Department of Electrical Engineering
Assignment
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Course Details

Course Title:	Power Electronics	**Module:**	4rth
Instructor:	Engr.Aamir Aman	**Total Marks:**	50

Student Details

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Q1.	The solar energy is low density energy so it is perfect to be installed in urban and suburban areas. In this way the zero energy building goal can be reached but many other problems arise for the real integration. What is your opinion that the future of photovoltaic, solar thermal and hybrid PV/T systems is in the building integration?	Marks 10 CLO 1
Q2.	What is the technical difference between grid forming and grid supporting inverters? Back your answer with valid data, facts and figures.	Marks 10 CLO 1
Q3.	Electric cars and hydrogen cars both run on apparently clean fuels. However, the source of electricity or hydrogen production may be based over partially clean processes. It is a question of the future, which of them will prevail.	Marks 10 CLO 2
Q4.	Is it possible to control speed using Boost Converter? Give your answer with proper example.	Marks 10 CLO 2
Q5.	Describe the effect on distortion on the output frequency of the cycloconverter? Back your answer with valid data, facts and figures.	Marks 10 CLO 2

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☺ GOOD LUCK ☺

Answer Sheet

Q1:

The solar energy is low density energy so it is perfect to be installed in urban and suburban areas. In this way the zero energy building goal can be reached but many other problems arise for the real integration. What is your opinion that the future of photovoltaic, solar thermal and hybrid PV/T systems is in the building integration?

Ans:

Solar thermal and hybrid just seem to have an increasingly tough time hitting their paybacks for large installations, not because either of those are deficient, but because the juggernaut of PV has rolled so strong and so hard through the building technologies sector. PV keeps making it harder for everything else to compete.

My approach on this is to assume that the human cost is inevitably the expensive one ... mistakes cost more than high technology, training is expensive, people rotate through jobs, they call in sick, and they vary the way they interact with systems.

PV seems to be best positioned to minimize the human cost of power. Once installed the maintenance is minimal, there are few integration problems of weather-sealing like with hybrid systems, not having to maintain and replace things like pumps and compressors is helpful. I've seen some wonderful hybrid technologies, but they are inevitably custom made and just can't compete on power with PV which is rolled off of assembly lines like taffy. PV was just the lucky one to benefit from scale integration, partly as a byproduct of the semiconductor industry. The regulations, building codes and processes are being optimized for PV in ways that they just can't standardize for less-popular systems.

The problems you mention about integration with PV are with us for solar thermal and hybrid as well, they all need variations in code and training. But with PV, the whole industry is working to the resolution of the integration issues.

Q2:

What is the technical difference between grid forming and grid supporting inverters? Back your answer with valid data, facts and figures.

Ans:

Grid forming converters can be represented as an ideal AC voltage source with a low output impedance. As voltage sources present a low output impedance so, they need an extremely accurate synchronization system to operate in parallel with other grid forming converters. E.g. UPS

AC voltage generator by the grid forming power converter will be used as a reference, for the rest of the grid feeding power converter connected to it. It is very much suitable for islanded mode of operations.
Grid supporting converter can be represented either as an ideal AC control current source, in parallel with the shunt impedance or as an ideal AC voltage source in series with a link impedance. Its main aim is to participate in regulating the amplitude and frequency of the AC grid voltage by controlling the active and reactive power supplied to the grid.

OR

1) The task of Grid forming converter is to maintain the voltage and frequency of the micro grid. It is essentially like a slack bus in power system.
2) The task of Grid supporting converter is to simply dispatch some set active and reactive power or dispatch based on some command signal. So, it is more like the PQ bus in power system.

Q3:

Electric cars and hydrogen cars both run on apparently clean fuels. However, the source of electricity or hydrogen production may be Based over partially clean processes. It is a question of the future, Which of them will prevail.

Ans:

I think, both technologies should be developed as quickly as possible so that cars based on electro mobility and other ecological energy sources become widely available. The infrastructure of the battery charging station and hydrogen-oxygen fuel should also be built. Which technology will develop to a greater extent will be determined by the time and cost of charging the fuel.

In my opinion, hydrogen fuel cell technology and electro mobility should become economical and safe in the future. However, currently hydrogen production is not cheap. The storage of hydrogen, e.g. in cylinders in cars that would be fueled by this fuel, is associated with a high risk of a dangerous explosion. Space shuttles in space programs in the USA were fueled by hydrogen-oxygen fuel. However, there have been tragic catastrophes.

Will the technologies of electric motors and the new generation of batteries installed in cars and other motor vehicles be developed in the scope of the main directions of development of electro mobility of the automotive industry? Will the technology of hydrogen engines or other types of engines be developed as part of the development of eco-motorization? At present, in the majority of countries, there is no financial resources for financing high-budget pro-ecological projects from public finance funds? Should new, new ecological innovations, new technological solutions in the field of renewable energy sources, new Eco electrodes producing electricity for the needs of electro mobility in the automotive industry, new generations of batteries, photovoltaic panels, energy storage and transmission stations, hydrogen and other engines, etc. be created that the production

and use of electricity generated from renewable energy sources becomes profitable, that it becomes a profitable business, that electro mobility will become more and more profitable, profitable, and the prices of electric cars drop significantly? If this process lasts for a long time, there may be a shortage of time to implement the necessary reforms aimed at disseminating in the global economy a model of sustainable pro-ecological development based on the concept of green economy. If this process lasts much longer than by 2030, there may not be enough time to carry out the necessary reforms to reduce greenhouse gas emissions and, consequently, the planet's warming process will accelerate considerably, this process will be irreversible and will continue to accelerate and towards the end of the 21st century century will lead to a global climate disaster that threatens the life of all humanity and most other forms of life on Earth.

Q4:

Is it possible to control speed using Boost Converter? Give your answer with proper example.

Ans:

We can control the speed of the induction motor by changing the motor voltage while V while keeping V/F constant where F is the frequency of the voltage applied on the motor. This condition is required to keep the flux phi constant.
So, yes we can use DC/DC boost converter to control the voltage and then you can use DC/AC inverter to generate the AC for the motor. You have to change the frequency of the inverter by changing the switching speed of the inverter switches. You have to generate as sinusoidal waveform as possible.This can be accomplished by using PWM and filtering.

OR

The boost converter is used to "step-up" an input voltage to some higher level, required by a load. This unique capability is achieved by storing energy in an inductor and releasing it to the load at a higher voltage. This brief note highlights some of the more common pitfalls when using boost regulators.
The buck converter is so named because the inductor always “bucks” or acts against the input voltage. The output voltage of an ideal buck converter is equal to the product of the switching duty cycle and the supply voltage. ... When the switch is opened the supply current to the inductor is suddenly interrupted.

Q5:

Describe the effect on distortion on the output frequency of the cycloconverter? Back your answer with valid data, facts and figures.

Ans:

The function of the cycloconverter is to convert constant voltage, constant frequency into variable voltage, and variable frequency without any intermediate stage.

Principle of cycloconverter
The cycloconverter consists of dual converter in which one converter works as positive converter whereas the other as the negative converter.

Types of cycloconverter
According to frequency:

(1) Step up cycloconverter and

(2) Step down cycloconverter

According to output voltage:

(1) Single phase to single phase –

(a) Centre taped cycloconverter and

(b)Bridge configuration cycloconverter

(2) Single phase to three phase

(3) Three phase to three phase

All types of cycloconverters are phase commutated except step up cycloconverter. The step up cycloconverter is forced commutated.

Advantages

- Higher efficiency due to single stage conversion
- All the cycloconverter works on line commutation except step up cycloconverter therefore it is not necessary for extra commutating components.
- The power transfer from supply to load and vice versa at any power factor.
- It can operate at distorted output waveform in the case of one SCR gets damaged.
- It can generate high quality sinusoidal waveform particular at low frequency whereas the static inverter generate step wave voltage waveform at low frequency (< 10 Hz).

Disadvantages

- Control circuit becomes complex due to higher number of SCRs.
- Low power factor for low output voltage
- The supply should be short circuited due to failure of commutation circuit.