MOI UNIVERSITY

UNIVERSITY EXAMINATIONS 2008/2009

THIRD YEAR,SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF

BACHELOR OF ENGINEERING
IN
ELECTRICAL &COMMUNICATIONS ENGINEERING

COURSE CODE: ECE 362
COURSE TITLE:ELECTRICAL MACHINES II
TIME:3 HRS

INSTRUCTIONS TO CANDIDATES

ATTEMPT ANY FIVE OF THE FOLLOWING SEVEN QUESTIONS.

QUESTION ONE

1(a)Explain the advantages of having stationary armature and rotating field system in a synchronous generators?

(6 MRKS)

(b)(i)Define the terms *pitch factor(k_c)* and *distribution factor(k_d)* as applied to the armature windigs of an alternator. ***(2 MRKS)***

(ii)Find the value of k_d for an alternator with 9 slots per pole for the following cases:one winding in all the slots,one winding using only the first 2/3 of the slots per pole and three equal windings placed sequentially in 60° group. ***(3 MRKS)***

(c)What are the advantages of the using salient pole rotor over cylindrical rotor in alternators. ***(3 MRKS)***

QUESTION TWO

2(a)Derive from the first principles the equation of induced E.M.F in armature windings of an alternator. ***(5 MRKS)***

(b) A 60-Kva 220V,50-Hz single phase alternator has effective armature resistance of 0.016Ω and an armature leakage reactance of 0.07Ω.Calculate the voltage induced in the armature when the alternator is delivering rated current at a load power factor of;

(i)Unity
(ii) 0.7 lagging
(iii) 0.7 leading

(6 MRKS)

(c)What are the advantages of using fractional-pitch coils in the armature of an alternator. ***(3 MRKS)***

QUESTION THREE

3(a)(i) What are the causes of changes in voltage in Alternators when loaded?

(3 MRKS)

(ii)What is armature reaction in alternators. Clearly draw the phasor diagram of an alternator depicting the effect of armature reaction when the power factor of the load is leading. ***(2 MRKS)***

(b)The open and short-circuit test readings for a 3-phase,star-connected,1000-kva,2000v,50Hz,alternator are as below:

Field Amps	10	20	25	30	40	50
O.C Terminal V	800	1500	1760	2000	2400	3800
S.C Armature current (A)		250	300	360		

The effective armature resistance is 0.2Ω per phase. Draw the characteristic curves and estimate the full-load percentage regulation using Ampere-turn method at 0.8 p.f lagging and 0.8p.f leading. ***(9 MRKS)***

QUESTION FOUR

4(a)(i)What is *an infinite bus-bar*? ***(1 MRKS)***

(ii)Outline the conditions to be met before an alternator is connected to grid. ***(3 MRKS)***

(b)((i)With the help of vector diagrams give a detailed outline on how two alternators can be synchronized using the three lamps method. ***(8 MRKS)***

(ii)Give two disadvantages of using the three-lamps method. ***(2 MRKS)***

QUESTION FIVE

5(a)With the help of a clearly drawn and labeled phasor diagram derive an expression of the power developed by a salient pole synchronous generator. ***(6 MRKS)***

7 (a)With the help of diagrams describe the three lamps method of synchronizing three phase alternators. ***(5 MRKS)***

(b) A 3 phase wye connected synchronous generator supplies current of 10 A having phase angle of 20° lagging at 400V.Find the load angle and the components of armature current (d-axis and q-axis) if Xd = 10Ω and Xq = 6.5Ω.Assume armature resistance to be negligible. ***(4MRKS)***

(c) Give a brief comparison between synchronous motors and induction motors. ***(5 MRKS)***

(b)A synchronous motor absorbing 60Kw is connected in parallel with a factory load of 240Kw having a lagging power factor of 0.8 .If the combined load has a p.f of 0.9,what is the value of the leading Kvar supplied by the motor and what p.f is it working? ***(4 MRKS)***

(c)Briefly describe the procedure used in starting a synchronous motor. ***(4 MRKS)***

QUESTION SEVEN