



## Final exam questions

Subject group name: **NC Machine Tools**

Neptun code: ZVEGEGTNWNC

Credit points: 3

Subject in this subject group:

- **NC Machine Tools** (BMEGEGTNWNC)

Program: Master Program in Mechanical Engineering Modelling (2N-MW0)

Specialization: Design and Technology (2N-MW0-DT)

Responsible person:

- Dr. István Németh, [nemeth.istvan@gpk.bme.hu](mailto:nemeth.istvan@gpk.bme.hu)  
Department of Manufacturing Science and Engineering, Faculty of Mechanical Engineering

You can check the current subject forms at the Educational Portal of the Faculty of Mechanical Engineering.

<https://oktatas.gpk.bme.hu/>

Always check the for updates at [edu.gpk.bme.hu](http://edu.gpk.bme.hu) before preparing for the exam, especially if the subject group contains at least one subject from your final semester!

**Valid from 01 September 2022**

*Dr. István Németh*

associate professor

1. Units of CNC machine tools. Elements of CNC integration. Signing of NC motion axes (X, Y, Z, A, B, C).
2. Structural materials of machine tools. Trends in structural materials / structural design of machine tools.
3. Main building units of linear motion systems. Advantages and disadvantages of sliding (friction) guideways. Typical constructions of linear sliding guideways.
4. Advantages and disadvantages of rolling guideways. Types of rolling guideways. Service life calculation and static load calculation of rolling guideways.
5. Principle and characteristics of hydrostatic guideways.
6. Main parts of a ball screw drive. Characteristics and types of ball screws. Preloading methods of ball screws. Mounting methods of ball screws.
7. Selection (calculations) of ball screws: (1) Service life (dynamic load); (2) Permissible rotational speed; Definition of DN number of ball screws; (3) Permissible buckling load; (4) Permissible static load. Problems / limitations of using ball screws.
8. Rack and pinion drive: advantages, disadvantages, preloading methods, application for machine tools.
9. Linear motors: types; advantages and disadvantages; their application for machine tools.
10. Hydrostatic screws: construction principle; advantages and disadvantages; their application for machine tools.
11. NC rotary feed motion: Driving mechanisms (gears; worm wheel; torque motor). Advantages and disadvantages of torque motors and their application.
12. Machine tool spindles I. Basic requirements of spindles. Types and characteristics (advantages, disadvantages) of spindles: belt, gear, direct, integrated (built-in) spindles.
13. Machine tool spindles II. Types of spindle bearings. Typical rolling bearings used for spindles. Characteristics of hybrid ceramic ball bearings and their application for machine tool spindles. Lubrication of the rolling bearings of spindles.
14. Machine tool spindles III. Characteristics of magnetic bearings, hydrostatic bearings and aerostatic bearings and their application for machine tool spindles.
15. Machine tool spindles IV. Construction types and main building units of lathe spindles and milling spindles.
16. Machining centres I. Definition, classification, and typical constructions of machining centres. Building units of machining centres.
17. Machining centres II. Types of tool magazines, tool changers, pallet changers.
18. Machining centres III. Application of two ball screws for driving a slide. Types and main characteristics of 5-axis machining centres.
19. Building units of CNC lathes: spindle, slides, tailstock, turret, steady rest, workholding devices, workpiece feeding solutions.

20. Characteristics of CNC turning centres. Why a turning centre is different than a normal CNC lathe?  
Typical construction of one or double spindle lathes and turning centres.
21. Characteristics of grinding machines compared to milling machines. Typical surface grinders and cylindrical grinders.