Automobile

1. **Course number and name:** 020AUTES3 Automobile

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours per week

3. **Name(s) of instructor(s) or course coordinator(s):** Roy Harb

4. **Instructional Materials:** Course handouts

5. **Specific course information**
   a. **Catalog description:**
   This course introduces students to automotive engineering, it deals with several systems existing in an automobile such as clutches, manual and automatic gearboxes, torque converter, 4x4 transfer, CV joints, transmission, differential, suspension, wheel geometry, steering box, and braking systems.

   b. **Prerequisites:** Mechanical Systems (020SMEES1).

   c. **Required** for ME students.

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
   A student who successfully fulfills the course requirements will have demonstrated an ability to:
   - Identify the different parts of the automobile.
   - Explain the working of various parts like engine, transmission, clutch, brakes, and tyres.
   - Describe how the steering, the differential, and the suspension systems operate.
   - Develop a strong base for understanding future developments in the automobile industry.

   b. **PI addressed by the course:**

PI	1.2	1.3	3.2
Covered	x	x	
Assessed	x	x	x

7. **Brief list of topics to be covered**

- **Chapter 1: Automobile: Motion and Transmission of Power**
  - Engine: source of motion in automobile.
  - Characteristics of thermal engine.
  - Characteristics of electric motor.
  - Gear ratio.
  - Global function of transmission system.

- Transmission components.
- Various types of transmission: Front wheel drive – Rear wheel drive – All wheel drive – Hybrid.

- **Chapter 2: Clutch**
  - Global function
  - Diaphragm-spring clutch.
    - Components: characteristics and function of each.
    - Operating principle of the system.
    - Equation of the torque.
    - Clutch control: general description.
    - Hydraulic control.
      - Components: characteristics and function of each.
      - Operating principle of the control system.
  - Torque converter
    - Function.
    - Components: Characteristics and function of each.
    - Lock-up clutch.
    - Torque equation.
    - Operating principle of the system.
    - Characteristics of torque converter.
- **Chapter 3: Gearbox/Transmission**
  - Function of the gearbox in transmission of power in automobile.
  - Manual transmission system.
    - Identical shaft gearbox.
    - Non-identical shaft gearbox.
    - Kinematic schema.
    - Calculation of gear ratios.
    - Synchromesh devices.
      - Function.
      - Borg-Warner synchromesh device
      - Outer cone synchromesh device.
    - Gear interlock device.
  - Automatic transmission
    - Planetary gear set: simple and combined
      - Components and possible combinations.
      - Kinematic schema.
      - Calculation of possible ratios.
    - Control parameters
    - Electro hydraulically controlled system.
    - Kinematic schema reading for various ratios.
    - Automatic transmission special functions: Interlock, shift-lock, shift program selection …
  - Continuously variable transmission (CVT).
    - Components: characteristics and function of each.
    - Operating principle.
- **Chapter 4: Transfer Case**

    - Function
    - Types.
        - Design.
        - Operating principle.
- **Chapter 5: Propeller Shafts, Driving Shaft and Joints**
    - Function.
    - Propeller shafts with U joint.
    - Driving shafts.
    - Joints.
    - Flexible discs.
- **Chapter 6: Final Drive and Differential**
    - Final drive.
        - Function.
        - Types.
        - Final drive ratio.
    - Differentiel.
        - Function.
        - Design.
        - Operating principle.
        - Differential lock.
- **Chapter 7: Vehicle Body**
    - Description of various body construction types.
    - Materials in body making.
- **Chapter 8: Suspension**
    - Function.
    - Operating principle of the suspension.
    - Types of springs.
    - Struts / shock absorbers.
- **Chapter 9: Wheel Suspension**
    - Rigid axle.
    - Semi-rigid axle.
    - Independent suspension.
- **Chapter 10: Steering**
    - Steering principle.
    - Steering linkage.
    - Steering gear.
    - Power steering system.
- **Chapter 11: Brakes**
    - Hydraulic braking system.
    - Power assisted brake.
    - Braking force distribution.
    - Parking brake.
    - Electronic chassis control systems.
- **Chapter 12: Wheels and Tyres**
    - Wheels.
        - Requirements.

        - Structure.
    - Wheel adjustments
    - Tyres.
        - Requirements.
        - Structure.
        - Types.
        - Tyres designation.