**Power Management Systems () Theory Exam 2009**

1. (3pts) What is a power management system (PMS)? State 4 main objectives of a PMS.

**Answer:**

A power management is a superior management control system that monitors and commands the power generation, distribution, and consumers.

It has the following objectives:

* Ensure that power is available for the required operational load
* Prevent overload of generators when the load increase
* Prevent complete blackout as a result of anything that might happen, whatever bus configuration.
* If complete blackout occurs: restore power as fast as possible

1. (3pts)What is the objective and advantages with the “load-dependent start” and “load-dependent stop”?

**Answer:**

The overall objective is to ensure that actual load is supplied by an appropriate number of generators. The main advantage is that the online generators can be run at optimal fuel efficiency, thus reducing fuel consumption and unnecessary wear and tear.

Load dependent start:

To ensure that enough generated power is available for the required operational load, by starting automatically the next standby generator in the startup sequence when required by a load increase.

Load dependent stop:

To stop the next generator in the stopping sequence when there are too much generator capacity online, i.e. when there are too much surplus power.

1. (3pts) What is a blackout and what should the PMS do if a blackout has occurred?

**Answer:**

(2pts) A partial blackout is loss of one or several power buses, but not all. A complete blackout, or just “blackout” is the loss of power on all main power buses.

(1pts) If a blackout has occurred, the PMS should automatically try to restore the power as soon as possible. This is called “blackout restoration”.

1. (3pts) Explain the difference between the functions “Load reduction” and “Load shedding”?

**Answer:**

(1pts) “Load reduction” is a function in the PMS that rapidly commands a reduction of the VSDs in a critical overload situation. The basic function of reducing the load is implemented in the control logic of the VSD itself, and this can be triggered both locally, often by sensing frequency drops locally, or externally by the command signal from the PMS.

(1pts) “Load shedding” is a function in the PMS that commands disconnection of particular groups of power loads (circuits) in a prioritized sequence. This is done to rapidly remove load in a critical overload situation.

(1 pts) The difference is therefore that the “load reduction” reduces the load rapidly to a preset % value and from there can be steadily raised again, while the “load shedding” throws out entire groups of loads that needs to be reconnected and restarted. Load shedding is typically used as a last resort if load reduction fails to recover the situation first.

**Power Management Systems () Theory Exam 2010**

1. (2pts) What is a power management system (PMS)? State 4 main objectives of a PMS.

**Answer:**

A power management is a superior management control system that monitors and commands the power generation, distribution, and consumers.

It has the following objectives:

* Ensure that power is available for the required operational load
* Prevent overload of generators when the load increase
* Prevent complete blackout as a result of anything that might happen, whatever bus configuration.
* If complete blackout occurs: restore power as fast as possible

1. (6pts) A PMS performs “load management” where the most important objective is to avoid overload situations that may result in blackout. In addition to *load-dependent start and stop*, this typically includes functions :
2. Heavy consumer control
3. Load reduction
4. Load shedding

Briefly explain the methods of each of these functions to avoid overload.

**Answer:**

Heavy consumer control:

Start interlock of heavy consumers. PMS receives start request signals from consumers defined as “heavy consumers”. PMS start standby generator if not enough power is available for start of the heavy consumer. PMS issues start allowed signal to heavy consumer as soon as sufficient power is available. Power reservation for heavy consumers, e.g. drawworks.

Load reduction:

To ensure fast reduction in the event of sudden generator overload (e.g. due to generator trip). Several methods:

1. Power phase back: The PMS or some other device may send information of the available load (alternatively the load on the most loaded generator) to the thruster drives. At some configurable level(s) the converter quickly reduces power.

ii) Frequency phase back: The frequency converter senses the frequency of the supply voltage. When the frequency drops below some configurable level(s) the frequency converter quickly reduces power.

Load shedding:

PMS disconnects predefined groups of low prioritized (nonessential) loads if an overload situation occurs. Load shedding is typically used as a last resort if load reduction fails to recover the situation first.

1. (2pts) Explain how the PMS can command each diesel-engine and generator in order to actively adjust the active and reactive power load sharing between parallel gensets.

**Answer:**

With governors in droop mode, the PMS can command the reference frequency to the governors (the no-load frequency setting of the droop curve) of each diesel-engine in order to adjust the active power sharing between the gensets. Similarly the PMS can command the reference voltage to the AVRs to adjust the reactive power sharing.