

## MSc EXAM QUESTIONS

Degree of study: MSc  
Field of Study: Mechanics and Machine Construction

1. Variational rules of mechanics.
2. Stress of a thick-wall tubing.
3. Free vibrations of one-dimension continuous systems.
4. Theorem of thin slabs.
5. Crawl function of deformations and stress relaxation function (for a chosen dynamic model).
6. Laplace and Fournier transforms.
7. The concept of transmittance of a dynamic system.
8. The concept of stability of an automatic adjustment system.
9. Basic ideas of Concurrent Engineering.
10. Functions of CAD (Computer Aided Design), CAE (Computer Aided Engineering), PLM (Product Lifecycle Management), and PDM (Product Data Management) systems.
11. Smart materials in engineering applications.
12. The influence of the crystalline structure of a material (its defects) on its macroscopic mechanical properties.
13. Task of identifying a dynamic model in the domain of time and frequency (define).
14. Gears with high transmission ratios – planetary and strain wave.
15. Non-linear MES issues.
16. Critical states of rotating systems.
17. Push-pull manufacturing.
18. Scheer's model of Computer Integrated Manufacturing.
19. Relational databases.
20. Scheme and operating principle of genetic algorithm.
21. Structure and operating principle of an artificial neuron and artificial neural network.
22. Equivalent weight when designing a vehicle drive system.
23. Differential units with increased friction (rule for calculating, characteristics).
24. Planetary gears in automatic transmissions of vehicles.
25. Torque vectoring (operating principle).
26. Kinds of defects of gears in vehicle drive systems.
27. Determined and undetermined heat conduction and basic laws describing them.
28. Structure of catalytic reactors.
29. Methods of regeneration of diesel particulate filters.
30. Systems for regulating vehicle wheels slip.
31. Input signals used while controlling operation of Electronic Stability Program (ESP).
32. Systems for warning the driver against a collision.
33. Operating principle of Brake Assist (BAS)
34. Materials for load-bearing structures – fatigue characteristics, Wohler curve.

35. Causes and kinds of degradation of load-bearing structures.
36. Comparison of P and PI regulators.
37. Issue of viscosity of the working medium in drive systems.
38. Analysis of energy and power flow in a construction machine with a hydrokinetic drive.
39. Analysis of energy and power flow in a construction machine with a hydrostatic drive.
40. Analysis of energy and power flow in a construction machine with a hybrid drive.
41. Choice of drive elements of a construction machine with multi-part fittings,
42. Process of estimating reliability parameters of mechanical systems.
43. Mechanical properties of composite materials.
44. Structures of hybrid drives.
45. Resistance to motion of an excavator boom or a crane, pitched in a vertical plane.
46. Load sensing in machines with hydrostatic drive.
47. Kinds and characteristics of pumps and hydraulic engines.
48. Driving simulators – main modules of the simulator and their functions, kinds of simulators.
49. Methods of evaluating the effectiveness of a braking system under traction test (approval) conditions.
50. Criteria for evaluating the main frame of a vehicle.