MODULE 2 – Introduction to Technology Of EV

2.5 Summary

Final Module Quiz

**Questions for Section 2.1**

### Question 1 What is the most suitable electric machine technology for EVs?

1. Brushed DC motor
2. Induction motor and permanent magnet motor
3. Switched reluctance motor

Ans. B

### Question 2 Why are lithium-ion batteries commonly used in electric cars? Because of...

1. High energy density
2. Lowest cost
3. Abundant availability of lithium

Ans. A

### Question 3 To what concept does the term regenerative braking refer?

1. Converting the mechanical energy of the wheels to electrical energy in order to slow the vehicle and the charge battery in the process
2. Operating the electric motor as a generator
3. In case of an induction motor, this means that the rotor speed is greater than the RMF (Rotating magnetic field) speed
4. All the above

Ans. D

### Question 4 What is the main use of a single stage transmission in an electric car?

1. Higher efficiency
2. Speed reduction and associated torque multiplication
3. Higher lifetime of motor
4. Better maneuverability of the car

Ans. B

### Question 5 Why is an open differential used in an electric car?

1. It is more rugged and can carry more torque than a limited slip differential
2. It is simple
3. Traction control problems can be overcome by using suitable motor control algorithms
4. All of the above

Ans. D

### Question 6 You have two attempts to answer this question. For an induction motor, match the following principles to the right component.

The **Components** are:

* Motor drive
* Stator
* Rotor
* Motor

The **Principles** to choose from:

* Same as the inverter and variable frequency drive
* Can be operated as a generator as well
* Sets up a rotating magnetic field based on the AC power supply
* Collection of conducting bars short-circuited by end rings

a. Motor drive

Select an option

1. Same as the inverter and variable frequency drive.
2. Can be operated as a generator as well
3. Sets up a rotating magnetic field based on the AC power supply.
4. Collection of conducting bars short-circuited by end rings.

Ans. A

b. Stator:

Select an option

1. Same as the inverter and variable frequency drive.
2. Can be operated as a generator as well.
3. Sets up a rotating magnetic field based on the AC power supply.
4. Collection of conducting bars short-circuited by end rings.

Ans. C

c. Rotor:

Select an option

1. Same as the inverter and variable frequency drive.
2. Can be operated as a generator as well.
3. Sets up a rotating magnetic field based on the AC power supply.
4. Collection of conducting bars short-circuited by end rings.

Ans. D

d. Motor:

Select an option

1. Same as the inverter and variable frequency drive.
2. Can be operated as a generator as well.
3. Sets up a rotating magnetic field based on the AC power supply.
4. Collection of conducting bars short-circuited by end rings.

Ans. B

**Questions for Section 2.2**

### Question 1 You have two attempts for this question. Please match the following EV types to its main characteristics via the dropdown menus.

The **EV types** are:

* Fuel Cell EV
* Battery electric vehicle
* Plug-in hybrid electric vehicle
* Hybrid electric vehicle

The **characteristics** to choose from:

* Gasoline is the only fuel source
* Uses gasoline for long journeys and battery energy for short journeys
* Hydrogen is the only fuel source
* Charging the battery is the only way to refuel the vehicle.

1. Fuel Cell Electric Vehicle:

Select an option

1. Gasoline is the only fuel source
2. Uses gasoline for long journeys and battery energy for short journeys
3. Hydrogen is the only fuel source
4. Charging the battery is the only way to refuel the vehicle

Ans. C

2. Battery Electric Vehicle:

Select an option

1. Gasoline is the only fuel source
2. Uses gasoline for long journeys and battery energy for short journeys
3. Hydrogen is the only fuel source
4. Charging the battery is the only way to refuel the vehicle

Ans. D

3. Plug-in Hybrid Electric Vehicle:

Select an option

1. Gasoline is the only fuel source
2. Uses gasoline for long journeys and battery energy for short journey
3. Hydrogen is the only fuel source
4. Charging the battery is the only way to refuel the vehicle correct

Ans. B

4. Hybrid Electric Vehicle:

Select an option

1. Gasoline is the only fuel source
2. Uses gasoline for long journeys and battery energy for short journeys
3. Hydrogen is the only fuel source
4. Charging the battery is the only way to refuel the vehicle

Ans. A

### Question 2 When we compare the electric drivetrain of a **hybrid EV** to an **EV**, it:

1. Is the same as an EV, plus a fuel-burning engine of some type that can recharge the batteries periodically
2. Contains no battery
3. Is different from an EV

Ans. A

### Question 3a For an HEV electric car with an electric motor power of 40kW and a mechanical power from the internal combustion engine of 40kW, determine:

a. The hybridization rate:

1. 1
2. 0.5
3. 2

Ans. B

### Question 3b For an HEV electric car with an electric motor power of 40kW and a mechanical power from the internal combustion engine of 40kW, determine:

b. What type of HEV it is:

1. Micro-hybrid
2. Semi hybrid
3. Full hybrid

Ans. C

### Question 4 What is the purpose of the power split in the series-parallel hybrid powertrain?

1. Split the power between the wheels and the vehicle accessories
2. Split the power between the series and parallel drivetrains
3. Split the power between the front and rear wheel drive

Ans. B

### Question 5 You get two attempts for this question. Please match the following EV types to its main characteristics via the dropdown menus.

The **types** are:

* Electric car
* Hybrid Electric Vehicle
* Plug-in Hybrid Electric Vehicle

The **characteristics** to choose from:

* Powered solely by fossil fuels
* Zero tailpipe emissions only when directly powered from the battery that is charged
* Zero tailpipe emissions.

1. Electric car:

Select an option

1. Powered solely by fossil fuels
2. Zero tailpipe emissions only when directly powered from the battery that is charged
3. Zero tailpipe emissions

Ans. C

2. Hybrid Electric Vehicle:

Select an option

1. Powered solely by fossil fuels
2. Zero tailpipe emissions only when directly powered from the battery that is charged
3. Zero tailpipe emissions

Ans. A

3. Plug-in Hybrid Electric Vehicle:

Select an option

1. Powered solely by fossil fuels
2. Zero tailpipe emissions only when directly powered from the battery that is charged
3. Zero tailpipe emissions

Ans. B

**Questions for Section 2.3**

### Question 1 Why is AC charging power for electric cars limited to less than 50kW?

1. Electric car batteries cannot handle higher charging powers
2. Due to size and weight restrictions for the on-board charger
3. Due to limitations from the grid standards
4. Due to power restrictions of the motor drive

Ans. B

### Question 2 Why is an on-board charger required in an electric car?

1. To convert AC power from the grid to DC power for charging.
2. For controlling the speed of the car.
3. To monitor the degradation of the EV battery.
4. To control the discharging of the EV battery during driving.

Ans. A

### Question 3 Where and for what type of charging is the type 1 charging connector used?

1. DC charging in USA-Japan
2. Three-phase AC charging in Europe
3. Single phase AC charging in Europe
4. AC charging in USA-Japan

Ans. D

### Question 4 What level and mode is DC fast charging above 100kW?

1. Level 2 charging, Mode 3
2. Level 2 charging, Mode 4
3. Level 3 charging, Mode 3
4. Level 3 charging, Mode 4

Ans. D

### Question 5 During the battery charging process, in what region is DC fast charging done?

1. CC region
2. CV region
3. In both regions
4. CV region for a short period of time

Ans. A

**Questions for Section 2.4**

### Question 1 >>What is the benefit of smart (EV) charging over conventional charging?

1. Smart charging can be done based on renewable energy generation
2. Smart charging based on energy prices is cheaper than conventional charging
3. Smart charging can be done based on loading on the grid
4. All of the above

Ans. D

### Question 2 What is the main reason for electric cars normally not having multiple gears?

1. Gears are expensive
2. The electric motor together with the motor drive can provide peak torque at nearly all speeds
3. The motor drive is a bidirectional power converter
4. Gears do not allow regenerative braking

Ans. B

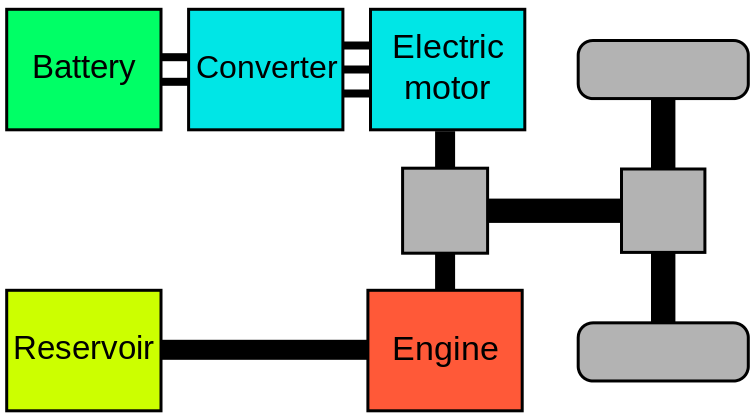
### Question 3 A hybrid is such that it has start-stop functionality and can partially (not fully) provide all the torque needed to drive the wheels.

What is the HEV type?

1. Micro-hybrid
2. Mild hybrid
3. Full hybrid
4. PHEV

Ans. B

### Question 4



What is the hybrid vehicle drivetrain type drawn in the above image?

1. Parallel hybrid
2. Series hybrid
3. Plug-in series hybrid
4. Series-parallel hybrid

Ans. A

### Question 5 A car is an electric car if and only if it has:

1. A high voltage battery
2. An electric drivetrain
3. An auxiliary battery
4. Cables for transferring electric power

Ans. B

Question 6

Two families living in Delft, one owning a Tesla model S (100 kWh battery) and the other a Nissan Leaf (30 kWh battery), want to go on holiday to Milan. They decide to drive the fastest route through Germany, so the drive is approximately 1200 km. They fast charge on the way, which means they charge their battery up to 80% SOC at every stop. How many more times does the Leaf have to stop to charge than the Model S? Assume that the two cars:

* Charge at the same fast charging power
* Have the same energy consumption of 0.2 kWh/km
* Start the trip with a battery of 80% SOC
* Only charge when the battery reaches 0% SOC
* Charge from 0% to 80% every time they stop for charging
* Can always find a charger en-route when needed

1. 2 times
2. 5 times
3. 7 times
4. 10 times

Ans. C