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Reg. No. : .....

Name : .....

Fifth Semester B.Tech. Degree Examination, November 2014
(2008 Scheme)
08.505 : ELECTRICAL MACHINES – II (E)

Time : 3 Hours Max. Marks : 100

Instruction : *Answer **all** questions from Part – **A** and **one full** question from **each** Module of Part – **B**.*

PART – A

1. Define synchronous speed. Derive an expression for it.

2. A 3 phase star connected alternator on open circuit is required to generate a voltage of 3600 V, 50 hz when driven at 500 r.p.m. The stator has 3 slots /pole/ phase and 10 conductors /slot.

   Calculate :
   i) The number of Poles
   ii) The useful flux per pole.

   Assume winding is full pitched.

3. Explain the effect of second harmonics and third harmonics in the generated emf of a 3 phase alternator.

4. Why synchronous machines are designed to have high reactance and low resistance ?

5. An Oscillogram for a step test on a star connected 3 phase, 2.5 KVA, 220 V, 50 hz, 1000 rpm alternator shows the following results (r.m.s. values) Max : line voltage – 200 V Minimum line voltage – 180 V Max line current – 90 Amp Minimum line current – 55 amp. Calculate X_d and X_q in per unit values.

6. Draw the phasor diagram of an alternator based on Blondels two reaction theory when it delivers power to
   i) a lagging p.f. load and
   ii) leading p.f. load

P.T.O.

7. A plant takes 400 kW at 11 kV 3 phase 50 hz at 0.75 p.f. lag. Determine the rating of a synchronous condensor to be connected to bring the power factor to unity.

8. Draw the power Vs Power angle diagram of a synchronous machine and explain.

9. What are $\vee$ and $\wedge$ curves of a synchronous machine ?

10. A synchronous motor is not self starting. Why ? **(10×4=40 Marks)**

PART – B

Module – I

11. Draw the developed winding diagram of a 3 phase 21 slot 4 pole double layer lap wound armature. **20**

OR

12. a) With relevant diagrams explain the constructional features and principle of operation of a salient pole alternator. **10**

    b) Explain the effect of armature mmf on main pole mmf when an alternator is operating at
    i) lagging power factor
    ii) Unity power factor. Also state the reason of accounting the effect of armature reaction as a fictitious reactance X_a in calculations. **10**

Module – II

13. a) Define regulation. What are the different methods for determining regulation ? Explain any one method. **10**

    b) A 220 V 50 hz 6 pole star connected alternator has a resistance of 0.05 ohm per phase. It gave the following data for open circuit, short circuit and full load zero power factor characteristics.

Field Current (Amps)	0.2	0.6	0.8	1.2	1.4	1.8	2.2	2.6	3.4
O.C. voltage per phase (V)	17	50	67	99	112	134	151	164	179
Short circuit current (A)	6.6	20	26.5	40	46.3	59	–	–	–
Zpf voltage per phase (V)	–	–	–	0	17	51	81	102	133

Determine

i) Short Circuit Ratio of the machine

ii) Leakage reactance per phase

iii) Mmf required to overcome the effect of armature reaction. 10

OR

14. a) What is Synchronizing Power ? Explain its significance in alternator operation. Derive an expression for the same. 10

b) A 5 MVA, 10 KV, 1500 rpm, 50 hz alternator runs in parallel with other machines its synchronous reactance is 15% find

1) no load

2) full load synchronsing power per unit mechanical degree of displacement of 0.8 p.f. lagging. Also calculate the synchronising torque if the mechanical displacement is 0.5°. 10

Module – III

15. a) Derive an expression for the mechanical power developed in a cylindrical rotor synchronous motor. 8

b) A 1500 kW 3 phase star connected 3.3 kV synchronous motor has reactances of Xd = 4.01 and Xq = 2.88 Ω /phase. Neglect losses. Calculate the excitation emf when motor is supplying rated load at u.p.f. Calculate the maximum mechanical power that the motor can supply with constant excitation. 12

OR

16. Write short notes on

1) Electrical and Mechanical load diagram.

2) Hunting in Synchronous machines.

3) Natural frequency of Oscillations.

4) Brushless alternator. 20