

Roll Number: \_\_\_\_\_

**Thapar Institute of Engineering & Technology, Patiala**

Department of Mechanical Engineering

**END SEMESTER EXAMINATION**

B. E. (Second Year): Semester-IV (2017/18)

Course Code: **UTA002**

Course Name: Manufacturing Processes

May 26, 2018

Saturday, 09.00 – 12.00 Hrs

Time: 3 Hours, M. Marks: 100

Name of Faculty: VJ, DG, ATS, GK, APS, RSJ, RK, HNV, SKS

**Note: Attempt all questions**

**Assume missing data, if any, suitably**

**Mention your group number on the top of answer sheet.**

**Support your answers with neat sketches wherever required.**

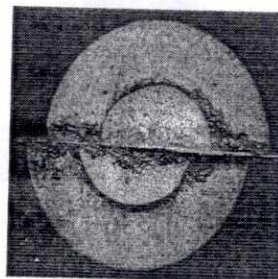
**Students are strictly instructed to attempt the questions in sequence.**

**Use handout for Q2 (a).**

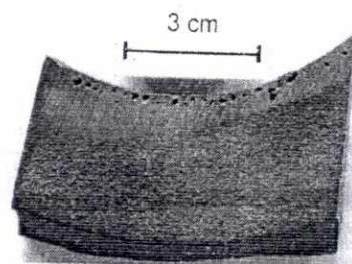
- Q.1 (a) Calculate the maximum cutting velocity of a tungsten carbide cutting tool, if it is employed to turn a cylindrical shaft of diameter 50 mm upto length of 200 mm in a single pass in 5 min. After this tool will be blunt and no longer used. Assume feed of the tool to be 0.25 mm/rev. (Take Taylor's exponent for tungsten carbide as  $1/5$ ). Also calculate the corresponding tool life if the cutting velocity is decrease by half for the same tungsten carbide tool. (10)
- Q.1 (b) A Round billet made of 70-30 Brass is extruded at a temperature of 675°C. The billet diameter is 125 mm, and the diameter of the extrusion is 50 mm. Calculate the value of extrusion force required and true strain. Average flow stress of 70-30 Brass decreases linearly with the temperature. Average flow stress at 600°C is 224 MPa and at 750°C its 276 MPa. (5)
- Q.1 (c) Identify the type of casting defects involved in the given Fig 1 (a, b, c). Describe the causes and their remedies for each defect. (8)



(a)



(b)



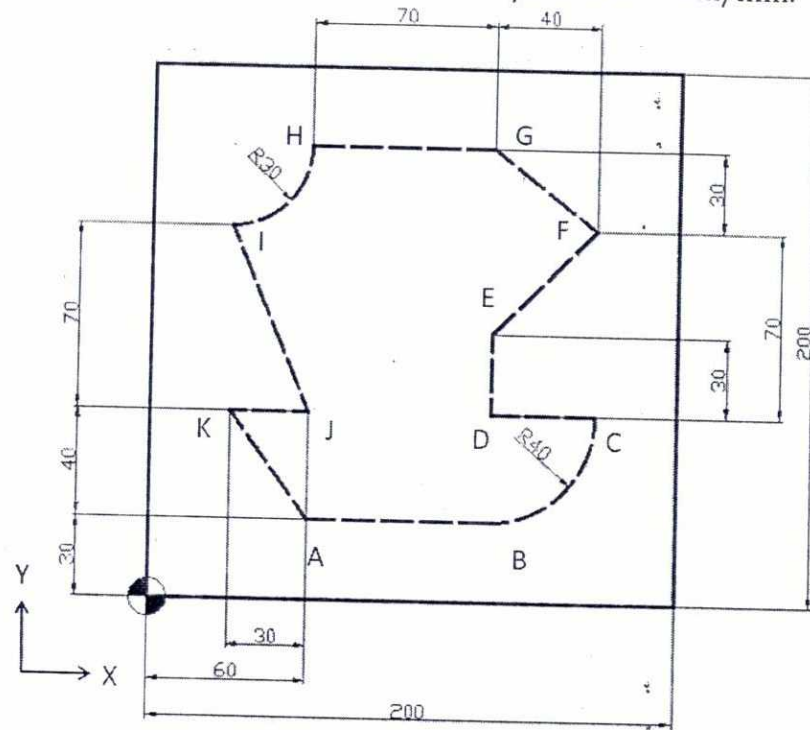
(c)

(Fig. 1)

- Q.1 (d) Draw the schematic of an arc welding process in which the arc is not visible. Also, briefly explain why the arc is not visible to operator. (07)
- Q.2 (a) Write a CNC program for engraving the given dotted profile (ABCDEFGHIJKA) shown in Fig. 2 in absolute mode. Use the following data:

- Depth of profile is 5 mm.
- Diameter of the cutter is 2 mm.
- Cutting speed and feed rate are 0.52 m/s and 100 mm/min.

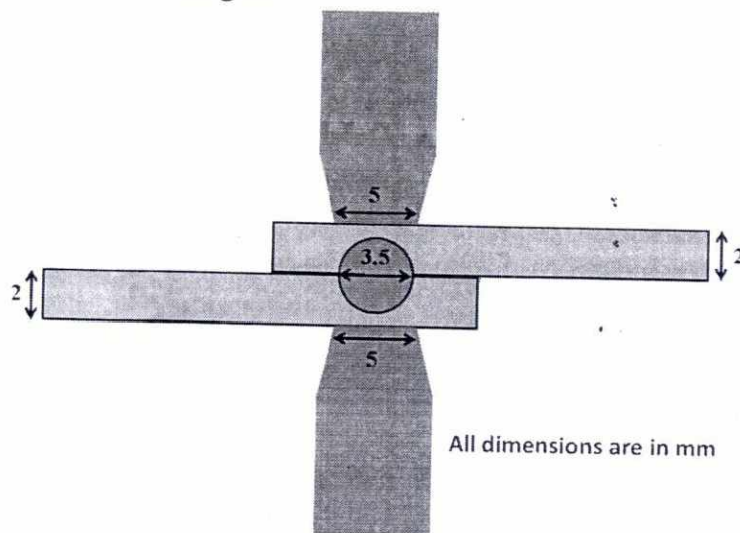
(10)



(Fig. 2)

- Q.2 (b) The two metal sheets are welded by resistance welding process as shown in Fig. 3. The welding process uses **5000 A** for very short duration of **0.15 s**. The resistance is assumed to be **0.0002  $\Omega$**  and the nugget form in between sheet is spherical shape. The unit melting energy required to melt the metal is **15.0 J/mm<sup>3</sup>**. Calculate what proportion of the heat generated was used to form the weld nugget and what proportion was dissipated into the work metal, electrodes, and surrounding air?

(10)



(Fig. 3)

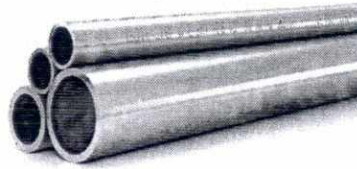
- Q.2 (c) Compare the different types of die casting processes in terms of (i) Injection pressure (ii) production rate (iii) cycling time (iv) usage of the process.
- Q.2 (d) Draw a labeled schematic of two different forming processes showing the

(07)



production of seamless tubes as shown in Fig. 4.

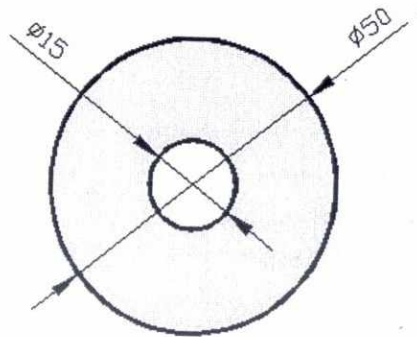
(06)



(Fig. 4)

- Q.3 (a) A compound die will be used to blank and punch a large washer out of 6061ST aluminum alloy (the allowance is  $a = 0.06$ ) as shown in Fig. 5. The thickness of sheet stock is 3.50 mm. The outside diameter of the washer is 50 mm and the inside diameter is 15 mm. Determine (a) the punch and die sizes for the blanking operation, and (b) the punch and die sizes for the punching operation. Also, compare the maximum possible axial force(s) for the operation(s) if, considered individually, when the shear strength = 325 MPa and the tensile strength is 450 MPa.

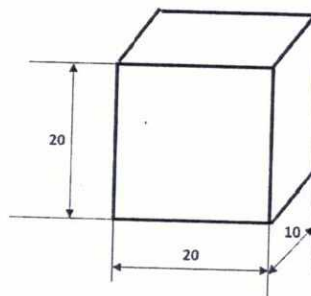
(10)



(Fig. 5)

- Q.3 (b) An automobile manufacturer wants to produce an aluminium component as shown in figure 6. Draw a neat sketch of pattern with all dimension by assuming shrinkage allowance = 1.5 cm/m, machining allowance = 0.5 cm and draft =  $3^\circ$ . All dimensions are in cm.

(10)



(Fig. 6)

- Q.3 (c) Write down any five essential Mechanical properties of Tool Material.
- Q.3 (d) Compare the threads manufactured by **Thread Rolling** and **Thread Cutting** in the terms of

(05)

1. Production rates
2. Material wastage
3. Strength of threads

4. Grain alignment

Q.3 (e) Which welding power source characteristic should be used for (i) manual and (ii) semi-automatic welding process? Justify your answer with the help of static characteristics of power source.

(04)

(08)

### HAND OUT:

G00 X\_Y\_Z - Rapid transverse  
G01 X\_Y\_Z\_F - Linear motion with feed  
G02 X\_Y\_Z\_R - Tool movement in clockwise direction  
G03 X\_Y\_Z\_R - Tool movement in anti-clockwise direction  
G20 - Inches mode  
G21 - Metric mode (in mm)  
G28 - Go to machine home position in incremental mode  
G43H1 - Height offset of the tool in downward direction  
G90 - Absolute method  
G91 - Incremental method  
G94 - Feed in mm/min  
G95 - Feed in mm/rev  
X - Absolute mode in X- axis  
Y - Absolute mode in Y- axis  
Z - Absolute mode in Z- axis  
M03 - Spindle rotation clockwise  
M04 - Spindle rotation anti-clockwise  
M05 - Spindle stop  
M06 - Tool change  
M30 - Program Stop and Rewind.  
M98 - Sub program calling  
M99 - Sub program end