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THAPAR UNIVERSITY

B.E. SECOND YEAR, Dec 2016
MANUFACTURING PROCESSES (UTA-002)
END SEMESTER EXAMINATION
(Jul – Dec 2016)

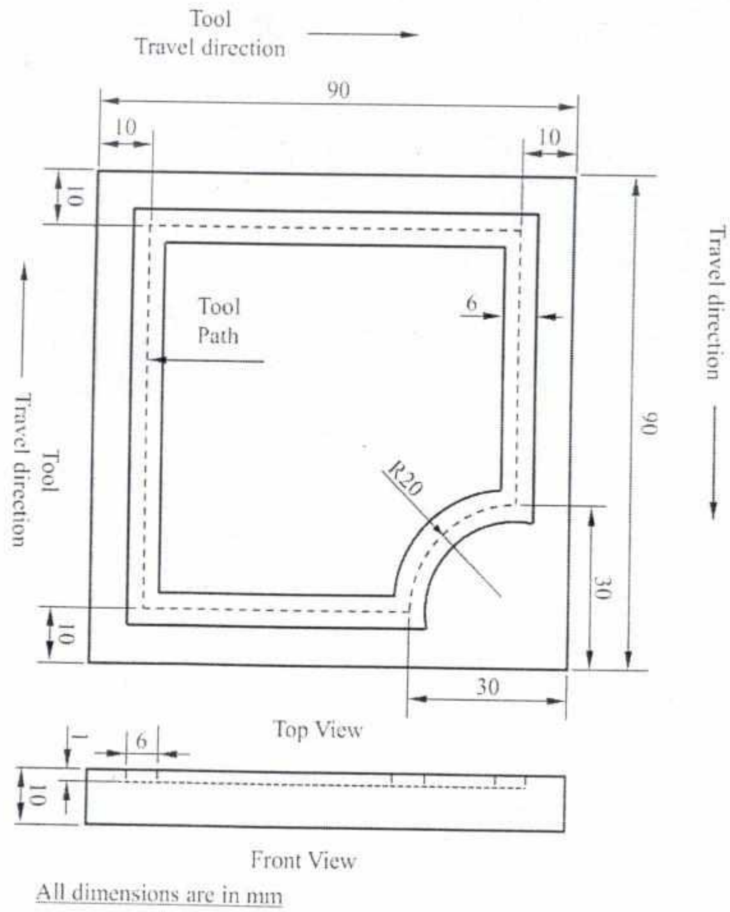
TIME: 3 HRS

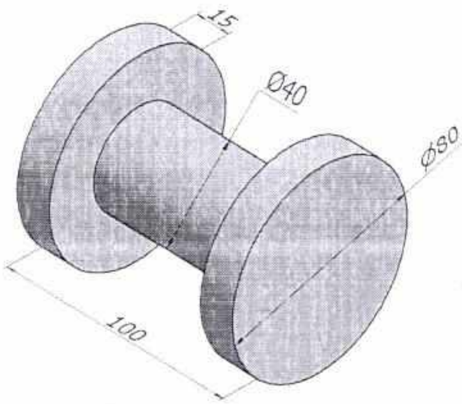
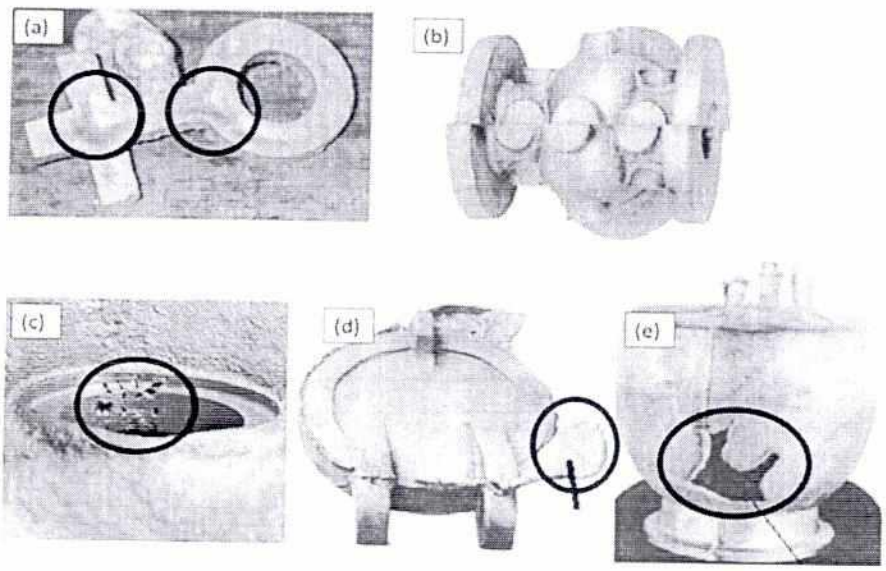
Max. Marks: 100

Instructors: A Batish, DM, DG, VJ, RKS, ATD, NHV

Note:

- **All questions are compulsory**
- Mention your group number on the top of answer sheet.
- Support your answers with neat sketches wherever required.
- The evaluated answer sheets will be shown to the students on 21st Dec, 2016 in the Workshop Block at 12.30 P.M.

1	(a)	A 150-mm-long, 75-mm-diameter titanium alloy rod is being reduced in diameter to 65 mm by turning on a lathe in one pass. The spindle rotates at 400 rpm and the tool is traveling at a feed rate of 200 mm/min. Calculate the cutting speed, material removal rate, time of cut and power required. Assume specific energy of cutting is 3.5 W-s/mm^3.	7
	(b)	Write a manual part program for making slot of depth 1 mm and width 6 mm in an aluminium block as shown in Fig. 1. Consider tool rotational speed, feed rate and diameter of end mill cutter as 2500 rpm, 100 mm/min and 6 mm, respectively. Also show the workpiece reference point with proper diagram.  **Figure 1**	10

2	(a)	The blank for the spool shown in the accompanying Fig. 2 is to be sand cast out an aluminum casting alloy. Make a sketch of the wooden pattern for this part. Include all necessary allowances for shrinkage and machining. Assume Shrinkage allowance = 12.5 mm/m, machining allowance = 1.6 mm and draft = 3°.  **Figure 2**	12
	(b)	Identify the common defects observed in a casting process as shown in Fig. 3.  **Figure 3**	5
3	(a)	Two flat copper sheets (each 1.5 mm thick) are being spot welded by the use of a current of 7000 A and a current flow time of 0.3 s. The electrodes are 5 mm in diameter. Estimate the heat generated in the weld zone. Assume weld nugget is cylindrical, resistance is 200 $\mu\Omega$ and specific energy needed to melt copper is 6.1 J/mm^3.	10
	(b)	Compare the forming processes of drawing and conventional extrusion with respect to continuity, applications, working temperature and force.	7
4	(a)	The voltage - length characteristic of a D.C. arc is given by V=20+40L, where, 'V' is the arc voltage and 'L' is the length of arc in cm. The power source characteristic is approximated by a straight line with an open circuit voltage is 60 V and short circuit current is 250 A. Calculate, (1) change in arc power when the arc length is changed from 3 mm to 5 mm, (2) arc length at a maximum current of 100 A.	10

	(b)	How shielded metal arc welding electrodes are commonly classified, and what information does the designation usually provide? Why shielded metal arc electrodes are often baked just prior to welding?	7
5	(a)	A washer having a hole with 15 mm diameter and an outside diameter of 22 mm is to be made from 3.5 mm thick sheet of 0.2% carbon steel using a compound die. The ultimate shear strength of the material is 220 MPa. i. Determine the punch and die sizes for both blanking and piercing operation. ii. Find the total cutting force if both punches act simultaneously to blank and pierce. iii. What will be the cutting force if the punches are staggered in such a way that only one punch acts at a time. Assume clearance to be 4% of the thickness.	12
	(b)	Why is it important that a blanking punch and die be in proper alignment? How can we prevent flattening or wrinkling during deep drawing?	5
6	(a)	What are some common molding die materials for permanent-mold casting? What are some of the metals more commonly cast by this process? By what mechanisms do die-casting dies typically fail?	5
	(b)	Calculate the extrusion force for a round billet 300 mm in diameter, made of stainless steel and extruded at 1000°C to a diameter of 70 mm using the information in Fig. 4 below.	10

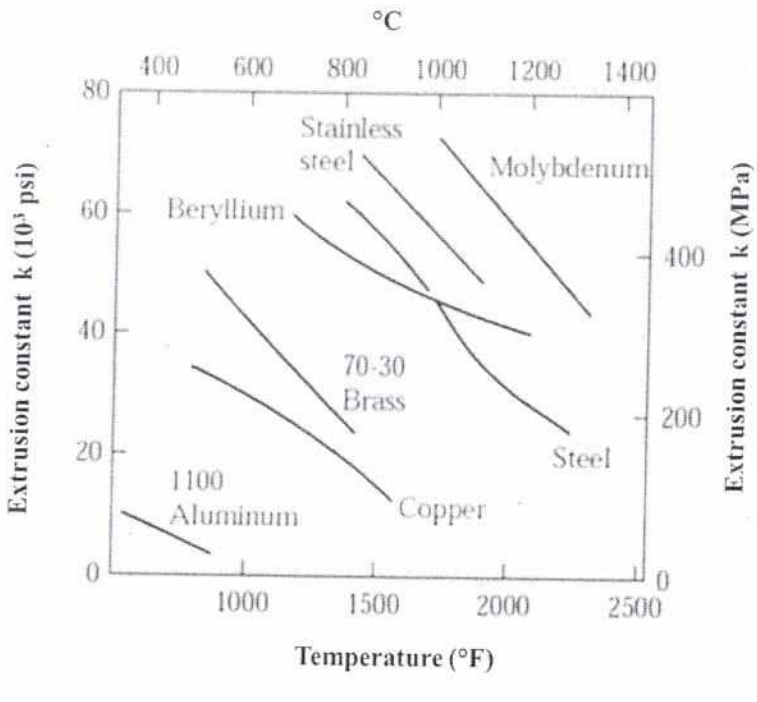


Figure 4

HAND OUT:

G00 X_ Z_ – Rapid transverse

G01 X_ Z_ F_ – Linear motion with feed

G02 X_ Z_ R_ – Tool movement in clock wise direction

G03 X_ Z_ R_ – Tool movement in anti-clock wise direction

G20 – Inches mode

G21 – Metric mode (in mm)

G28 – Go to machine home position in incremental mode

G43 H1 – Height offset of the tool in downward direction

G90 – Absolute method

G91 ~~G98~~ – 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

M00 – Program stop

M02 – Program end and halts program execution

M03 – Spindle rotation clockwise

M04 – Spindle rotation anti-clockwise

M05 – Spindle stop

M06 – Tool change

M08 – Coolant on

M09 – Coolant off

M30 - Program Stop and Rewind.

M98 – Sub program calling

M99 – Sub program end