 60**

1. **Attempt all questions from sections A and B**
2. Section A and B should be answered on **separate answer books.**
3. Marks allocated for each question are given on the side.
4. Give neat sketches where necessary.
5. Use of **preheat tables and Schaeffler's Diagram** is permitted

Section A

1. Explain in step-by-step manner Caine's method of determining the size of riser for casting (7)

Explain also the merits of this method over Chvorinov's method of riser design. (3)

2. Draw and explain the pattern of variation of voltage and current with time for conventional MIG welding where short circuiting type transfer is encountered. (4)

Also correlate this pattern with short circuiting phenomena and show it by sketch. (2)

Describe, with reference to the above mentioned pattern, how the process is optimized to minimize spattering as well as to prevent wire getting stuck in the weld pool. (4)

3. (a) Give the major classification of stainless steels in different types. Give one or two line explanation of each. (4)

(b) What are the problems encountered during welding of stainless steel. Give methods of overcoming these. (6)

Or

Type 316 stainless steel, with the following chemical composition is to be welded using coated electrodes. (6)

C%	Mn%	Si%	Cr%	Ni%	P%	S%
0.08	2.0	1.0	18	14	0.045	0.03

Electrodes with three different compositions are available as follows:

Type	C%	Cr%	Ni%	Mo%
1	0.08	25	12	3
2	0.08	25	20	-
3	Same composition as stainless steel base plate (type 316)			

Choose the most suitable electrode for welding the plates of type 316 stainless steel as stated above.

Give reason for your choice and also state reasons for not selecting other two type of electrodes.

4. Two low alloy boiler steel plates of 20 mm thickness are butt welded using 3.15 mm dia. basic coated electrodes of matching composition. Determine the degree of preheat required when the composition of material of plate is given as:

cont. -2

C%	Cr%	Mo%	Ni%	Mn%
0.2	1.1	0.65	0.3	0.7

(5)

If the welding conditions for MMA welding used with 3.15 mm dia. electrode are:
I=120 amp; V=25 volts; v=2.5 mm/sec.,
Determine the weld centerline cooling rate at 450 C when this preheat is used.
Assume room temperature of 25 C. The cooling rate is given by formulae (5)

Thick plate $$-\frac{dT}{dt} = \frac{2\pi k (T-T_0)^2}{(q/v)}$$

Thin plate $$-\frac{dT}{dt} = \frac{2\pi k \rho c h^2 (T-T_0)^3}{(q/v)^2}$$

Parameter $$\tau = h\sqrt{\frac{\rho c (T-T_0)}{(q/v)}}$$

Here q = Rate of heat input in to plate
v = Welding speed
h =Plate thickness
k, ρ, c are material properties with usual meaning. These are given as
Specific heat = 440 J/Kg. K
Thermal conductivity= 50W/m. K
Density = 7840 Kg/m^3

Section B

1. During cup drawing process what are the different processes which contribute to stress in cup wall. Illustrate with figures. 4
2. Derive an expression for analysis of radial stress during flange drawing in the cup drawing process. 4
3. What is nesting in sheet blanking? Give two examples of nesting. 3
4. In tube sinking determine the contribution to drawing stress due to drawing through conical portion of die. 4
5. Determine the drawing stress in a tube sinking process at the end of conical portion of die for the following data.
   Initial outer diameter of tube = 24 mm Thickness = 2mm
   After drawing outer diameter of tube = 20 mm Thickness = 2 mm
   Semi-die angle = 10 deg. Yield strength in tension = 300 N/mm^2
   Co-efficient of friction = 0.1 3
6. In wire drawing process how to find the stress due to shear deformation at the entrance to die. 2