Roll Number:_____

Thapar University, Patiala

Department of Mechanical Engineering

B. E. (Second Year): Semester-IV	Course Code: UTA002 Course Name: Manufacturing Processes
19th May , 2017	Friday, 09.00 – 12.00
Time: 3 Hours, Max. Marks: 100	Name of Faculty: VJ, DM, DG, ATS, GK, 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 31st May, 2017 in the central workshop at 10:00 am.
Use handout for Q1(a).

Q.1(a) A component of aluminium, as shown in Fig. 1, is to be prepared by a CNC lathe. Write the manual a part program to prepare the component by properly marking the workpiece reference point on the answer sheet. **12**

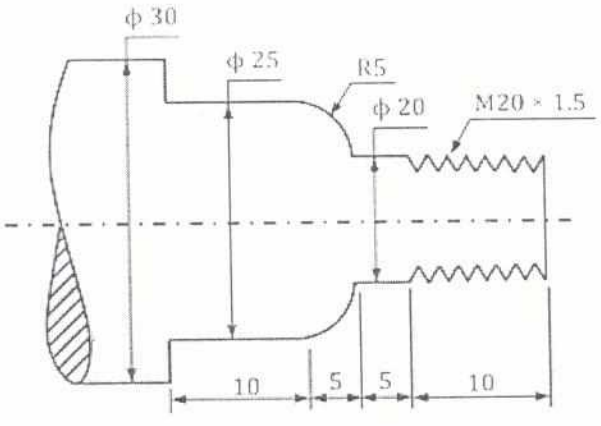
Consider,

(i) Spindle speeds in turning and threading operations are 2500, and 500 RPM, respectively.

(ii) Feed rate during rough and finish turning are 100 and 30 mm/min, respectively.

(iii) Depth of cut during rough turning is 0.5 mm, finishing allowance is 0.2 mm and tool retract distance is 0.5 mm.

(iv) Threading: The included angle of thread is 60°. No. of finishing passes are 4. Finishing allowance is 0.04 mm. Minimum depth of cut and depth of cut for first pass are 0.01 and 0.1 mm, respectively.



All Dimensions are in mm

(Fig. 1)

Q.1(b) The outside diameter of a cylinder made of steel alloy is to be turned on a lathe. The starting diameter is 300 mm and the length is 625 mm. The feed is 0.35 mm/rev and the depth of cut is 2.5 mm. The cut will be made with **08**

cemented carbide cutting tool whose Taylor tool life parameters are: n = 0.24 and C = 450. Units for the Taylor equation are min for tool life and m/min for cutting speed. Compute the cutting speed that will allow the tool life to be just equal to the cutting time for three of these parts.

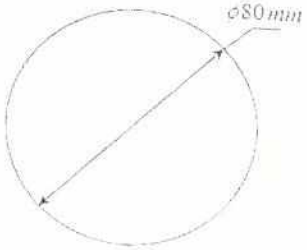
Q.1 (c) Explain why is it not always advisable to increase cutting speed in order to increase production rate? **05**

Q.2(a) With the help of neat and labelled diagram, describe the classifications of metal forming processes. Explain the different forming modes based on working temperature. **07**

Q.2(b) A manufacturing industry wants to produce a final product as shown in Fig. 2 using forming route. Suggest the required operation to produce the final product from a cold rolled steel sheet of thickness 4 mm. The final part is circular in shape with diameter = 80 mm (refer Fig. 2). **10**

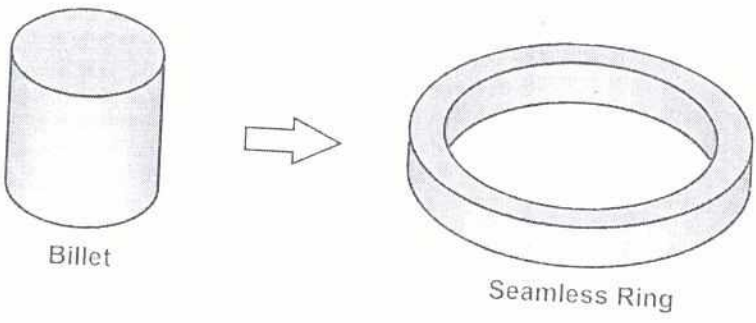
(i) Design the appropriate punch and die sizes for the suggested operation if the allowance for the cold rolled steel is 'a' = 0.075.

(ii) Determine the blanking force required if the steel has shear strength = 315 MPa and the tensile strength is 420 MPa.



(Fig. 2)

Q.2(c) A seamless ring has to be made from a billet as shown in Fig. 3. Explain with the help of neat sketches how this can be made by using suitable forming processes. **08**



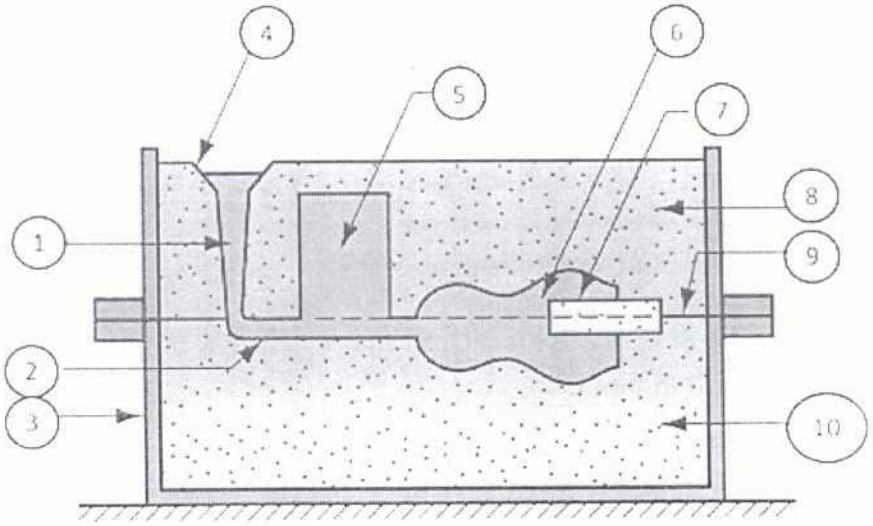
(Fig. 3)

Q.3(a) An automobile manufacturer wishes to produce 10 aluminium small cylindrical components using investment casting. The final part requires a diameter of 7.5 mm and height of 15 mm. The dimensions of the central sprue and runner are given in the following table. **15**

Central sprue	Dia: 15 mm; Max length: 145 mm
Runner	Dia: 5 mm; length: 10 mm

Calculate the mass of the material required for completely filling the moulds, runners and sprue. The density of aluminium is 2.6 g/cm^3. Also, draw a neat sketch of the above investment casting with dimensions (Assume Shrinkage allowance = 0 mm/m, machining allowance = 1 mm and draft allowance = 0° for investment casting process).

Q.3(b) Name each part of the gating system in casting as shown in Fig. 4. What are the problems associated with too large and too small riser design? **10**



(Fig. 4)

Q.4(a) The arc voltage characteristics of a DC welding power source is given by V=20+40L volts (L is in cm). During a welding operation the arc length is expected to vary between 4 and 6 mm with the welding current limited between 450 and 550 amperes. If the power source has a linear characteristic, calculate the arc power at an arc length of 5 mm. What is the open circuit voltage? **10**

Q.4(b) Write down the operating range of current (A) and voltage (V) in a typical resistance welding operation with a suitable justification. Draw a Force, Current Vs Time graph representing a typical spot welding cycle. **08**

Q.4(c) Explain with a neat labelled schematic the arc welding process that should be used for welding of thick plates for ship-building. **07**

Hand Out

G00 X_ Z_ – Rapid transverse
G01 X_ Z_ F_– Linear motion with feed
G02 X_ Z_ R_F_– Tool movement in clockwise direction
G03 X_ Z_ R_F_– Tool movement in anti-clockwise direction
G20 – Inches mode
G21 – Metric mode (in mm)
G28 U_ W_ – Go to machine home position in incremental mode
G70 P_ Q_ F_ – Finishing cycle
G98 – Feed in mm/min
U – Incremental mode in X- axis
W – Incremental mode in Z- axis
X – Absolute mode in X- axis
Z – Absolute mode in Z- axis

Multiple turning cycle:	G71 U_ R_
	G71 P_ Q_ U_ W_ F_
Multiple threading cycle:	G76 P(m) (r) (a) Q_ R_
	G76 X_ Z_ P_ Q_ F_

M03 – Spindle rotation in clockwise direction
M04 – Spindle rotation in anti-clockwise direction
M05 – Spindle stop
M06 – Tool change
M30 – Program Stop and Rewind

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