Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B. TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY2017

SUBJECT: AUTOMOTIVE PRODUCTION TECHNOLOGY (AAE 2253)

REVISED CREDIT SYSTEM
(26/04/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Assume missing data suitably by clearly stating the assumption.
- Give sketches/graphs/examples wherever necessary.

1A The total solidification times of three casting shapes are to be compared: (1) a sphere with diameter = 10 cm, (2) a cylinder with diameter and length both = 10 cm, and (3) a cube with each side = 10 cm. The same casting alloy is used in the three cases. (a) If the mold constant = 3.5 min/cm^2, compute the total solidification time for each casting. (b) Theatrically, which geometric element would make the best riser? Why? **(03)**

1B A cast iron cylinder liner is to be manufactured using horizontal true centrifugal casting process with the following dimensions: length = 35 cm, outside diameter= 21 cm, and inside diameter = 20.2 cm. Determine the required rotational speed (in rpm) in order to obtain a G-factor of 80, so that operation will be successful. **(02)**

1C With reference to **Figure 1**, identify defects A, B, and C of casting. Suggest a method to prevent each defect. **(03)**

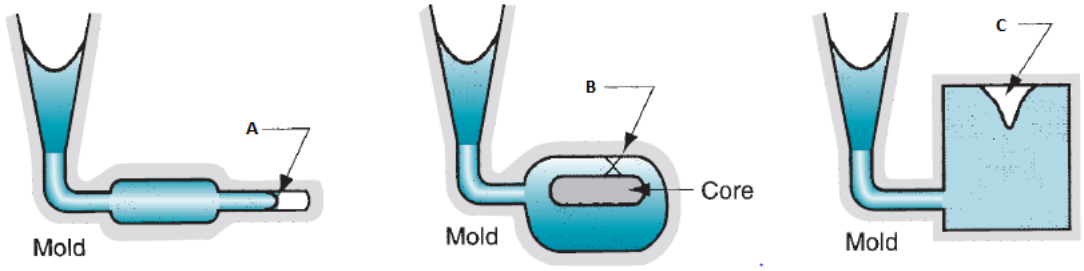

Figure 1

1D What is the function of the following in casting (a) core print (b) chill? **(02)**

2A Define cold working and hot working. Indicate the temperature range of hot working, cold working in terms of melting point of material. **(02)**

2B What is super plasticity? What is its significance with reference to automotive sheet metal processing? **(02)**

2C You are supplied with two metallic powder packets with different powder shapes and sizes. How would you determine which among the metallic powders is having more inter-particle friction? **(02)**

2D What is the advantage and disadvantage of flash formation in impression die forging? **(02)**

2E Explain the significance of (a) neutral axis in bending (b) neutral point in rolling. **(02)**

3A A circular washer with 50 mm outer diameter and 25 mm inner diameter is to be made from 1 mm thick sheet. Determine the punch and die dimensions for (a) blanking and (b) punching, if clearance per side is 0.65 mm. **(02)**

3B An L-shaped structural section is direct extruded from an aluminum billet in which Lo =500 mm and Do = 100 mm. Dimensions of the cross section are given in **Figure 2** Die angle= 90º. Determine (a) extrusion ratio, (b) shape factor. Given **(04)**

$$K_x = 0.98 + 0.02\left(\frac{C_x}{C_c}\right)^{2.25}$$

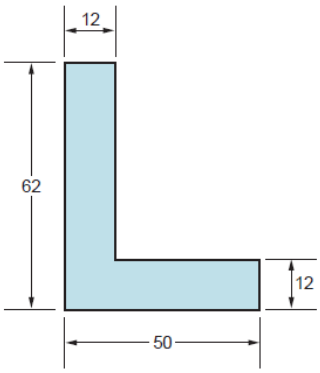

Figure 2

3C A bending operation is to be performed on 5.00 mm thick cold-rolled steel. The part drawing is given in **Figure 3**. Determine the blank size required. Given K_{ba}=0.33. Determine the bending force required in the operation if the bend is to be performed in a V-die (K_{bf} =1.33) with a die opening dimension of 40 mm. The material has a tensile strength of 600 MPa and a shear strength of 430 MPa. **(04)**

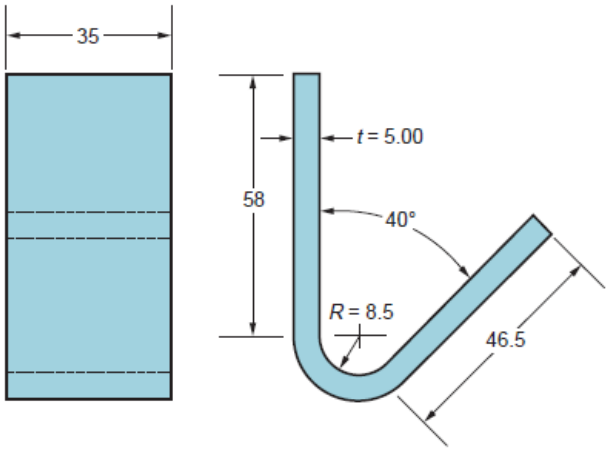

Figure 3

4A Draw the RC circuit used for the spark generation of Electrical Discharge Machine and sketch the variation of voltage and the current waveforms during a spark cycle in EDM. **(03)**

4B What is the basic principle of the intensifier used in abrasive waterjet machine to generate very high pressure of the order of 4000 bars? **(02)**

4C For the following applications, identify the most suitable non-traditional machining processes that could be used, and present arguments to support your selection. Indicate the material removal mechanism for each process. **(03)**

(a)The application is drilling of 3000 holes of 0.6 mm in a turbine engine combustion dome with the separation between holes in each direction=1.6 mm.

(b) The application is to cut large quantities of fabrics for a furniture company that makes upholstered chairs and sofas. Many of these fabrics are strong and wear-resistant, that make them difficult to cut

(c)The application is the need for a very quick generation of a mold cavity with a contoured bottom in a 50 mm cube of steel. The overall size of the cavity is 25 x 19 mm and its depth is 5 mm.

4D In a wire EDM operation performed on 7 mm thick C1080 steel (melting point = 1500^{o}C) using a tungsten wire electrode whose diameter = 0.125 mm, past experience suggests that the overcut will be 0.02 mm,so that the kerf width will be 0.165 mm. Using a discharge current 10 amperes, what is the allowable feed rate that can be used in the operation. **(02)**

5A With reference to Figure 4, compare the strength and grain size at points 1, 2 and 3 on the HAZ of a weldment. Explain the reason for your answer. **(03)**

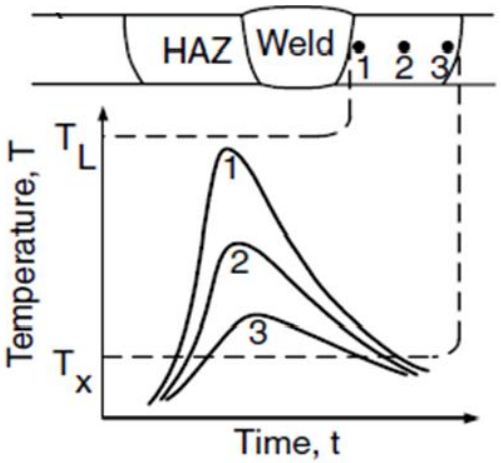

Figure 4

5B At a remote location, a crack of 10 cm length is observed on a railway track. Which welding process you would suggest for re-joining the railway track? Explain the principle of operation of the welding process using sketches? **(03)**

5C A welding power source has a rated output of 5000 W. Heat transfer factor of 0.8 and melting factor of 0.6 may be assumed. The melting temperature of the base metal is 1760 K. It is required to make a continuous fillet weld with a cross-sectional area of 15 mm^2. Determine the travel speed at which this can be accomplished. **(02)**

5D With the help of a sketch, brief on the principle of fused model deposition based additive manufacturing process. **(02)**