Mechanics and Machine Construction and Design II degree – questions for diploma exam (specialty: International Design Engineer)

Academic Year 2023/2024

1. Principles and criteria for the selection of metal materials.
2. Characterize weldable high-strength steel.
3. Characterize corrosion-resistant steels and acid-resistant.
4. Characterize aviation materials.
5. Materials for nuclear Energy
6. Diffusion mechanism of heat and mass transport
7. Energy and mass of conservation equations.
8. Thermal and concentration boundary layers
9. Heat and mass transfer analogy “Lewis law” and Lewis number
10. Heat transfer between wall separated fluids. Peclet's law.
11. The concepts of concentration and differentiation of process operations in the view of the increase in its productivity.
12. The idea of total (complete) machining and the possibilities for its realization considering the processing capabilities of contemporary work centers.
13. Techniques and the means used in modelling manufacturing systems operation and related process flow.
14. Quantitative metrics used in the description of automation level and flexibility attributes of process performance.
15. Technical and organizational conditionings determining the realization capabilities of multi-part machining in integrated manufacture.
16. Modelling of stationary closed loop systems.
17. Control of discrete nonstationary systems.
18. Modal energy participation.
19. Building the map of optimal spindle speeds during HSM of flexible details.
20. Virtual prototyping technique for predicting fatigue endurance of the vehicles components.
21. Explain: what is the difference between the plane state of stresses of the plane state of strains.
22. Explain: what determines elongation of the axially tensioned bar.
23. Describe and review yield criteria of Tresca and von Mises.
24. The basic idea of FEM method.
25. Measurement uncertainty.
26. Statistical analysis of measurement data.
27. Differences between experimental and theoretical research.
28. False positive results.
29. Double-blind design.
30. What is a sensor? Advantages and disadvantages of digital and analogue sensors?
31. Robots development trends.

32. Advantages and disadvantages of ultrasonic sensors for distance measurement.
33. Discuss Spherical Linear Interpolation Applications of dual quaternions.
34. Boiler efficiency and heat losses.
35. The components of a typical boiler system.
36. The equipment for the fuel preparation for the boiler.
37. Types of stem boilers.
38. Classification of welding processes.
39. Special bonding processes.
40. FEM - comparison of different types of element meshes.
41. Shell modelling – examples of applications.
42. The concept of the composite part based approach in CAPP and its meaning in computer aided process planning.
43. Generalized models of process structure for complex mechanical components and chief factors determining operation sequences.
44. Attributes considered within industrial classification and coding systems and used in Computer Aided Process Planning.
45. Technologies and means required for the use of generative methods of Computer Aided Process Planning.
46. Rankine Cycle.
47. Bryton Cycle.
48. The main components in turbine power plants.
49. Energy losses in the turbine stage.
50. Turbine flow parts.
51. Systematics of modern manufacturing technologies.
52. Machining centers, structure, principles of creation, equipment.
53. Characteristics of HSC/HSM, dry machining
54. Computational Fluid Dynamics and its applications.
55. Conservation law of mass in fluid mechanics.
56. Conservation law of momentum in fluid mechanic.
57. Conservation law of energy in fluid mechanics.
58. How Human Resources Management impacts on organizational performance.
59. Characterize the relationship between motivation, job satisfaction and money.
60. Why is it necessary to have a reward strategy? - Examples of reward strategies.