Exam questions on the course «Automation foundations»

The 1st block

1. Describe the term System. Draw a diagram of systems’ components.
2. Describe the term System. Write about components of a system including an input, an output, a system boundary and environment.
3. Describe the term System and Subsystem. Draw a scheme that represents Supersystem, System and Subsystem.
4. Classify systems according to the time frame. Describe each category of systems.
5. Classify systems according to the complexity of the system. Describe each category of systems.
6. Describe static and dynamic systems. Give examples of these systems.
7. Describe linear and non-linear systems. Give examples of these systems.
8. Describe a system’s modeling. Write about main advantages of using models.
9. Modeling methods for complex systems. Describe physical and abstract models. Give examples.
10. Modeling methods for complex systems. Describe mathematical and descriptive models. Give examples.
11. Describe Simulink tool of modeling, its advantages in the modeling processes.
12. Describe objects of Simulink tool of modeling. Give example of a scheme built in Simulink.
13. Write about signals and blocks in Simulink modeling systems.
14. Describe continuous and discrete states in Simulink models. Give examples of blocks that represent these states.
15. Work with MATLAB. Write about such elements of the Simulink library as an add, gain, sine wave and switch.
16. Work with MATLAB. Write about such elements of the Simulink library as an integrator, derivative and unit delay.
17. Describe an integrator block in Simulink, its purpose and work.
18. Write about the work of an integrator in Simulink. Describe this block’s parameters; how we are able to change the initial value.
19. Write about the work of an integrator in Simulink. Describe zero-crossing signals: rising, falling and either.
20. Write about the work of mathematics blocks in Simulink modeling tool. Describe a sum, product and gain blocks in details.

The 2nd block

1. Describe systems with algebraic loops in Simulink modeling tool.
2. Describe a process of determining step size for discrete systems.
3. Describe the use of Constant blocks and blocks generating sine waves. Write about connection of blocks.
4. Describe creation of Sub-blocks in Simulink modeling tool. Write about the work of sub-systems.
5. Describe triggered systems. Write about subsystems with rising, falling and rising or falling triggers.
6. Write about conditional control flow statements. Give examples of (If…else) and (Switch) statements.
7. Write about Data types in Simulink. Describe data types that are commonly used in systems.
8. Describe Stateflow diagrams. Analyze a meaning of states in systems.
9. Draw Stateflow diagram, describe states and transition of states in the system.
10. Describe a connection of Stateflow charts with Simulink blocks. Write how input and output signals are created.
11. Write about types of variables in Stateflow diagrams. Describe each of them.
12. Draw a scheme combining elements from Stateflow and Simulink diagrams. Stateflow has to include input and output signals.
13. Describe a creation of subcharts in Stateflow diagrams. Write how conditions in transitions between states work.
14. Write about events in Stateflow. Give examples of different events.
15. Represent changing states of Stateflow diagram that represents the work of a traffic light.
16. Represent changing states of Stateflow diagram that describes changing temperatures in houses.
17. Represent changing states of Stateflow diagram that describes the timetable of events.
18. Represent changing states of Stateflow diagram that represents plans for a trip.
19. Analyze a connection of Stateflow diagram with UML diagram of states.
20. Describe the process of modeling in UML with Use case diagram and a diagram of states.

The 3rd block

1. Solve the following equation in Simulink $\ddot{q}+k^{2}\*q= \frac{F}{a}$, F = H\*sin (w\*t).

|  |  |  |  |
| --- | --- | --- | --- |
| *H* | *w* | *k* | *а* |
| 2 sm | 0,3 *s-1* | 0,4 *s-1* | 1 *s-2* |

1. Solve the following equation in Simulink $\ddot{q}-k\*q= \frac{F}{a}$, F = H\*cos (w\*t).

|  |  |  |  |
| --- | --- | --- | --- |
| *H* | *w* | *k* | *а* |
| 2 sm | 0,7 *s-1* | 0,4 *s-1* | 1 *s-2* |

1. Solve the following equations using Simulink tools. $\ddot{b}+60\*b= Q+7$, where Q is equal to $Q=\sin(\left(wt\right)), w=10$
2. Solve the following equations using Simulink tools. $\ddot{a}+5\*a= N+7$, where N changes its value from 5 to 10 after 15 seconds from the start.
3. Solve the following equation in Simulink 

|  |  |  |  |
| --- | --- | --- | --- |
| *A*  | *w1* | *l*  | ϕ*0* |
| 2 m | 3 *s-1* | 40 m | 0.1° |

1. Solve the following equation in Simulink . Every 10 seconds, the value of A changes by ± 1.

|  |  |  |  |
| --- | --- | --- | --- |
| *A*  | *w1* | *l*  | ϕ*0* |
| 4 m | *5 s-1* | 30 m | 2° |

1. Solve the following equation in Simulink . Every 10 seconds, the value of A changes by ± 4.

|  |  |  |  |
| --- | --- | --- | --- |
| *A*  | *w1* | *l*  | ϕ*0* |
| 6 m | *2 s-1* | 15 m | 1° |

1. Solve the following equation in Simulink . C is the rigidity of the elastic suspension. Let c = 0.5 kg / s2.

|  |  |  |
| --- | --- | --- |
| *m*  | *V* | *А1* |
| *0.7 kg*  | *0.9 m/s* | * 1. *m*
 |

1. Solve the following equation in Simulink . C is the rigidity of the elastic suspension. Let c = 2 kg / s2.

|  |  |  |
| --- | --- | --- |
| *m*  | *V* | *А1* |
| *0.9 kg*  | *2 m/s* | *0.5 m* |

1. Solve the following equation in Simulink $m\_{1}\ddot{x}\_{1}+\left(c\_{1}+c\_{2}\right)x\_{1}-c\_{2}x\_{2}=0,$

$m\_{2}\ddot{x}\_{2}+c\_{2}x\_{1}-c\_{2}x\_{2}=0 $

|  |  |  |  |
| --- | --- | --- | --- |
| m1 | m2 | c1 | c2 |
| 2 kg | 3 kg | 5 kg/s2 | 1. kg/s2
 |

1. Solve the following equation in Simulink $m\_{1}\ddot{x}\_{1}+\left(c\_{1}+c\_{2}\right)x\_{1}+c\_{1}x\_{2}=0,$

$m\_{2}\ddot{x}\_{2}+c\_{1}x\_{1}-c\_{2}x\_{2}=0 $

|  |  |  |  |
| --- | --- | --- | --- |
| m1 | m2 | c1 | c2 |
| 1 kg | 8 kg | 3 kg/s2 | 1. kg/s2
 |

1. Solve the following equation in Simulink $m\_{2}\ddot{x}\_{1}+\left(c\_{1}-c\_{2}\right)x\_{2}-c\_{1}x\_{1}=0,$

$m\_{1}\ddot{x}\_{2}-c\_{2}x\_{1}+c\_{1}x\_{2}=0 $

|  |  |  |  |
| --- | --- | --- | --- |
| m1 | m2 | c1 | c2 |
| 3 kg | 5 kg | 3 kg/s2 | 4 kg/s2 |

1. Solve the following equation in Simulink $\ddot{c}-20\*c= Q+15$, where Q is equal to $Q=\sin(\left(a\*t\right)), a=12$
2. Solve the following equation in Simulink $\ddot{n}-6\*c+5= Q+10$, where Q is equal to $Q=\sin(\left(a\*t\right)), a=6$
3. Create Stateflow diagram that demonstrates work of a factory. Use charts and subcharts.
4. Describe Stateflow diagram that realizes your schedule of everyday activities. Use charts and subcharts.
5. Create Stateflow diagram that simulates a control of temperature in an industrial oven.
6. Describe Stateflow diagram where the work of an industrial robot is realized.
7. Create Stateflow diagram that represents your life at the university.
8. Describe Stateflow diagram that demonstrates choice of you study trajectory. Use charts and subcharts.