EMARO/ROBOTICS – DIPLOMA EXAM QUESTIONS

1. Definition of reference frames for manipulators
2. Description of orientation in robotics
3. Denavit-Hartenberg notation
4. Methods of direct and inverse kinematic problems solution for serial manipulators
5. Jacobians in robotics
6. Methods of description of maniplutor dynamics
7. Direct and inverse dynamic problem in robotics
8. Joint space schemes for trajectory generation
9. Cartesian paths description and programming for serial manipulators
10. Position control of maniplulators
11. Position/force control
12. Definition of static stability in walking machines
13. Comment the main functions of walking robots control systems (also: draw the general scheme)
14. Give the sensors types which are used in mobile robots (walking machines, wheeled robots)
15. General stucture of autonomous robot control system
16. What it is robotics?
17. Please give the robots classification concering diverse criteria (those which you are familiar with)?
18. Definition of ZMP
19. Give general characteristics of control methods used in walking robots
20. Dynamic stability of bipeds
21. What will be the future trend in development of robotics? Why?
22. Position control versus torque control. What method is commonly used in industral manipulators.
23. What it is servo motor? What is the difference between typical DC motors with encoders and servo motors? Which one will bring more accurate control?
24. What are the DD motors? (DD - Direct Drive) What is the difference between DD and DC motrs based control? When DD are used?
25. How is defined static stability in walking machines
26. EMG signals: measurement, analysis, utilisation.
27. Discusse the bone remodelling phenomenon
28. Biomechanical injury criteria (in biomechanics of impact)
29. Present and discuss an algorithm of kinematic analysis program (capable to deal with an arbitrary multibody system).
30. What are the kinematic constraints equations and how are they related with kinematic pairs?
31. Write and discuss equations the motion of a rigid body in 2D and 3D space.
32. Logical planner in agent-based systems (situation calculus in first-order logic, plan operators, comparison of STRIPS and ADL, plan search procedure, partial-ordered plan) (Art.Intel.)
33. Stochastic inference in Dynamic Bayesian Networks (purpose and definition of Bayesian networks, Markov processes and first-order assumptions, DBN and its inference tasks, HMM, Kalman Filter and Particle Filter) (Art.Intel.)
34. Camera calibration (coordinate systems and transformations, intrinsic and extrinsic camera parameters, parameter estimation procedure, non-linear distortions) (Computer Vision)

35. Stereo-vision (principle, normalization (registration) of the stereo-pair, epipolar constraint, solving the correspondence problem for depth-map estimation) (Computer Vision)
36. Explain the DFT and FFT transforms (purpose and definition of DFT, inverse DFT, interlace decomposition and butterfly computation in FFT, aliasing problem, computational complexity of DFT and FFT) (Signal Processing)
37. Explain the digital filter types: FIR and IIR filter (linear time-invariant systems, impulse response, convolution, recursive equation, transmittance function – form, poles and zeros, relation to recursive filter parameters) (Signal Processing)