

姓名 Name	徐志三
学号 Student ID	012162825021
专业班级 Class	车辆911604
学院 School	国际教育学院

Test Paper of Wuhan University of Technology (A)

2018~2019 Academic Year 2nd Semester, Course: Manufacturing Technology of Automobile and Engine, Closed-book exam

Time: 120mins, class hours, credits, Total Points: 100, Percent in final evaluation

result: %, Date:

No.	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
Full score	23	28	26	23							100
Score	8	12	12	9							41

Score 8

QUESTION I (23 Points)

1. What is the production process of automobiles? What is the manufacturing process of automobile production? (4 points)

答: ①汽车的生产过程是指汽车从零件加工并组装成汽车的过程。
②有基本生产过程、辅助生产过程、服务生产过程及生产技术准备过程。
③生产过程时汽车零部件加工时的过程, 分为工艺安装、工艺、工艺。

2. What are the three types of auto parts production? (3 points)

答: ①切削加工
②机械加工
③热处理。

3. Briefly introduce the methods for obtaining workpiece dimension. (4 points)

答: ①试刀法
②静调整法
③定尺寸刀具法
④主动或自动检测控制法。

4. What is operation? Describe the arrangement principles of machining operation (6 points)

答: 工序是一个工或一组工人在同一设备上所进行的连续加工过程。
安排原则: ①先粗后精
②先主后次
③先基准后其他

5. What is machining allowance? What are the main factors influencing machining allowance? (6 points)

答: 加工余量是加工时所保留的一定进给量, 由毛坯的制造误差、加工误差、热处理变形、测量误差等因素影响。

Score 12

QUESTION II (28 Points)

6. Figure 1 shows the positioning condition of transmission case 1. The positioning element consists of two taper pins 2 both movable from top to bottom and from left to right, bearing plate 3 and bearing nail 4. Please analyze (12 points):

- (1) What is the over-positioning?
- (2) The degree to which the freedom is restricted by the positioning elements in the figure.
- (3) Decide whether there exists over-positioning.

答: ①过定位是指定位元件对工件的某一自由度进行了重复的限制。
②自由度: x, y, z
自由活动销2限制 x, y, z
支承板3限制 x, z
支承钉4限制 y

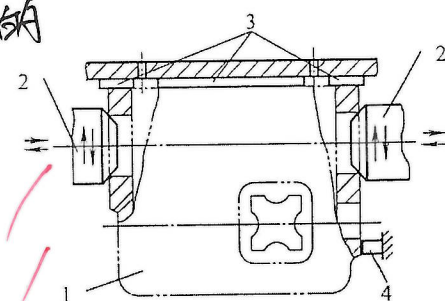


Figure 1

(3) 存在定位误差, 支承板3个支承钉4点都可限制。

7. Figure 2 is a machining and positioning diagram of piston and pin hole. The piston has a full height of $106_{-0.1}^0$ mm, pin hole position of 56 ± 0.08 mm and symmetry requirement of 0.2 mm. Please analyze (16 points):

- (1) What is positioning error? What are the main reasons for positioning error?
- (2) Please calculate the positioning error of process size 56 ± 0.08 mm.
- (3) Assuming that the coaxiality error between the seam allowance and the piston skirt is zero, please calculate the positioning error of the symmetry and determine whether it meets the processing requirement.

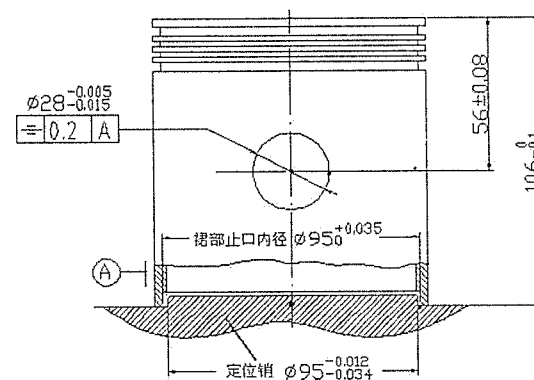


Figure 2

解: (1) 定位误差是工件在定位过程中所产生的误差, 分为基准重合误差和基准不重合误差。

产生的原因: ① 工序基准与定位基准不重合产生的误差。
② 因工件与定位元件的公差间隙而产生的基准位移误差。

$$(2) \Delta_{jb} = 0.1 \text{ mm}$$

$$\Delta_{jy} = 0 \text{ mm}$$

$$\Delta d = \Delta_{jb} + \Delta_{jy} = 0.1 \text{ mm}$$

工序尺寸 $56 \pm 0.08 \text{ mm}$ 的定位误差为 0.1 mm。

$$(3) \Delta_{\text{对称}} = \Delta d = \Delta_{jb} + \Delta_{jy} = 0.1395 \text{ mm}$$

故不满足加工要求。

8. Figure 3 is the assembly diagram of the first principle axis journal of the crankshaft and the bearing pedestal. 1 is the crankshaft, 2 and 4 are thrust washers, 3 is the mainshaft bearing of the cylinder and 5 is the timing gear. Design requirements: the assembly gap between the journal and shoulder of the first principle axis and the thrust washer is $A_0 = 0.05 \sim 0.25\text{mm}$. Design requirements: $A_1 = 43.5\text{mm}$; $A_2 = A_4 = 2.5\text{mm}$; $A_3 = 38.5\text{mm}$. The assembly method of complete interchange is to be used, to ensure assembly precision. (20 points)

- (1) Please explain the principle of shortest dimension chain.
- (2) Set up assembly dimension chain and determine increasing and decreasing links with circuit method.
- (3) Solve and calculate the dimensional tolerances and limit deviations of the related parts.

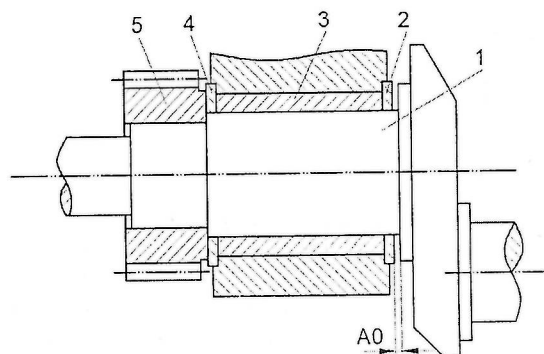
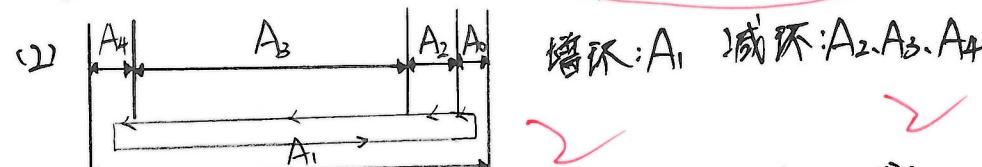


Figure 3

Standard tolerance (from GB/T 1800.3-1998)

Basic dimensions (mm)		≤ 3	$>3 \sim 6$	$>6 \sim 10$	$>10 \sim 18$	$>18 \sim 30$	$>30 \sim 50$
Tolerance grade (μm)	IT8	14	18	22	27	33	39
	IT9	25	30	36	43	52	62
	IT10	40	48	58	70	84	100

解: (1) 最小尺寸链是确定工件尺寸所需最短尺寸所组成的环。



(3) $A_0 = A_1 - (A_2 + A_3 + A_4)$ $A_1 = 43.5$ $A_2 = A_4 = 2.5$ $A_3 = 38.5$

~~(3) 计算公差~~

BINDING LINE. No answer or student information within binding edge. 试卷装订线. 装订线内不要答题, 不要填写考生信息.

(3) $T_0 = 0.25 - 0.05 = 0.2\text{mm}$
 $T_0 = T_1 + T_2 + T_3 + T_4 = 0.2\text{mm}$
 $T_1 = \frac{T_0}{4} = 0.05\text{mm}$
 $T_2 = T_4 = 0.025\text{mm}$
 $T_3 = 0.1\text{mm}$
 $0.025 \times 2 + 0.062 \times 2 = 0.174 < 0.2\text{mm}$
 故公差等级为 IT9
 $T_1 = T_3 = 0.062\text{mm}$ $T_2 = T_4 = 0.025\text{mm}$

BINDING LINE. No answer or student information within binding edge. 试卷装订线. 装订线内不要答题, 不要填写考生信息.

9. Describe the advantages and disadvantages of the assembly methods of complete interchange and incomplete interchange and the application occasions of such methods. (6 points)

答: ① 完全互换装配法的优点是: 可以使互换的工件完美配合, 缺点是: 是制造时间长, 成本高, 适用于: 小批量、精度高的工件。
 ② 不完全互换装配法的优点是: 生产周期短, 加工成本低, 缺点是: 装配精度不够高, 适用于: 大批量、精度不高的工件。

Score 9

QUESTION IV (23 Points)

10. As shown in Figure 4, the slender axis workpiece (a and b in Figure 4) and thin-wall cylindric workpiece (c in Figure 4) are cut after being clamped with different fixtures on the machine tool. And different machining errors in dimension and shape occur in the machined parts. Please analyze reasons for the machining errors of the workpieces (6 points)

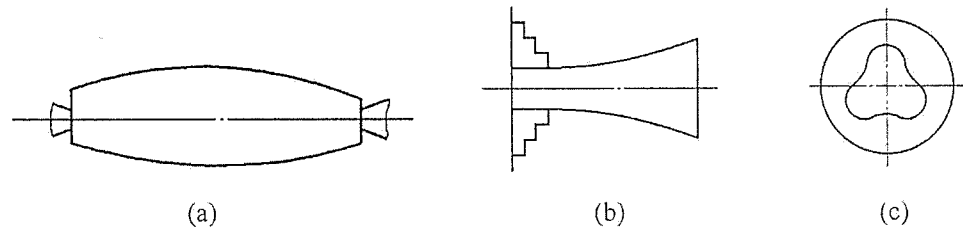


Figure 4

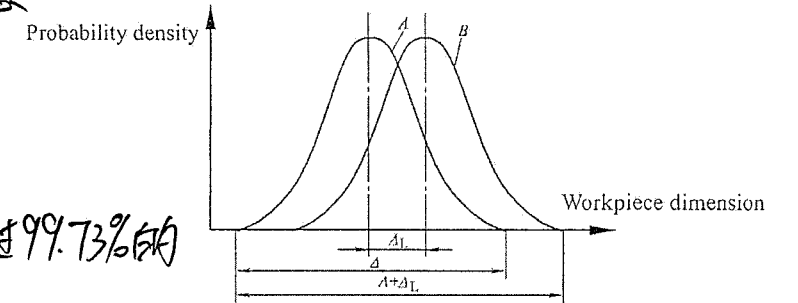
解: (a) 图a为细长光轴工件, 两端固定, 加工时 ~~两端应力大, 加工时变形小; 中间应力小, 加工时变形大~~ 故加工后为腰鼓形。
 (b) 图b为细长光轴工件, 左端由卡盘固定, 右端由顶尖固定, 加工时左端应力大, 加工时变形小; 右端应力小, 加工时变形大, 故加工后为喇叭形。
 (c) 图c为薄壁筒形工件, 由三个卡盘固定, 固定过紧, 加工时如图 故三处凸起部位 ~~前层厚, 加工后~~ 恢复管状如图c。

11. Machine separately two batches of workpieces on the machine tool with static adjustment method. The dimension distribution curves obtained are shown as A and B in Figure 5. Δ is the dimension distribution range; ΔL is the deviation of the distribution center of the two batches of workpieces and T is the process tolerance of the workpiece. Please analyze: (11 points)

- (1) What is the 6 σ principle? What does it mean in the manufacturing process?
- (2) Please determine the nature of the machining error leading to the change in the dimension distribution curves of the two batches of workpieces and describe how to eliminate the machining error.
- (3) Please provide the condition for ensuring that there is no rejected part in the two batches of workpieces.

解: (1) 是在正态分布条件下, 以尺寸 $\pm 3\sigma$ 的尺寸范围, 在正常

制造中6 σ 代表超过99.73%的产品为合格。



(2) 该误差可能为刀具加工时热变形, 伸长量较大导致的加工误差, 当刀具加工一段时间后更换刀具可消除此加工误差。

12. Analyze the influences of cutting heat on residual stress on the machined surface of the workpiece in the cutting process, at the end of cutting and when the workpiece is completely cooled in the machining process based on Figure 6. Here, t_H representing room temperature when the workpiece has high plasticity and t_p refers to the temperature; $+\sigma$ and $-\sigma$ represent tensile stress and compressive stress, respectively; 1, 2 and 3 represent three layers of metal at different distances from the workpiece surface, respectively. (6 points)

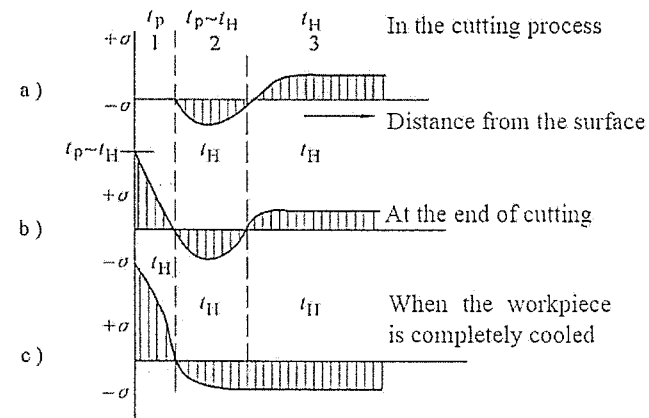


Figure 6

答:

..... 试卷装订线
 BINDING LINE No answer or student information within binding edge BINDING LINE
 装订线内不要答题，不要填写考生信息
 试卷装订线