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(1) State conditions for synchronization of 2 alternators.

Ans → Both phase & magnitude must be equal for grid voltage & synchronous machine terminal voltage.
→ Grid voltage & synchronous machine terminal voltage must have same phase sequence.
→ Freq. of 2 alternators must be similar. (not equal)

(2) State effect of wrong synchronisation.

Ans → When phase sequence isn't matched then it results in high voltage, which damages the windings.
→ When voltages aren't matched, it leads to short circuit.
→ When freq is not similar, it results in sudden acceleration/deceleration of rotor, leading to damaging shaft.

(3) Explain necessity of synchronisation of alternators.

Ans System becomes unstable if not synchronis[ed]. Alternators will trip from high voltage swin[gs] that damage components like generator.

(4) State adv. of using no. of small generating units instead of single large unit for supplying power.

Ans. In small generating units in parallel, even when 1 unit gets shut down, others work & continue to generate. But when singe large unit gets shut down, then system gets down. Also in order to accomodate ratings of current small generating units are used.

(5) Why freq. of incoming alternator is kept slightly higher than bus-bar freq?

Ans After sync. due to load sharing incoming alternator reduces its speed. Alternator increasing its speed isn't possible. If we don't keep freq. not higher, grid tries to reduce freq. to match incoming alternator, leading to reduced freq. of grid and efficiency.

(6) From given test setup how can you make synchronous machine become generator feeding power to bus?

Ans By gradually increasing excitation of field, which increases terminal voltage greater than grid voltage. Hence, generator feeds power to bus.

(7) If 2 400V machines are synchronized by either dark lamp or bright lamp method what will be voltage rating of bulb?

Ans Worst case:-
terminal & grid voltage will be 180° out of phase.
Voltage operating across bulb is:-

$$= \frac{V_t + V_{grid}}{\sqrt{3}}$$

$$= \frac{V_t - V_t \angle 180^\circ}{\sqrt{3}} = \frac{2 V_t}{\sqrt{3}}$$

Bulb rating $= \frac{2 V_t}{\sqrt{3}}$ → terminal voltage.