Sheet (5)

(1) A 3-phase, star-connected alternator supplies a load of 10 MW at p.f. 0.85 lagging and at 11 kV (terminal voltage). Its resistance is 0.1 ohm per phase and synchronous reactance 0.66 ohm per phase. Calculate the line value of e.m.f generated.

(2) The effective resistance of a 2200V, 50Hz, 440 KVA, 1-phase, alternator is ٠,٥ohm. On short circuit, a field current of 40 A gives the full load current of 200 A. The electromotive force on open-circuits with same field excitation is 1160 V. Calculate the synchronous impedance and reactance.

(3) A 60-KVA, 220 V, 50-Hz, 1-φ alternator has effective armature resistance of ٠,٠١٦ohm and an armature leakage reactance of 0.07 ohm. Compute the voltage induced in the armature when the alternator is delivering rated current at a load power factor of
(a) unity (b) 0.7 lagging. (c) 0.7 leading.

(4) In a 50-kVA, star-connected, 440-V, 3-phase, 50-Hz alternator, the effective armature resistance is 0.25 ohm per phase. The synchronous reactance is 3.2 ohm per phase and leakage reactance is 0.5 ohm per phase. Determine at rated load and unity power factor: (a) Internal e.m.f. Ea
(b) no-load e.m.f. E0
(c) percentage regulation on full-load
(d) value of synchronous reactance which replaces armature reaction.

(5) A 100-kVA, 3000-V, 50-Hz 3-phase star-connected alternator has effective armature resistance of 0.2 ohm. The field current of 40 A produces short-circuit current of 200 A and an open-circuit emf of 1040 V (line value). Calculate the full-load voltage regulation at 0.8 p.f. lagging and 0.8 p.f. leading. Draw phasor diagrams.

(6) A 3-phase, 10-kVA, 400-V, 50-Hz, Y-connected alternator supplies the rated load at 0.8 p.f. lag. If arm. resistance is 0.5 ohm

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and syn. reactance is 10 ohms, find the power angle and voltage regulation.

(7) A given 3-MVA, 50-Hz, 11-kV, 3-φ, Y-connected alternator when supplying 100 A at zero p.f. leading has a line-to-line voltage of 12,370 V; when the load is removed, the terminal voltage falls down to 11,000 V. Predict the regulation of the alternator when supplying full-load at 0.8 p.f. lag. Assume an effective resistance of 0.4 Ω per phase.

(8) The following test results are obtained on a 6,600-V alternator:

Open-circuit voltage:	3,100	4,900	6,600	7,500	8,300
Field current (amps):	16	25	37.5	50	70

A field current of 20 A is found necessary to circulate full-load current on short-circuit of the armature. Calculate by (i) the ampere-turn method and (ii) the synchronous impedance method the full-load regulation at 0.8 p.f. (lag). Neglect resistance and leakage reactance. State the drawbacks of each of these methods.

(9) An 11-kV، 1000-kVA, 3-phase, Y-connected alternator has a resistance of 2 Ω per phase. The open-circuit and full-load zero power factor characteristics are given below. Find the voltage regulation of the alternator for full-load current at 0.8 p.f. lagging by Potier method.

Field current (A)	:	*40*	*50*	*110*	*140*	*180*
O.C.C. line voltage	:	*5,800*	*7,000*	*12,500*	*13,750*	*15,000*
Line volts zero p.f.		*0*	*1500*	*8500*	*10,500*	*12,500*

(10) The following figures give the open-circuit and full-load zero p.f saturation curves for a 15,000-kVA. 11,000 V, 3-φ, 50-Hz, star-connected turbo-alternator:

Field AT in 10^3	: 10	18	24	30	40	45	50
O.C. line kV	: 4.9	8.4	10.1	11.5	12.8	13.3	13.65
Zero p.f. full-load line kV	: —	0	—	—	—	10.2	—

Find the armature reaction, the armature reactance and the synchronous reactance. Deduce the regulation for full-load at 0.8 power lagging.

(11) A 3-phase alternator has a direct-axis synchronous reactance of 0.7 p.u. and a quadrature axis synchronous reactance of 0.4 p.u. Draw the vector diagram for full-load 0.8 p.f. lagging and obtain therefrom (i) the load angle and (ii) the no-load per unit voltage.

(12) A 3-phase, Y-connected syn. generator supplies current of 10 A having phase angle of 20° lagging at 400 V. Find the load angle and the components of armature current I_d and I_q if $X_d = 10$ ohm and $X_q = 6.5$ ohm. Assume armature resistance to be negligible.

(13) Two alternators A and B operate in parallel and supply a load of 10 MW at ٠,٨ p.f. lagging.
(a) By adjusting steam supply of A, its power output is adjusted to 6,000 kW and by changing its excitation, its p.f. is adjusted to 0.92 lag. Find the p.f. of alternator B.
(b) If steam supply of both machines is left unchanged, but excitation of B is reduced so that its p.f. becomes 0.92 lead, find new p.f. of A.

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