

Steps to Find Induced EMF in armature of alternator

1. Find total number of slots S (mostly given in problem)
2. Find the number of slots per pole = n
3. Find the number of slot per pole per phase = m
4. Find Chording Angle $\alpha = \frac{\text{Short Slots}}{n} \times 180$
5. Find the coil span factor for pitch factor K_c or $K_p = \cos \frac{\alpha}{2}$
6. Find the distribution angle $\beta = \frac{180}{n}$
7. Find distribution factor $K_d = \frac{\sin \frac{m\beta}{2}}{m \sin \frac{\beta}{2}}$
8. Find EMF per phase $E_{Ph} = E_1 = 4.44 K_c * K_d \Phi T$ volts
9. Find line Voltage $E_L = \sqrt{3} E_{Ph}$
10. **If harmonics are present then do the following steps**
11. Find the coil span factor for fundamental frequency $K_{c1} = \cos \frac{\alpha}{2}$
12. Find the coil span factor for 3rd harmonics $K_{c3} = \cos \frac{3\alpha}{2}$
13. Find distribution factor for 3rd harmonics $K_{d3} = \frac{\sin \frac{3m\beta}{2}}{m \sin \frac{3\beta}{2}}$
14. Find flux at 3rd harmonics = $\Phi_3 = \frac{1}{3} \Phi$
15. Find EMF per phase for 3rd harmonics $E_3 = 4.44 K_c * K_d f \Phi T$
16. Find the coil span factor for 5rd harmonics $K_{c5} = \cos \frac{5\alpha}{2}$
17. Find distribution factor for 5rd harmonics $K_{d5} = \frac{\sin \frac{5m\beta}{2}}{m \sin \frac{5\beta}{2}}$
18. Find flux at 3rd harmonics = $\Phi_3 = \frac{1}{3} \Phi$
19. Find EMF per phase for 5rd harmonics $E_5 = 4.44 K_c * K_d f \Phi T$
20. Resultant $E = \sqrt{E_1^2 + E_3^2 + E_5^2}$