SHEET (1)

1) At a location in Egypt, it is decided to supply a load of 300 Kw at 60 Hz. The only power source available is that of the Egyptians grid. It is decided to supply this load by a motor – generator set (i.e. a synchronous motor driving a synchronous generator). How many poles should each of the machine have.

2) A three phase, four pole synchronous machine has 24 stator slots. The slots contain a double layer winding with two coil side per slot. Coils are four turn each. The coil pitch is chorded by one slot.
   a) Find the slot and coil pitch in electrical degrees.
   b) Find the pitch, distribution and winding factors of this machine.
   c) How well will this winding suppress third, fifth and 7^{th} harmonic.

3) A 20 MVA, 11 Kv, 50 Hz, three phase star connected alternator is driven at 1500 rev/min. the winding is housed in 360 slots and has 6 conductors/slot, the coil span is (5/6) of a pole pitch. Calculate the sinusoidally – distributed flux/pole required to give a line voltage of 11- KV on open circuit. And the full load current per conductor. (*Assume all conductor are connected in series*)

4) Determine the distribution and the winding factors for a three phase winding with two slots per pole per phase. The coil span is 5 slot pitches.
   If the flux wave in the air gap consists of the fundamental and 30% third harmonics, calculate the percentage increase in the r.m.s value of the phase voltage due to this harmonic.

5) The air gap flux distribution of an alternator contains fifth and seventh harmonics whose magnitudes are respectively 10% and 5% of the fundamental. Find the corresponding percentage in harmonics in the terminal voltage. The machine has 106 conductor/slot, a 14 poles and a three- phase double-layer winding with a coil pitch of 6 .

6) A single phase alternator has 16 poles, 6 slots per pole, 10 conductor per slot, a slot core length of 0.45 m, a stator bore of 1.8 m, a fundamental flux density of 1 tesla, and runs at 375 r.p.m calculate the open circuit e.m.f with all conductor turns are connected in series.

7) A three phase four pole winding of a double layer type is to be installed in 48 stator slots. The coil span is 75 mechanical degree and there are 10 turns per coil in the winding. All coils in each phase are connected in series and the three phase are connected in star. The flux per pole in the machine is $5.4*10^6$ lines, and the speed of the rotation is 1800 r.p.m. Calculate the resulting line voltage. (What will the line voltage, if all coil groups are connecting in parallel)

8) A 3 ph, 50 Hz, 4 pole , 20 MVA, star connected, turbo alternator has the following parameters.

Number of slots	= 72	Number of conductor/slot	= 20
coil span	= 15 slot	Flux per pole	= 0.01 web.

If all the conductors, of each, phase, are connected in series. Determine:

a) The R.M.S value of line to line voltage.
b) The amplitude, of the M.M.F per phase of the armature at full load
c) Speed of the prime mover
d) Speed of the M.M.F of the field winding: with respect to the stator
e) Speed of the M.M.F of the armature 3 phase winding with respect to the stator
f) Speed of the M.M.F of the armature 3 phase winding with respect to the M.M.F of the field-winding.
g) Will this machine produce a uniform electromagnetic torque? Comment.