BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2013 - 2014

COMPREHENSIVE EXAMINATION (Closed book)

SECOND YEAR

Course Code: ME F 243 Date: 29-05- 2014

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 70

Duration: 3HRS Weightage: 35%

PART A

1a) Mention the desired properties of pattern materials [2]

b) With rough sketch, briefly explain the blister and misrun in castings [3]

c) Calculate the time required to drill a 25 mm diameter hole in a workpiece having thickness of 60 mm to the complete depth. The cutting speed is 14 m/min. and feed is 0.3 mm/rev. Assume length of approach and over travel as 5 mm. [6]

2a). With a sketch explain how resistance seam welding is done [2]

b) How will you make seamless tubes using extrusion (show the sketch)? [3]

c) An aluminum disc with 200mm diameter and 25mm thickness is forged to a final thickness of 15mm. Estimate the maximum forging force when the coefficient of friction is 0.3 and the tensile yield stress is 25MPa. Neglect strain hardening. [6]

3a) List the different machining operations in lathe [2]

b) Explain how the heat is distributed (to work, chip and tool) in metal cutting process using a graph [3]

c) An iron cannon ball with a diameter of 20cm is manufactured through sand casting. Shrinkage is assumed to be 4% for the material used. Determine the diameter and height of the riser for sound casting. [6]

PART B

4a) With sketch, briefly explain tapping and counter boring operations in drilling [3]

b) An AISI steel 1020 carbon steel strip 400mm wide and 10mm thick, rolled to a thickness of 7mm. The roll radius is 200mm and it rotates at 200 rpm. The work material has a strength coefficient of 530 MPa and strain hardening exponent of 0.26. Determine the true strain, average flow stress and the rolling force. If the rolling machine of total 200kW is available, can this machine perform the job? [7]

5a) Compare up milling and down milling using sketch [2]

b) The job shown in figure needs to be machined from a stock of 704mm X 504mm X 204mm in the workshop, which is equipped with a shaper, a drilling machine and a universal milling machine. As an engineer, analyze all the options of producing the component, and justify the production of the job in one or combination, of these machine tools. The operating conditions in the machine tools are as follows:

a. The feed of 0.5mm/stroke or revolution is same in all the machine tools
b. The depth of cut of 1mm is same in all the machine tools
c. The cutting speed is 10m/min in all the machine tools
d. The approach is 30mm and over travel is 30mm in all the operations
e. The cutting time to return time ratio is 3:1
f. The tools available in the workshop are: slab milling cutter of diameter 100mm and width 750mm, end mill of diameter 25mm, drill bit of diameter 25mm and single point cutting tool. [8]

Figure not to scale.

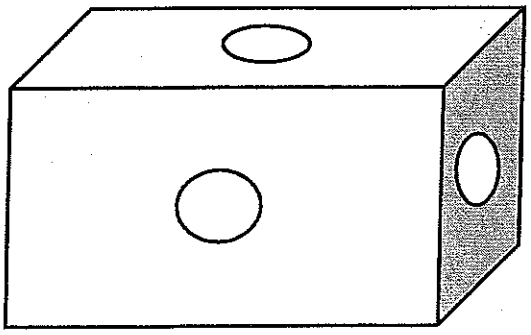
Product dimensions are:

Length - 700mm

Width - 500mm

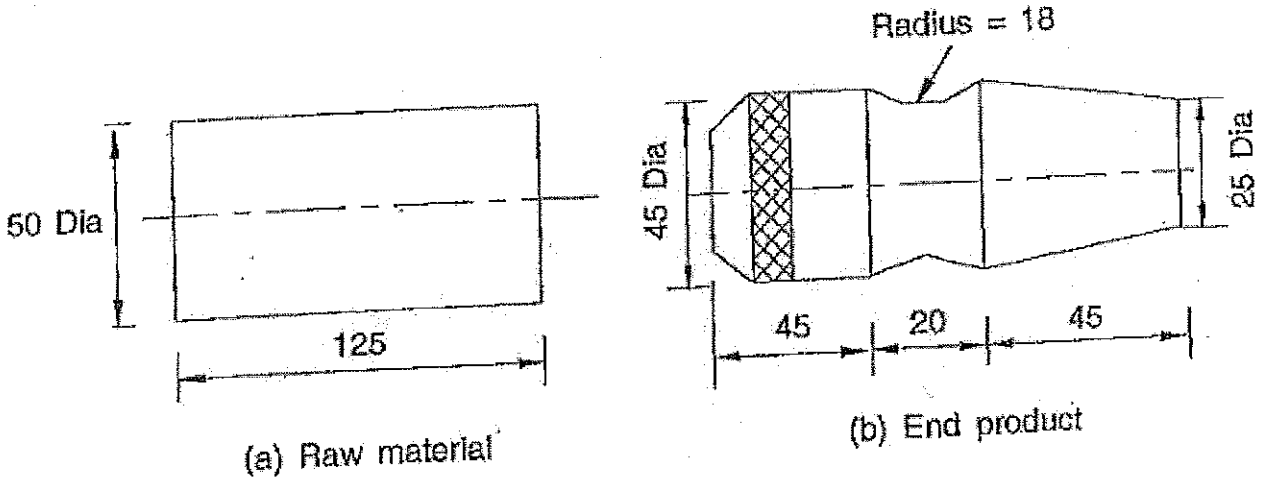
Height - 200mm

Through holes ϕ = 25mm



6a) List the different abrasives used in grinding [2]

b) Write a possible sequence of operation with proper cutting tools and machine tool used for each process for producing the part shown in the fig(b) below from a raw material shown in the fig(a):- [6]



(a) Raw material (b) End product

7a) Briefly explain the honing process with a simple sketch [3]

b) Estimate the time required to machine a cast iron surface 250 mm long and 150 mm wide on a shaper with cutting-to-return ratio of 3/2. Use a cutting speed of 21 m/min, a feed of 2 mm/stroke and a clearance of 25 mm. The available ram strokes on the shaper are: 28, 40, 60 and 90 strokes/min. Also, determine MRR assuming depth of cut as 4 mm. [6]

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SECOND SEMESTER 2013 - 2014

TEST- II (Open book)

SECOND YEAR

Course Code: ME F 243 Date: 30-04- 2014

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 30

Duration: 50 minutes Weightage: 15%

Notes:

- Answer all the questions
- Draw neat sketches wherever necessary
- Make suitable assumptions if required and clearly state them

1. Explain, with an example, the situation in which joining process becomes essential when compared to the other manufacturing processes. **[3M]**
2. It is required to weld broken leg of a mild steel chair, which process of welding you are going to suggest and why? **[3M]**
3. Tool life can be almost infinite at low cutting speeds. Would you recommend that all machining be done at low speeds? What are the limitations of doing so? **[3M]**
4. A carbide tool while machining a mild steel work piece was found to have a life of one hour and 40 minutes when cutting speed at 50 m/min. find the tool life if the tool is to operate at a speed 30% higher than previous one. Also, calculate the cutting speed if the tool is required to have a life of 2 hrs and 45 minutes. Assume exponent n= 0.28 **[7M]**
5. Consider a sheet metal of 50cm width and 7.5mm thickness. It is to be rolled to a thickness of 5mm in one pass using a mill whose steel rolls are of 80mm diameter, the value of $\mu = 0.10$ and the average flow stress of metal is 300MPa. The rolls were made up of steel with E = 200GPa.

   a. Calculate the average roll pressure neglecting roll flattening

   b. Estimate the minimum thickness to which the sheet could be rolled. **[7M]**
6. Two iron sheets, each 2 mm thick are being spot welded by the use of a current of 4000A and current flow rate of 0.36s. The electrodes are 8 mm in diameter. Estimate the heat generated in the weld zone. Assume that the resistance is $120\mu\Omega$ Also calculate the temperature rise assuming that the heat generated is confined to the volume of material directly between the two round electrodes and the temperature is distributed uniformly.

   [7M]

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2013 - 2014

TEST- 1 (closed book)

SECOND YEAR

Course Code: ME F 243 Date: 06-03- 2014

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 30

Duration: 50 minutes Weightage: 15%

Instructions: 1. Attempt all questions
2 Draw neat sketches where ever necessary

1. A down sprue leading to the runner of a mould has a length of 200mm and area of cross section of 400mm^2. The mould cavity has a volume of 0.002m^3. Determine **(a).** the velocity of the molten metal through sprue **(b).** volume flow rate of the metal and **(c).** mould filling time . [7]

2. A cylindrical riser is to be designed for a sand casting mold. The length of the cylinder is to be 1.25 times its diameter. The casting is a square plate, each side = 10 cm and thickness = 2 cm. If the metal is cast iron, and the mold constant = 3.0 min/cm^2 in Chvorinov's Rule, determine the dimensions of the riser if the solidification time is 30% more than that of casting. [6]

3. In a foundry, three castings of same weight and material are to be produced. Shapes of the three castings are: a cube, a sphere, and a cylinder. Find the cooling time ratio in all these cases. Assume for the cylindrical shaped casting a length to diameter ratio of 0.5. [7]

4. a) What is casting yield? How is it calculated? [4]

b) List the different types of patterns used in casting process. Give an example of components made from each type of pattern. Briefly justify why you would select a particular type of pattern for the example component you have given. [6]

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2013 - 2014

QUIZ- 1 (closed book)

SECOND YEAR

Course Code: ME F 243 Date: 27-03- 2014

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 10

Duration: 20 minutes Weightage: 5%

Instructions: 1. Attempt all questions
2. Draw neat sketches where ever necessary

1. How metal forming processes are classified? [1]

2. List any 5 components manufactured by extrusion process: [2]

3. Suggest a suitable process for the manufacture of rails and justify your answer [1]

4. How metal forming process different from other manufacturing processes? [2]

5. Differentiate sheet and plate :- [2]

6. A stock of thickness 30 mm is to be rolled. The reduction is to be from 30 mm to 10 mm: the corresponding change in length is from 50 mm to 75 mm. Calculate the relative draught and the minimum diameter of the rolls if the maximum angle of bite is 40 degrees [2]

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2012 - 2013

COMPREHENSIVE EXAMINATION (Closed book)

SECOND YEAR

Course Code: ME F 243 Date: 08-06- 2013

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 70

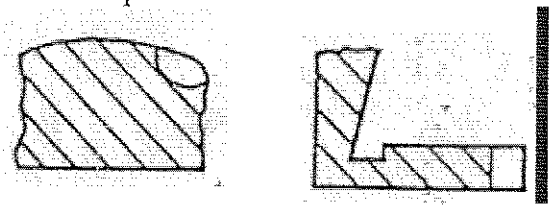
Duration: 3 HRS Weightage: 35%

SOLUTION KEY

PART A

1a) It should be easily shaped, worked, machined and joined.
It should be resistant to wear and corrosion.
It should be resistant to chemical action.
It should be dimensionally stable and must remain unaffected by variations in temperature and Humidity.
It should be easily available and economical.

b) Blister- blow hole formed on the surface
Misrun-liquid metal does not reach the far end



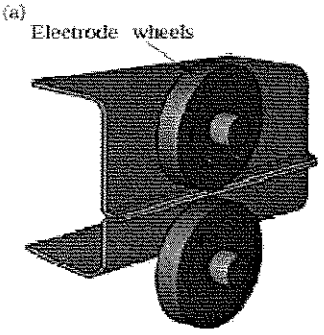
c) Given data: $D = 20$ mm, $Lj = 60$ mm, $v = 14$ m/min, $f = 0.3$ mm/ rev. with usual notations.
$N = 178$ rpm.

Length of tool travel = Lj + Length of approach and over travel.

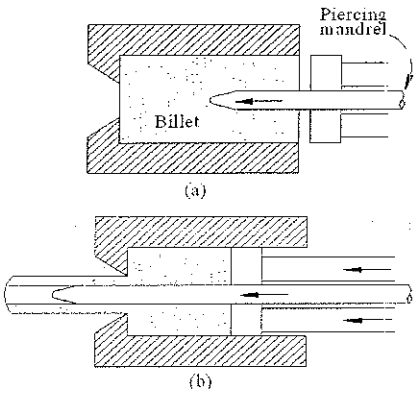
$= 60 + 5 = 65$ mm

$t = 65 / (0.3 \times 178) = 1.21$ minute.

2a) The electrically conducting rollers produce a spot weld
It can produce a continuous seam & joint that is liquid and gas tight

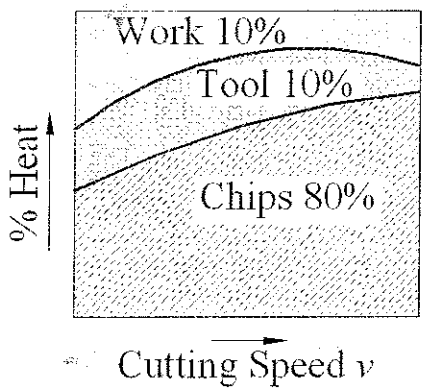


b)



3a) Turning, Facing, knurling, Grooving, Parting, Chamfering, Taper turning, Drilling, Threading

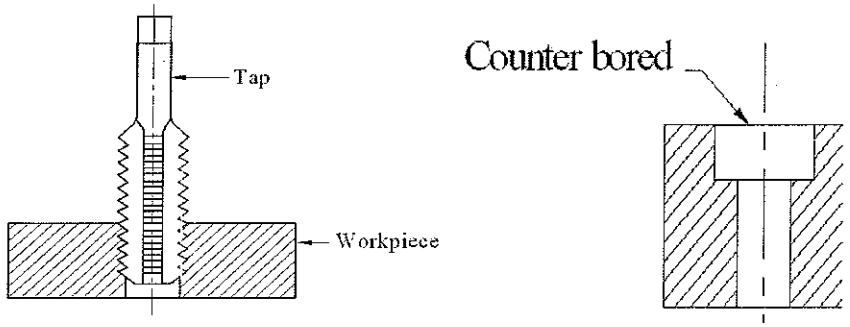
b)



c)
```
V1 =(4/3)*(3.14*R1^3); % Casting volume
A1=4*3.14*R1^2;
V2=0.04*3*V1; % Riser volume
X1=A1/V1;
D2 = (4*3*V2/3.14)^(1/3);
X2=(6/D2); % X2 should be less than X1
D22 = 6/X1;
% Diameter = Height = 0.2m
```

PART B

4a) Tapping & counter boring



b)

(2) *True strain* $\varepsilon = \ln\frac{h_0}{h_f} = \ln\frac{10}{7} = 0.36$

(3) The average flow stress $\overline{\sigma}_f = \frac{K\varepsilon^n}{1+n} = \frac{530 \bullet 0.36^{0.26}}{1+0.26} = 323\ MPa$

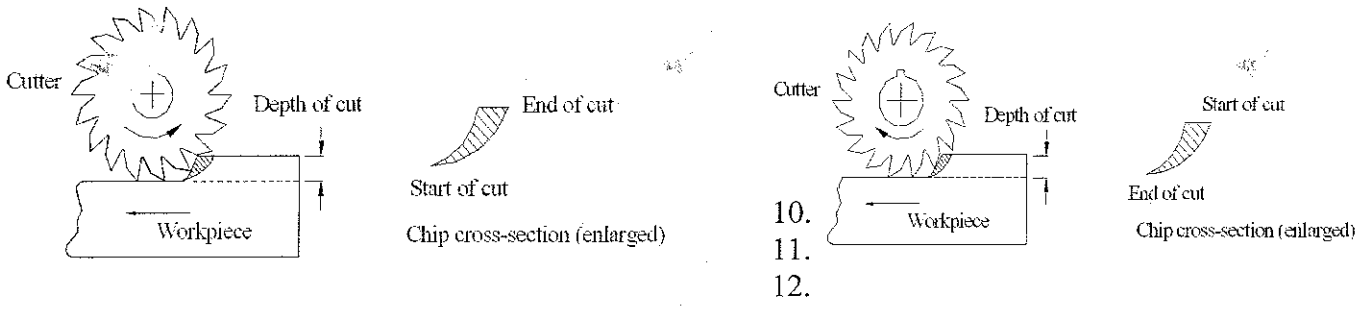
(4) *Contact length* $L = \sqrt{R(h_0 - h_f)} = \sqrt{0.2(0.01 - 0.007)} = 0.0245\ m$

The rolling force $F = Lw\overline{\sigma}_f = 0.0245 \bullet 0.4 \bullet 323 = 3.16\ MN$

(5) The required power of the two rolls to perform the job $P = \frac{\pi FLN}{30{,}000} = 1{,}621.48\ KW > 200\ KW$.

Thus the available machine cannot perform the rolling process.

5a) Up milling & down milling



10.
11.
12.

b)

Total time on shaper = 675min
Total time on drilling machine/vertical milling machine = 24.7min
Total time on milling machine (horizontal) = 271min
The choice is milling machine

6a) **Natural Abrasives**

- ***Sandstone*** **(Contains *quartz* as cutting agent)**
- ***Emery*** **–(55-65% Alumina, better abrasive action than quartz)**
- ***Diamond***

Synthetic Abrasives

- Silicon Carbide – used for cutting low tensile strength materials
- Aluminum Oxide - Suitable for machining materials of high tensile strength.

b) facing , turning, grue cutting, knurling and taper turning

7a) Honing is smoothening or sizing process. Low velocity abrading process in which metal is removed by abrasive sticks. Honing m/c – rotary & reciprocatory. Hone – the cutting tool for honing: Abrasive sticks (bonded abrasive) fixed on the periphery (spring loaded)

b) $L = 250 + 2 \times 25 = 300$ mm.

SPEED v = NL(1+m)/ 1000 m/min

N = 42 strokes/min

- Nearest available ram strokes is 40 strokes/min. Since calculated value is more than 40, this is chosen. Normally, we should not exceed the specified cutting speed, as it will affect the tool life adversely. Hence, select $N = 40$ strokes/min.
- With a chosen value of N, we cannot use Equation (5) for time calculation. Hence, substituting all the values in Equation (6), we get
- $t = 150 / (40 \times 2)$
- $= 1.88$ minutes

SOLUTIONS KEY

1) a) Velocity $= \sqrt{2gh}$.

$= 1.98$ m/s. — (2)

b) $Q = UA = 7.92 \times 10^{-3}$ m³/s. (2)

Time to fill the cavity $= V/Q$

$= 2.53$ sec — (2)

2) $As = 280$ cm², $Vol = 200$ cm³.

$t_1 = 3 \times (200/280)^2 = 1.53$ min. — (1)

$t_2 = 1.53 + 0.3 \times 1.53 = 1.98$ min. — (1)

$SA = 2\pi R(R+h)$, $Vol = \pi R^2 h$.

$t_2 = 1.98/3$

$R = 2.27$ cm $\quad D = 4.55$ cm — (4)

$h = 5.67$ cm

3) $4/3\ \pi R_1^3 - \pi r_2^2 l_2 = l_3^3$.

$l_2/d_2 = 0.5$

$$l_2 = 0.5 d_2 = R_2$$

$$4/3 \pi R_1^3 = \pi R_2^3 = l_3^3 \quad \text{—} \quad (2)$$

$$t_1/t_2 = (A_2/A_1)^2 = \left(\frac{2\pi R_2^2 + 2\pi R_2 l_2}{4\pi R_1^2}\right)^2$$

$$= 1.47 \quad \text{—} \quad (2)$$

$$t_1/t_3 = \left(\frac{6 l_3^2}{4\pi R_1^2}\right)^2$$

$$= 1.54 \quad \text{—} \quad (2)$$

$$t_2/t_3 = 1.05 \quad \text{—} \quad (1)$$

(4) (a)

$$Cy = \frac{Wc}{Wc + Wg} \times 100 \quad \text{—} \quad (2)$$

Details — (2)

(b) List the all 4 types with justification — 4 + 2

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SECOND YEAR

Course Code: ME F 243 Date: 27-03- 2014

Course Title: PRODUCTION TECHNIQUES-1 Max Marks: 10

Duration: 20 minutes Weightage: 5%

SOLUTION KEY

1. How metal forming processes are classified? [1]

1. Processes involving compressive stresses.
   Ex: (a) Forging, (b) Rolling, and (c) Extrusion.
2. Processes involving tensile stresses:
   Ex: (a) Stretch forming, (b) Creep forming, and
   (c) Vacuum forming
3. Processes involving shearing stresses:
   Ex: (a) Shearing, (b) Blanking, and
   (c) Fine blanking
4. Processes involving the combinations of tensile and compressive stresses:
   Ex: (a) Wire drawing, (b) Deep drawing, and
   (c) Ironing

2. List any 5 components manufactured by extrusion process: [2]

Typical parts produced by extrusion are trim parts used in automotive and construction applications, window frame members, railings, aircraft structural parts.

3. Suggest a suitable process for the manufacture of rails and justify your answer [1]

rolling

4. How metal forming process different from other manufacturing processes? [2]

- *Metal Forming Process*
  - *shape/size by deformation force*
  - *Plastic deformation – plastic working*
  - Bulk Deformation Process

5. Differentiate sheet and plate :- [2]
   - Plate and Sheet: These are intermediate products obtained by rolling. The difference between a plate and a sheet is determined by the thickness of the product. In general, plate has a thickness greater than 6 mm and sheet has a thickness less than 6 mm.

6. A stock of thickness 30 mm is to be rolled. The reduction is to be from 30 mm to 10 mm. the corresponding change in length is from 50 mm to 75 mm. Calculate the relative draught and the minimum diameter of the rolls if the maximum angle of bite is 40 degrees [2]

- ***Solution:***
- First stage: Given $t1$ = 30 mm, $t2$= 10 mm, α = 40 degrees
- Substituting the values in the equation of cos α, we get
-
- or D = 85.49 mm.
- Substituting the value of angle of contact in the equation of coefficient of friction we get,
- μ = tan 40 = 0.84.