

BITS, PILANI – DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
I Year I Semester: 2010 - 2011

Comprehensive Examination [Closed Book]

Course No: TA C112

Course Title: WORKSHOP PRACTICE

Max.Marks: 75

Date: 29-12-2010

Weightage: 25 %

Time: 3 hours

Note: (i) Answer all Question in a sequence (ii) Assume suitable value if required and clearly state them (iv) Answer Every Question on a fresh page (v) Answer Part 'A' in the BLUE and Part 'B' in the GREEN main answer book

PART 'A'

- Q.1 a) Determine the type of fit that can be obtained if the sizes of the hole and shaft are:

Hole: 50.00 $\begin{matrix} -0.026 \\ -0.065 \end{matrix}$ mm and shaft: Hole: 50.00 $\begin{matrix} -0 \\ -0.011 \end{matrix}$ mm

[5 Marks]

- b) A member formed by connecting a steel bar to an aluminium bar is shown in Fig.1. Assuming that the bars are prevented from buckling sideways, calculate the magnitude of force 'P' that will cause the total length of the member to decrease 0.25 mm. The values of elastic modulus for steel and aluminium are $2.1 \times 10^5 \text{ N / mm}^2$ and $7 \times 10^4 \text{ N / mm}^2$ respectively. **[6 Marks]**

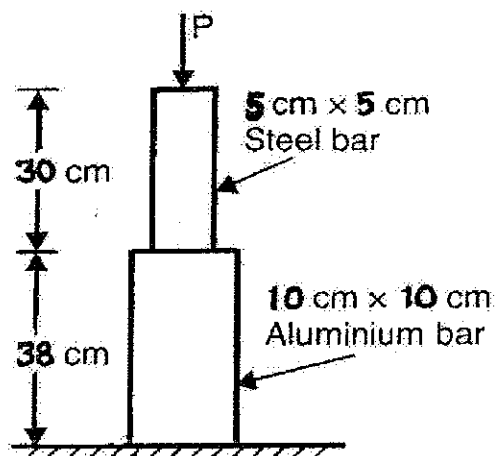


Fig.1

Q.2. a) Define Cutting speed, Feed, depth of cut and machining time in relation to shaper work. **[4 Marks]**

b) Calculate the cutting time for cutting 150 mm long keyway using HSS end mill of 20 mm diameter having 4 cutting teeth. The depth of keyway is 4.2 mm. Feed per tooth is 0.1 mm and cutting speed is 38 m/ min. Assume approach and overtravel distance as half of the diameter of the cutter and depth of 4.2 mm can be cut in one pass. **[6 Marks]**

Q.3. a) Give the comparison of among lapping, honing and superfinishing. **[5 Marks]**

b) Compare the solidification times for the following castings of three different shapes of same volume. Assume Volume of each casting = Unity. Give your justification about which shapes would have least and maximum solidification time.

(i) Cubic casting

(ii) Cylinder casting (with height equal to its diameter) and

(iii) Spherical casting **[6 Marks]**

Q.4. A component having length 120 mm and diameter 10 mm from a raw material of 120 mm length and 12 mm diameter, using a cutting speed of 32 m/min and feed rate of 0.8 mm/rev. How many times we have to resharpen or regrind if 800 workpieces are to be produced and find out the total cost for machining. Assume the cost of machining time, set-up time unproductive time together is Rs. 1.50 / sec. The cost of one tool resharpening is Rs. 25. In the Taylor's expression, use constants as 'n' = 1.25 and 'C' = 175. **[6 Marks]**

PART 'B'

Q.5 A carbide cutting tool when used for machining mild steel work-piece material at a cutting speed of 60m/min lasted for 150 minutes. Determine the (a) life of the tool when the cutting speed is increased by 15% and (b) cutting speed of the tool to get a tool life of 200 minutes. Take $n = 0.25$. **[6 Marks]**

Q.6 a) A job shown in Fig. 2 (all dimensions in mm) is to be produced from a raw material having 110 mm length and 60 mm diameter. For turning and facing operations, rpm is 250 and for drilling rpm of the drill is 200. Drilling operation is carried out on a drilling machine. Assume 2 passes for the turning operation and 5 passes for the facing operation and a feed of 0.5 mm/rev for all operations. For drilling, assume approach and over-travel distance as 20 mm. The setup time per component is 25% of the processing time. Calculate the total time required to manufacture 1000 components. Take the process sequence as facing, turning and drilling. **[6 Marks]**

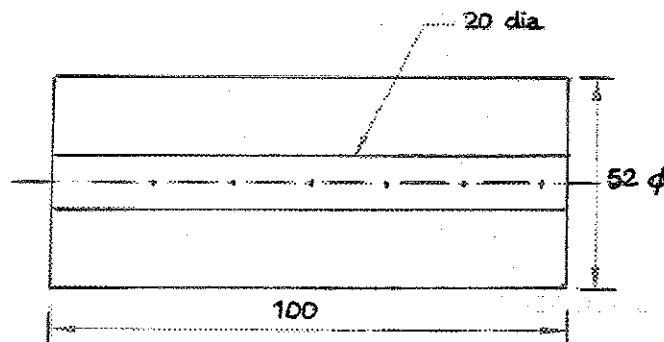


Fig.2

b) A stock of thickness 30 mm is to be rolled in two stages. In the first stage the reduction is to be from 30 mm to 10 mm and in the second stage it is from 10 mm to 5 mm. Find the minimum diameter of the rolls for the two stages if the maximum angle of bite is 40° for the first stage and 30° for the second stage. Also find the coefficient of friction between the rolls in both stages.

[6 Marks]

Q.7 a) Show the different types of welding joints with a neat sketch. [4 Marks]

b) A square duct required for an air-conditioning system is to be made from aluminum sheet metal. The duct is shown in Fig. 3 and the shaded portions in the figure indicate places where sheet metal work has to be done. Identify the sequential sheet metal operations involved in manufacturing the duct.

[6 Marks]

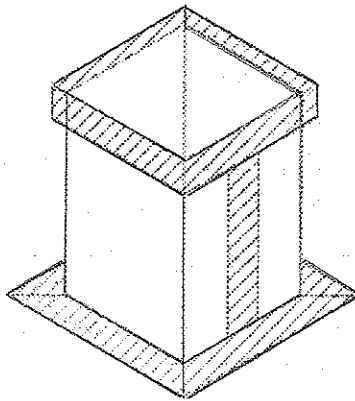


Fig.3

Q.8 a) Mention the type of plant layout required for the manufacture of the following products: Brakes, Boeing 747, IC Engines, Bolts, Submarines, and Studs. [3 Marks]

b) It is required to design a gearbox for the all new Lexus LFA F1 racing car. The gearbox is to have six gears for six different speeds. It is proposed to have the starting speed of 100 rpm and the maximum speed can go up to 10000 rpm. Calculate the six speeds for the gearbox design by rounding off each speed to the nearest 10. [6 Marks]

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I Year I Semester 2010-2011

Test No.2 (Open Book)

Course No. TA C112 Course Title: WORKSHOP PRACTICE Weightage: 10 %

Date: 12-12-2010 Max.Marks: 30 Duration: 50 min.

Notes: (i) Answer all the questions (ii) Draw neat sketches wherever necessary

- Q.1.** Calculate the time required to mill a slot of 350mm X 30mm in a workpiece of 350 mm length with a side and face milling cutter of 120 mm diameter, 30 mm wide and having 20 teeth. Metal removal rate is $25 \text{ cm}^3 / \text{min}$. The depth of cut and width of cut are 4.5 mm and 90 mm respectively. Assume cutting speed is 34 m / min and overtravel distance of 5 mm. **[8 Marks]**
- Q.2.** The sides of high speed steel cutting tool bar have to be finish ground on a surface grinder. The machine restricts the diameter of the wheel to 150 mm and no coolant is used. Find out the type of wheel required for this operation. Also give an appropriate specification for the grinding wheel for the prescribed operation. **[6 Marks]**
- Q.3.** Which one of the following casting shapes would have least solidification time? **[8 Marks]**
- A sphere of diameter 'D' = 25 mm ;
 - A cylinder with both diameter 'd' and height 'h' = 25mm ;
 - A cube with a length of side 'l' = 25 mm
- Q.4.** A steel ingot of length 100 mm, breadth 60 mm of thickness 50 mm is to be rolled in a rolling mill. The radius of the roll is 30 mm with the angle of contact 35° . If the elongation coefficient is 0.75, find the thickness and length of the rolled product. Is it possible to achieve a final thickness of 30 mm using the above rolling mill? Why and why not? What will be the maximum absolute draught for the above rolling mill if it is smooth and frictionless? **[8 Marks]**

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I Year I Semester 2010-2011

Test No.1 (Closed Book)

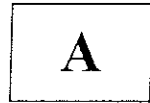
Course No. TA C112 **Course Title:** WORKSHOP PRACTICE **Weightage:** 10 %

Date: 31-10-2010 **Max.Marks:** 30 **Duration:** 50 min.

Notes: (i) Answer all the questions (ii) Draw neat sketches wherever necessary

- Q.1.** a. What is a single point cutting tool? **[2 Marks]**
- b. What are the functions of the following on a single point cutting tool? **[3 Marks]**
- Side cutting edge angle
 - End cutting edge angle
- Q.2.** A mild steel rod having 50 mm diameter and 160 mm length is to be machined to 35 mm diameter and 150 mm length. The work piece rotates at 400 rpm, feed is 0.2 mm / rev and maximum depth of cut is 2 mm. Machine tool used for the above process is lathe.
- a. Find the optimal process sequence. Justify your answer with suitable calculations for the machining time. **[9 Marks]**
- b. Suggest an appropriate fixture for the above operations on the lathe. **[1 Mark]**
- Q.3.** a. At what speed a 15 mm diameter drill will run to drill a hole through a brass plate 20 mm thick in order to cut the material at a surface speed of 60 m / min. Assume the length of approach and over travel is 0.3 times of drill-bit diameter. Estimate the feed used per revolution. Also calculate the time required to drill for the brass plate. **[7 Marks]**
- b. What are the uses for the following operations on a drilling machine? **[2 Marks]**
- Counter Boring
 - Spot Facing
- Q.4.** A mild steel plate 400 mm X 800 mm X 30 mm is to be shaped along its wider face. The ratio of return time to calculate time is 2 : 3 and the feed per cycle is 2 mm. Tool approach and over-travel respectively are 50 mm each. Calculate the machining time required for machining the given plate with H.S.D tools. Assume cutting speed of H.S.D tool is 24 m / min. **[6 Marks]**

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I Semester 2010-2011 QUIZ-2 (Closed Book)

Course No. TA C112

Course Title: Workshop Practice

Date: 25-11-2010

Max.Marks: 7.5

Weightage: 2.5%

Duration: 20 min

- Q1. Determine the length of cut required to mill a slot in a work piece, the milling cutter having 110 mm diameter and 18 teeth. The feed per tooth is 0.1 mm and cutting speed is 30 m / min. Assume milling time is 2 min. [1.5 Mark]

- Q2. For a given milling operation the parameters are given below:

Sl.No	Parameters	HSS Cutter
1	Cutter diameter (mm)	125
2	Feed (mm/tooth)	0.0425
3	Number of teeth	12
4	Cutting speed (m/min)	35

Assume Length of cut 220 mm including approach and travel.

[1.5 Mark]

Q.3 What is an abrasive? [1 Mark]

Q4. What are the two types of abrasives? Give 2 examples for each. [2 Mark]

Types

Example

1.

2.

Q5 The _____ are bonded together to form the grinding tool known as the grinding wheel. [0.5 Mark]

Q6. What is the difference between honing and polishing? [1 Mark]

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I Semester 2010-2011

QUIZ-1 (Closed Book)

Course No. TA C112

Course Title: Workshop Practice

Date: 04-10-2010

Max.Marks: 5

ANSWER-KEY

Q1. The dimensions of the shaft and hole are given in the table. Identify the type of fit for the assembly showing suitable calculations. [1 Mark]

Size of the hole	Size of the shaft
$20.00^{+0.05}$	$20.00^{+0.05}$

Solution:

$$\text{Max. size of hole} = 20.05 \rightarrow \textcircled{1}$$

$$\text{Max. size of shaft} = 20.05 \rightarrow \textcircled{2}$$

$$\text{Min. size of hole} = 19.95 \rightarrow \textcircled{3}$$

$$\text{Min size of shaft} = 19.95 \rightarrow \textcircled{4}$$

$$\text{Max. clearance} = \textcircled{1} - \textcircled{4} = 0.1$$

$$\text{Min. clearance} = \textcircled{3} - \textcircled{2} = -0.1$$

\Rightarrow transition fit

Q2. A tool life of 80 minutes is obtained at a speed of 30 m/min and 8 minutes at 60 m/min. Determine the value of 'n' in the Taylor's expression for tool life. [1 Mark]

Solution:

$$VT^n = C \Rightarrow V_1 T_1^n = V_2 T_2^n$$

$$V_1 = 30 \text{ m/min } T_1 = 80 \text{ min}$$

$$V_2 = 60 \text{ m/min } T_2 = 8 \text{ min}$$

$$\Rightarrow \left(\frac{T_1}{T_2}\right)^n = \frac{V_2}{V_1} \Rightarrow \left(\frac{80}{8}\right)^n = \frac{60}{30}$$

$$\Rightarrow (10)^n = 2$$

$$\Rightarrow n = 0.3$$

Q3. A member by connecting a steel bar to an aluminium bar is shown in Fig. Q3. Calculate the magnitude of force 'P' that will cause the total length of the member to decrease by 0.25 mm. Take the value of Young's Modulus for steel and aluminium as 210 GPa and 70 GPa respectively. [1 Mark]

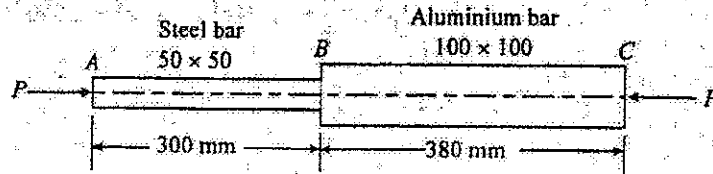


Fig.Q3

Solution:

$$\int l = \frac{PL}{AE}$$

$$0.25 = P \left[\frac{l_s}{A_s E_s} + \frac{l_a}{A_a E_a} \right]$$

$$0.25 = P \left[\frac{300}{2500 \times (210 \times 10^3)} + \frac{380}{10,000 \times (70 \times 10^3)} \right]$$

$$P = \frac{0.25 \times (700 \times 10^6)}{780} = \underline{\underline{224 \text{ kN}}}$$

Q4. Identify the crystal structures shown in Fig. Q4 and give an example of a material for each structure: [2 Marks]

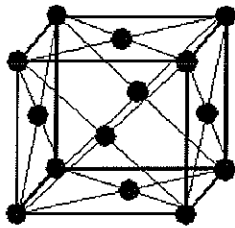


Fig.Q4 (a)

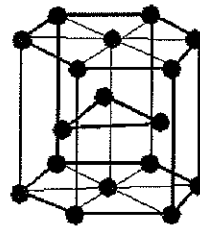


Fig.Q4 (b)

Solution:

(a) FCC
eg. Copper

(b) HCP
eg. Zinc