SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE401 SYNCHRONOUS AND INDUCTION MACHINES

II YEAR /IV SEMESTER

UNIT – I SYNCHRONOUS GENERATOR

Frequency & Poles

Let N = rotor speed in r.p.m.

P = number of rotor poles

f = frequency of e.m.f. in Hz

$\therefore$ No. of cycles/revolution = No. of pairs of poles = $P/2$

No. of revolutions/second = $N/60$

$\therefore$ No. of cycles/second = $(P/2)(N/60) = N\,P/120$

But number of cycles of e.m.f. per second is its frequency.

$$\therefore \quad f = \frac{N\,P}{120}$$

EMF Equation of an Alternator

E.M.F. Equation of an Alternator

Let Z = No. of conductors or coil sides in series per phase
ϕ = Flux per pole in webers
P = Number of rotor poles
N = Rotor speed in r.p.m.

In one revolution (i.e., 60/N second), each stator conductor is cut by $P\phi$ webers i.e.,

$$d\phi = P\phi; \qquad dt = 60/N$$

$\therefore$ Average e.m.f. induced in one stator conductor

$$= \frac{d\phi}{dt} = \frac{P\phi}{60/N} = \frac{P\phi N}{60} \text{ volts}$$

Since there are Z conductors in series per phase,

$$\therefore \text{ Average e.m.f./phase} = \frac{P\phi N}{60} \times Z$$

$$= \frac{P\phi Z}{60} \times \frac{120\,f}{P} \qquad \left(\because N = \frac{120\,f}{P}\right)$$

$$= 2f\phi Z \text{ volts}$$

R.M.S. value of e.m.f./phase = Average value/phase x form factor

$$= 2f\phi Z \times 1.11 = 2.22\, f\phi Z \text{ volts}$$

$$\therefore \quad E_{r.m.s.}/\text{phase} = 2.22 f\phi Z \text{ volts} \qquad \text{(i)}$$

If K_p and K_d are the pitch factor and distribution factor of the armature winding, then,

$$E_{r.m.s.}/\text{phase} = 2.22 K_p K_d f\phi Z \text{ volts} \qquad \text{(ii)}$$

Sometimes the turns (T) per phase rather than conductors per phase are specified, in that case, eq. (ii) becomes:

$$E_{r.m.s.}/\text{phase} = 4.44 K_p K_d f\phi T \text{ volts} \qquad \text{(iii)}$$

The line voltage will depend upon whether the winding is star or delta connected.

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THANK YOU