Machine tools design -MDP 4129
Final exam 1st semester 2019/2020
Date: 13/1/2020
full mark 90
Time: three hours

Kafrelsheikh University
Faculty of Engineering
Mechanical Engineering Dept.
4th year Production Eng.

- *No of exam questions are four (use the given space to answer each question. Use the back of the paper if required.*
- *No. of Pages are 10 pages –page 7,8,9,10 are blank pages*

Answer all the following questions

Question 1 [10 marks]

i. Complete the given table for the listed machining operations. Use ↷ for rotational motion, ⟶, for linear motion ⇢, for intermittent motion and ● for stationary. Use "WP" for the workpiece and "T" for the tool.

Machining Process	**Tool and WP movements**			
	Primary motion V		Secondary (feed) f	
Turning				
Drilling				
Milling				
Shaping				
Planning				
Broaching				

ii. List the essential elements of a machine tool

1-	
2-	
3-	
4-	

Question 2 [15 marks]
For the following gearboxes, calculate the number of structure diagrams, write the structural formulas and draw the structure diagrams for all cases.

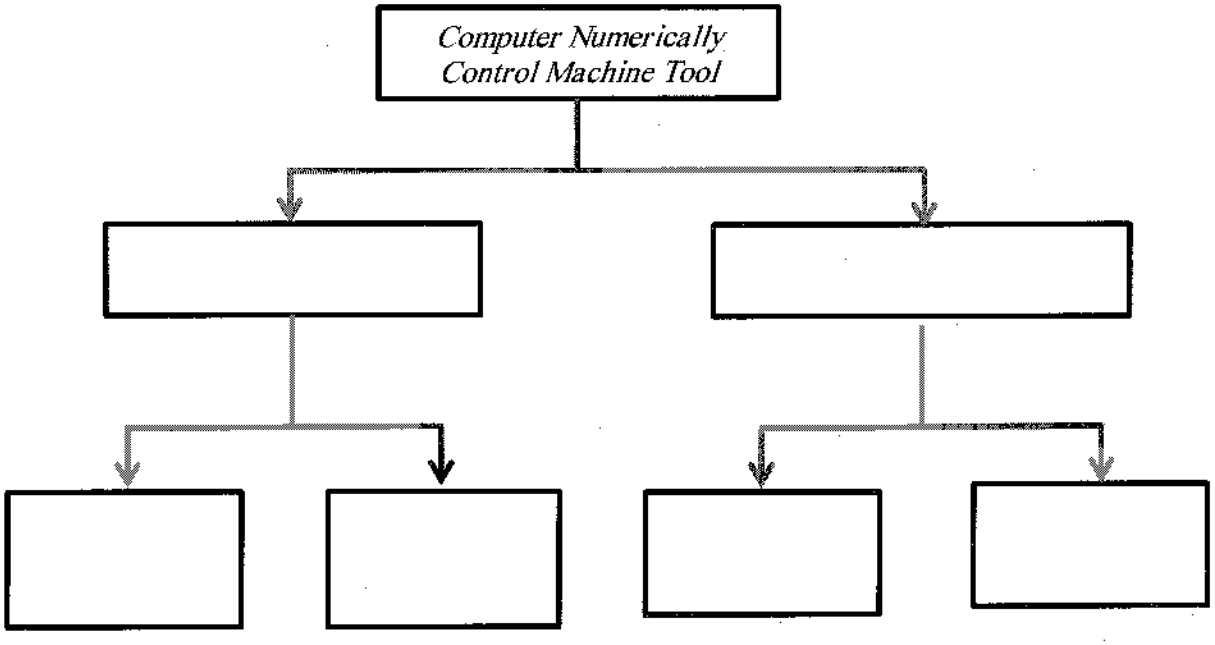
a) 6-speed gearbox

Question 2 (cont.)

b) 9-speed gearbox

Question 3 [20 marks]

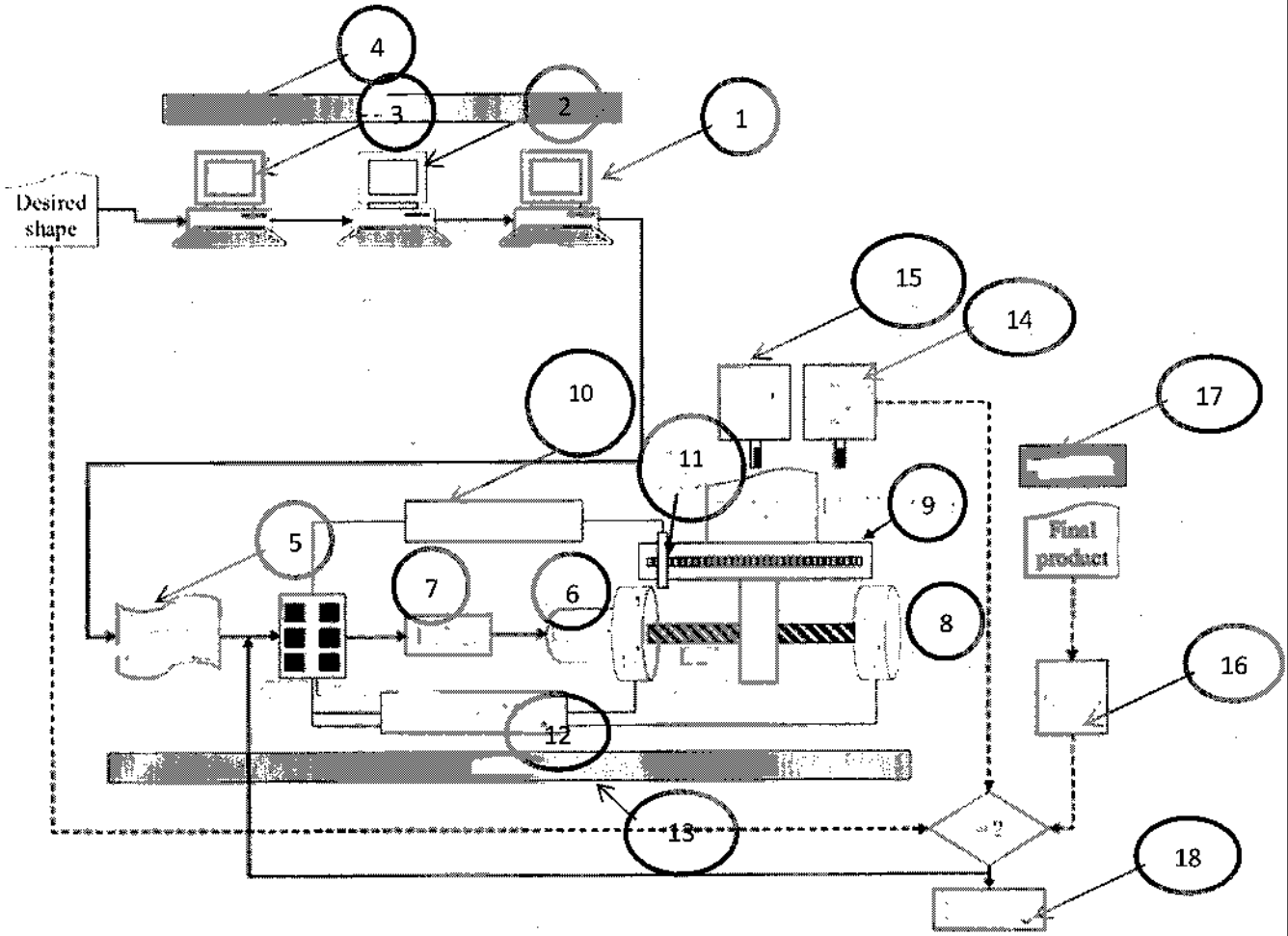
i. For simplified architecture of CNC machine tool, complete the following



ii. Show using simple sketches :-

a) Servo driving mechanism consists of a servo motor and power transmission device
b) Spindle unit consists of a spindle motor and power transmission device

iii. According to the given architecture of CNC system complete the following table



No.	Item Name
1	
2	
3	
4	
5	
6	
7	
8	
9	

No.	Item Name
10	
11	
12	
13	
14	
15	
16	
17	
18	

Question 4 [45 marks]

Design an 18-speed gearbox to produce 18 spindle speeds. The minimum spindle speed is 20 rev/min. Use geometric progression with progression ratio $\phi = 1.26$. The gearbox is powered by 1440 rev/min electric motor.

Your answer should show the followings (use **clear and neat sketch** when required).

a) Calculation of the number of structure diagrams
b) All possible structural formulas
c) The optimum structure diagram and why is it the optimum one.
d) Speed chart based on the optimum structure diagram
e) Kinematic diagram of the gearbox.
f) Number of teeth for every gear in each group assuming that the minimum number of teeth is 20. State the required assumptions.