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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(EE) (Sem.-5)

## SYNCHRONOUS MACHINES

Subject Code : BTEE-501 M.Code : 70554

Time : 3 Hrs.

Max. Marks : 60

### INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

### SECTION-A

1. Answer briefly :

a) Why is the field of an alternator wound on rotor?

b) Define :

- i) Pitch factor and            ii)

Distribution factor.

c) Define synchronous impedance. Why is it called so?

d) Why voltage regulation of an alternator is negative for leading power factor?

e) Why an alternator with low value of SCR has lower stability?

f) How the synchronous motor can be used as synchronous condenser?

g) Explain the role of damper windings in synchronous motor.

h) What are the conditions for parallel operation of alternators?

i) Explain the terms 'synchronizing power' and 'synchronizing torque'.

j) Differentiate transient and sub-transient reactances.

SECTION-B

2. Explain the problems associated with slot harmonics. How can they be reduced?
3. Derive emf equation of an alternator.
4. Explain the slip test method for the measurement of  $X_d$  and  $X_q$ .
5. Explain effects of varying excitation on armature current and power factor in synchronous motors. Draw 'V' curves.
6. An alternator is connected to an infinite bus and is running at no load. Briefly, explain how to increase its real and reactive power outputs.

SECTION-C

7. A 3-phase star-connected synchronous generator is rated at 1.5 MVA, 11 kV. The armature effective resistance and synchronous reactance are  $1.2 \Omega$  and  $25 \Omega$  respectively per phase. Calculate the percentage voltage regulation for a load of 1.4375 MVA at (a) 0.8 pf lagging and (b) 0.8 pf leading. Also find out the pf at which the regulation becomes zero.
8. A 3.5 MVA, slow speed, 3-phase synchronous generator rated at 6.6 kV has 32 poles. Its direct and quadrature axis synchronous reactances are  $9.6 \Omega$  and  $6 \Omega$  respectively. Neglecting armature resistance, determine the regulation and excitation emf needed to maintain 6.6 kV at the terminals when supplying a load of 2.5 MW at 0.8 pf lagging. What maximum power can generator supply at the rated terminal voltage, if the field becomes open-circuited?
9. Two identical 3-phase alternators running in parallel supply total demand of 1500 kW at 11 kV and 0.867 pf lagging. Each alternator supplies half the demand and has a synchronous reactance of  $50 \Omega$  per phase and resistance of  $4 \Omega$  per phase. The field excitation of the first alternator is so adjusted that its armature current is 50 A lagging. Determine the armature current of the second alternator and the generated voltage of the first alternator.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.

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