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学院 School		专业班级 Class		学号 Student ID		姓名 Name	
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Test Paper of Wuhan University of Technology (A)

2018~2019 Academic Year 2st 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											

Score	
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QUESTION I (23 Points)

1. What is the production process of automobiles? What is the manufacturing process of automobile production? (4 points)
2. What are the three types of auto parts production? (3 points)
3. Briefly introduce the methods for obtaining workpiece dimension. (4 points)

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

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

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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.

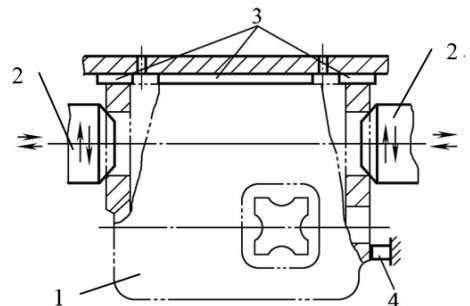


Figure 1

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 0.2mm. Please analyze (16 points):

- (1) What is positioning error? What are the main reasons for positioning error?
- (2) Please calculated 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 calculated the positioning error of the symmetry and determine whether it meets the processing requirement.

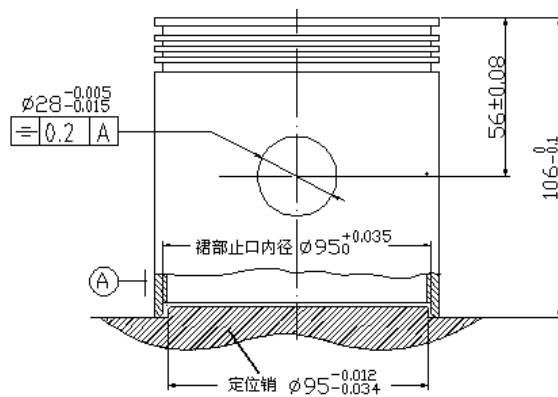
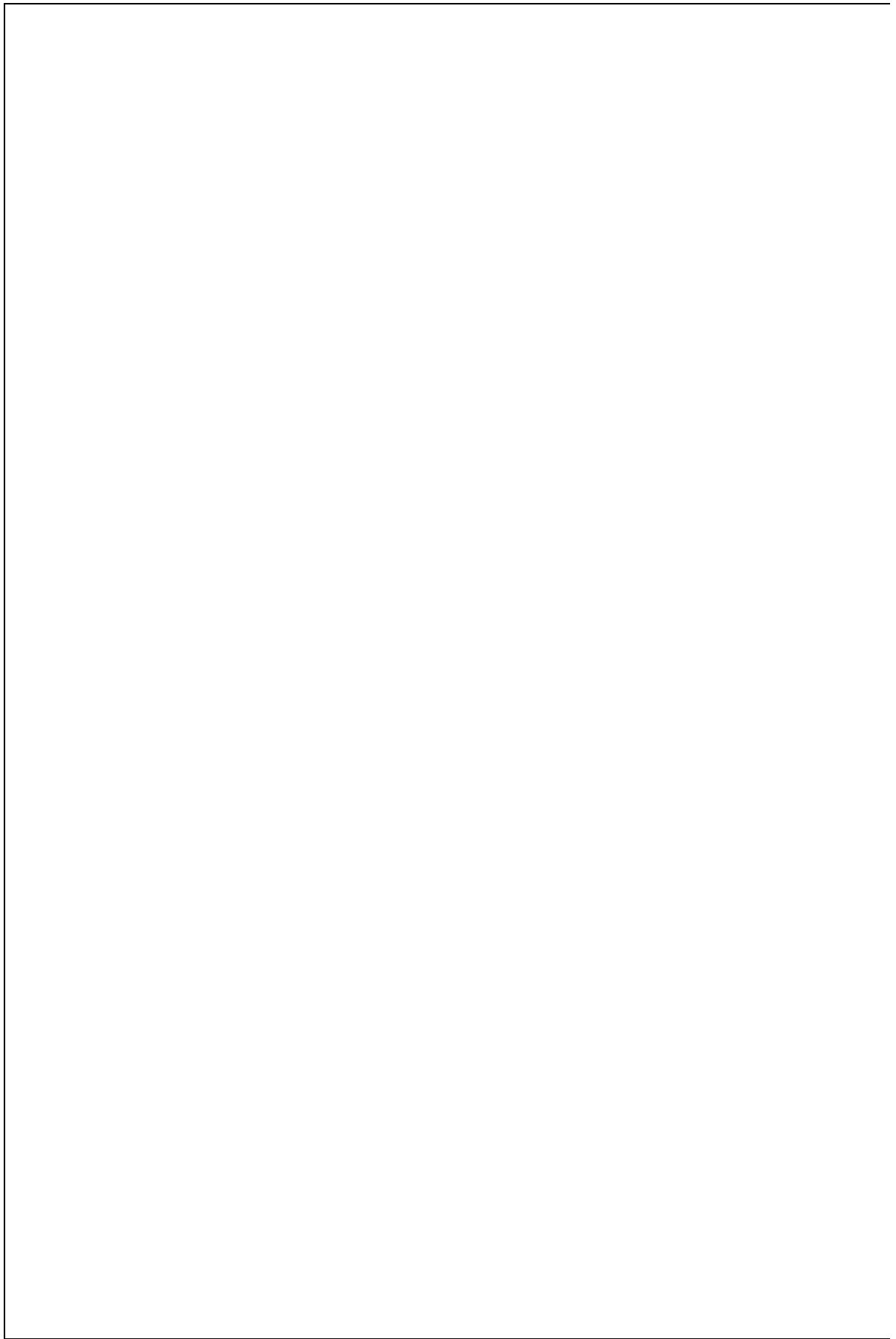


Figure 2

裙部止口内径	Inner diameter of seam allowance on the skirt
定位销	Locating pin



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QUESTION III (26 Points)

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.

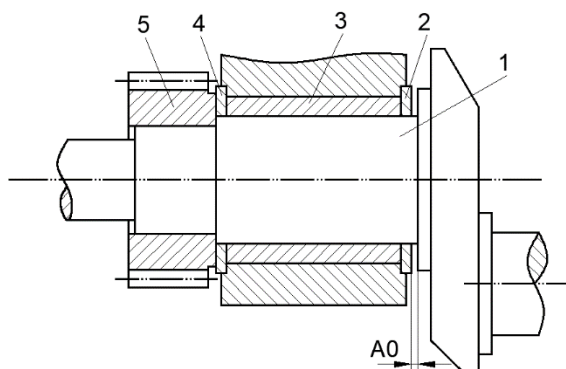


Figure 3
Standard tolerance (from GB/T 1800.3-1998)

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

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)

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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)

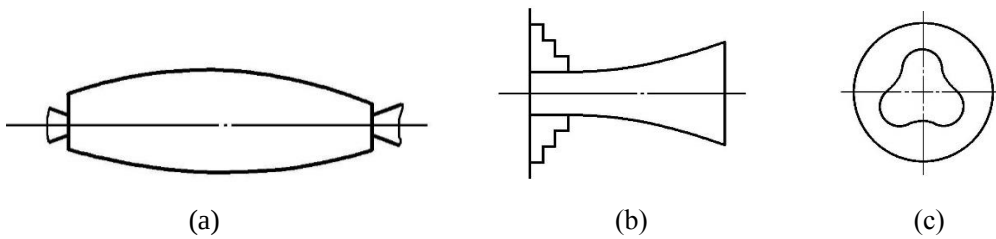


Figure 4

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 6σ 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.

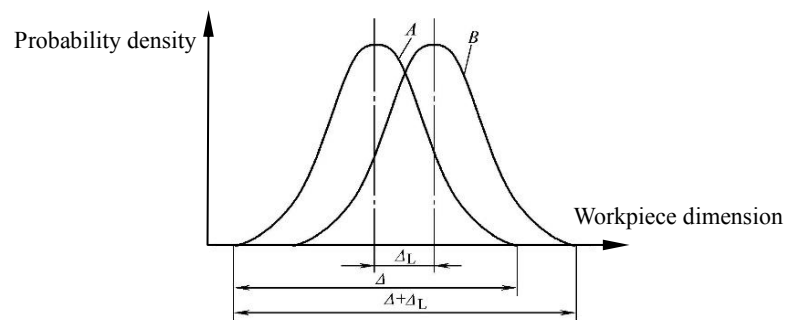


Figure 5

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)

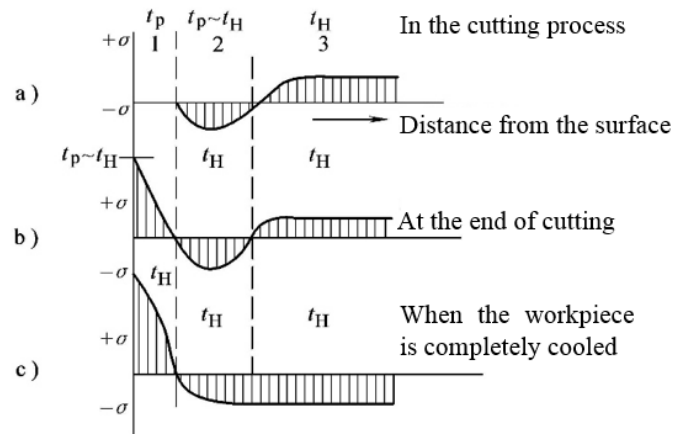


Figure 6

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