

**Full time training**  
**English – Mechatronics engineers – MSC**  
**Specialization in Informatics**

**State exam's questions**  
**Vehicle Dynamics + Electronics + Informatics**

Subject code: BGK-MEI-2021-AMM-E-JD+JE+JI

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**Vehicle Dynamics**

- JD 01 Static weight distribution, and its modifying factors
- Axle loads in steady, leveled condition.
  - Axle loads during acceleration, climbing uphill, during tow, and caused by air resistance
  - Inclination resistance
- JD 02 Cornering, weight distribution, side-skidding, and roll-over limits
- Force balance during cornering. Centrifugal, centripetal forces
  - Determining the yaw-rate
  - Rolling balance, skidding balance
- JD 03 Pull-force balance, resistances
- Components of the pull force balance equation, and
  - Detailed explanations of the components.
- JD 04 Pull diagram, and consequences
- Pull force, and vehicle speed equation from engine, vehicle, and tyre data.
  - Draw the pull force curves for at least 3 gears.
  - Draw the resistance curves
  - Draw the theoretical ideal pull-force hyperbole, and explain
  - Draw conclusions about maximum speeds (theoretical, and practical)

JD 05 Longitudinal slip, and tire forces

- Slip definitions for pull, and brake
- Explain the origin of the slip phenome
- Is slip a loss?
- Show normalized the tire forces in the range  $s: [-1,1]$ , and explain stable, and unstable ranges
- Explain additional braking effect for certain soil types

JD 06 Lateral slip, and side force

- Lateral slip definition (side-skidding angle)
- Explain the origin of the sike-skidding phenome
- What influences the side-skidding?
- Which vehicle dynamic property is being influenced by side-skidding?

JD 07 Ackermann condition of turning.

- Explain Ackermann condition on a drawing of a 4-wheeled vehicle
- Explain the steering angle differences between inner and outer wheels.
- Determine the outer wheel steering angle based on the inner wheel angle

JD 08 Neutral-, over-, and understeering conditions

- Create drawings for the 3 cases
- Explain the conditions based on the side skidding angles
- Show the steering wheel angle as a function of vehicle speed for the 3 cases

JD 09 Multi-mass dynamic models of vehicle suspension

- Draw models for 1, 2, 3, and 5 mass models.
- Which model is used for which type of modelling?

JD 10 Differential equation modelling of vehicle dynamics.

- Draw an at least 2 mass vehicle modell
- Set up the motion equations
- Write up the differential equation (at least 2nd order)
- Create a block modell based on the differential equation.
- Explain the solution possibilities of the modell created.

## **Vehicle Electronics**

- JE 01 Explain how the gasoline fuel-injection system work, the L- Jetronic system, and adaptation to specific operating conditions?
- JE 02 Explain how the electronic ignition system work, and knock-control?
- JE 03 Explain how the traction control system work, and electronic throttle control.
- JE 04 Explain how the emission control work, and lambda sensor?
- JE 05 Explain how the ABS anti-lock braking system work?
- JE 06 Explain how the vehicle safety system work, and electronic stability program (ESP)?
- JE 07 Explain how the parking assist system work?
- JE 08 Explain how the lane assist system work?
- JE 09 Explain how the Hybrid and Electric vehicles work?
- JE 10 Explain how the Autopilot system work?
- JE 11 Explain how the Internet of things of vehicles (IoT). Vehicle to vehicle and vehicle to environment communication work?

## **Vehicle Informatics**

- JI 01 Vehicle bus systems. Definition, properties
- JI 02 BUS system's classification
  - List, and compare different Vehicle information systems
  - How are different systems connected?
- JI 03 Bus Access Methods
  - Explain the collision avoidance between the various fieldbus systems.
- JI 04 ISO/OSI 7 layers model
  - Introduce, and explain the 7 layers
  - Explain the information exchange from application to application.

- JI 05 Can BUS system
- CAN history
  - CAN in automotive applications
  - CAN architectures, signal transmission methods
  - Fault tolerant CAN
- JI 06 Safety-critical BUS systems
- What does safety critical means?
  - Which vehicle information systems can fulfill safety critical expectations?
  - Which application require safety critical systems?
- JI 07 LIN BUS system
- LIN history
  - LIN in automotive applications
  - LIN architectures, signal transmission methods
- JI 08 MOST BUS system
- MOST in automotive applications
  - MOST architectures, features, signal transmission methods
  - Compare fiber optic and copper wire data transmissions
- JI 09 V2X Communication solutions
- What does V2X mean?
  - Which information channels can be used?
  - Which function can V2X bring in traffic?
  - How can it improve traffic safety?
- JI 10 OBD, OBDII
- What is OBD?
  - What is the difference between OBDI and II?
  - Which communication method is used?