(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2111 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) THEORY EXAMINATION 2011-12

ELECTROMECHANICAL ENERGY CONVERSION–II

Time : 3 Hours *Total Marks : 100*

Note :—All questions carry equal marks.

1. Answer any **four** parts of the following : **(5×4=20)**

   (a) Explain why 3-ϕ synchronous machines are always run at synchronous speed $\left(N_s = \frac{120\,f}{P} \right)$? The symbols having their usual meanings.

   (b) Explain why 3-ϕ synchronous machines are not self starting ? What are the methods for starting of the 3ϕ synchronous machines ?

   (c) Define the v-curves and inverted v-curves at different loading conditions of synchronous motors.

   (d) Discuss the constructional details and working principles of 3ϕ synchronous machines. Also mention its applications.

   (e) Explain why in case of 3 ϕ synchronous machines, the armature windings put on stator and field windings put on

rotor whereas in case of D.C. machines, the armature windings put on rotor and field windings put on stator poles ? Explain in brief.

(f) Write short notes on any **two** of the following :

(i) Mode of operations of synchronous motors.

(ii) Hunting Phenomena in 3 ϕ Synchronous motors.

(iii) Power Flow Equations of Cylindrical and Salient Pole Machines.

2. Answer any **two** parts of the following : **(10×2=20)**

(a) For a cylindrical rotor alternator working at lagging power factor, show that

$$\tan\delta = \frac{I_a\left(X_s\cos\theta - r_a\sin\theta\right)}{V_t + I_a\left(X_s\sin\theta + r_a\cos\theta\right)}$$

The symbols having their usual meanings.

(b) A 5 MVA, 11 kV, 50 Hz, 4-pole, star-connected synchronous generator with synchronous reactance of 0.7 p.u. is connected to an infinite bus. Find synchronizing power and the corresponding torque per unit of mechanical angle displacement —

(i) at no load and

(ii) at full load of 0.8. p.f. lagging.

(c) A 500 KVA, 11KV, 3-ϕ , star-connected alternators has the following data :

Friction and windage loss	=	1500 W
Open-circuit core loss	=	2500 W
Effective armature resistance/phase	=	40 Ω
Field copper loss	=	1000 W

Find the following parts in regarding with above synchronous alternators :

(i) Alternator efficiency of half-full load and at 0.85 power factor lagging.

(ii) Maximum efficiency of the alternator.

3. Answer any **two** parts of the following : **(10×2=20)**

(a) What are the similarities and dissimilarities between "Three Phase Transformers" and "Three Phase Induction Machines" ? Explain why a 3-ϕ IM can't runs at synchronous speed $\left(N_s = \frac{120\,f}{P}\right)$, symbols having their usual meanings ? Also explain the phenomena such as "Cogging" and "Crawling" associated with a 3 ϕ IM.