

SYLLABUS

of final state exams for study programme **Production Systems and Quality Management**

State examination subject: **Production systems**

----- *Programming of Production and Manipulation technology*

1. What does CNC mean? Write the main parts, what are the main differences between the traditional NC system and the modern CNC system?
2. What is CNC machining center and describe its components! Please, describe the principle of the movement PTP and CP movements?
3. What is the interpolation on the CNC machine tools? Explain the principle of linear interpolation. What are the loop systems for controlling tool movement? Describe advantages and disadvantages!
4. What is distance between absolute programming and incremental programming of CNC machines tools? Describe advantages and disadvantages. Which of CNC codes do you know? What is N, G, F, X, Z, S, and M in the CNC programming? Give the examples!
5. Describe the zero points on the CNC lathe? Where are they? Which are the important points on a CNC lathe? Please, draw the picture!
6. Write the homogeneous transforms for rotation about the z axis at angle θ and translation along the x axis a distance a! What is the Denavit - Hartenberg convention on the industrial robot?
7. Which coordinate systems on the robot KUKA do you know?

----- *Production technologies I a II*

8. Geometry of the tool in the static coordinate system, root chips, wear cutting wedge, built-up-edge when machining.
9. Mechanism of tool wear, tool durability, influence of selected parameters on cutting edge durability, life cycle of the tool.
10. Machining of metallic materials, cutting efficiency of tool materials.
11. Cutting forces in machining, cutting force calculation models, heat and machining temperature.
12. Optimization of cutting conditions, general optimization procedure, available solutions.
13. Satisfactory solutions for optimizing cutting conditions, permissible solutions.
14. Target functions for optimizing of cutting conditions, their determination.

----- *Industrial Robots and Manipulators for Automotive Production*

15. Industrial robots and manipulators (IRaM) as a part of production system, IRaM classification, IRaM application review in production and nonproduction areas.
16. Major technical characteristics of IRaM, measurement and evaluation of these characteristics.

17. Robot as mechatronic system – mechanical subsystem (major kinematic structures, shapes of a robot workspace), drive systems (pneumatic, hydraulic, electric and special drives units).
18. Robot programming methods – on-line and off-line methods, off-line programming systems
19. Output effectors of industrial robots – classification and characteristics of basic constructions solutions
20. Peripheral devices of robotic workstations

----- ***Automotive Waste Recovery and Recycling***

21. Define a waste management strategy (Waste Hierarchy Pyramid). How we can apply it for making of new cars?
22. How much waste from old cars we have to treatment and recycle by EU and India laws (Directive 2000/53/EC of, End-of-life Vehicles, Targets (by an average weight per vehicle and year)?
23. Strategy by design of new cars from point of view recycling. Which kind of materials is increasing and which is decrease? How it is with recovery and recycling composite materials?
24. Can you classify hazardous and non-hazardous waste from old cars? Are old cars hazardous waste? What means drying of old cars?
25. Plastic material in cars increase or decrease? How we can treat and recycle plastic waste? What we can do from recycling plastic material?
26. Name wherein the car is rubber present. How and where we can evaluate it? How we can recycle it (mechanical, cryogen)? What we can produce from rubber waste?
27. Name liquid waste from old cars. How we can evaluate it? Is it a hazardous or non-hazardous waste? Can we mix it each other?
28. Where in the car are ferrous and non-ferrous metals present? How we can recover them? Which kind is increasing and which kind is decreasing?
29. What strategies do we know about the processing of ELV? Compare the advantages and disadvantages of different strategies (power of processing, cleaning of raw materials, etc.).
30. Name the electric and electronic waste from old cars. How we can recycle them? Is it a hazardous or non-hazardous waste?
31. What is the difference between batteries and accumulators? Which kind of new raw materials we can take from old batteries and accumulators?

----- ***Computer Aided Production***

32. Computer aided production, basic description of computer aided systems.
33. CAD systems, description, modules, 3D modeling concepts of components, benefits, features.
34. CAQ systems, methods and tools of quality management, FMEA analysis, coordinate measuring machines.
35. CAPP systems, technological preparation of production, its tasks, technological documentation, principles of creation of technological documentation.

----- *Maintenance and Reliability in Automotive Production System*

36. Maintenance as part of the manufacturing process, tasks and maintenance objectives, the types of maintenance.
37. Total Productive Maintenance (TPM) – basic principle, three zero program, autonomous maintenance.
38. Standardisation of maintenance works – types of standards used in industrial maintenance.
39. Evaluation of the effectiveness of maintenance, Overall Equipment Effectiveness (OEE), calculation of availability, performance and quality.
40. Types of failures, ways to wear of machine parts.
41. Preventive maintenance, fundamentals of vibration diagnostics, infrared thermography, oil analysis.

State examination subject: **Quality Management**

----- *Total Quality Management in Automotive Industry*

1. Basic concepts of quality management (quality of product, quality management, process, process approach).
2. Evolution from quantity to quality.
3. Quality management system (8 principles of quality management, quality management process model).
4. Theory of Deming and Juran, characteristic signs.
5. International standardization of quality systems. Standards of quality.
6. Certification and accreditation.
7. Philosophy and principles of TQM.
8. Social and technical subsystem of TQM.
9. House of quality (three pillars of TQM).
10. European model of TQM (Business Excellence model, EFQM).
11. Integrated management system.
12. Total quality management methods.
13. Quality audits.

----- *Production Management in Automotive Industry*

14. Production and operation management, production system – characteristics and tasks.
Core and support functions of production system – their characteristics and relationships.
15. Production and manufacturing system, its classification and characteristics – production quantity.
16. Layout planning – types of layout and its characteristics.
17. Capacity Planning. Definition, measuring capacity and its importance to the organization.
Steps in capacity planning.
18. Inventory management – types and uses of inventory, inventory performance measures.
19. Material Requirements Planning – characteristics, objectives, structure, Enterprise Resource Planning.
20. System JIT, its characteristics and benefits for production management.