

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2083 Baishakh

Exam.	Back (New Course)		
Level	BE	Full Marks	30
Programme	BEL	Pass Marks	12
Year / Part	II / II	Time	3 hrs.

Subject: - Electrical Machines II (ENEE 253)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
 - ✓ Attempt All questions.
 - ✓ All question carry equal marks.
 - ✓ Assume suitable data if necessary.
1. With neat sketch, explain about constructional features of synchronous machine. Discuss different types of rotor and their applications.
 2. Define pitch factor and distribution factor, derive the EMF equation of an alternator.
 3. A 3 phase, star connected alternator with $R = 0.4\Omega$ and $x = 6\Omega$ per phase delivers 300A at power factor 0.8 to constant frequency 10 kV busbars. If the steam supply is unchanged, find the percentage change in the induced emf necessary to raise the power factor to unity. Ignore the change in losses.
 4. Explain the power capability curve of a synchronous alternator. What are its main components?
 5. A 300V, 1.5 MW, 3 phase synchronous motor has $X_d=4\Omega/\text{phase}$ and $X_q=3\Omega/\text{phase}$, neglecting all losses, calculate the excitation emf when motor supplies rated load at unity power factor. Calculate the maximum mechanical power which the motor would develop for this field excitation.
 6. What is hunting in synchronous machines? Explain in details and how they reduced.
 7. Illustrate the concept of d axis and q axis in synchronous machine. Why dq0 plane in synchronous machine is needed?
 8. A 250W, 230V, 50 Hz capacitor start motor has following impedances at standstill, $Z_m = 7+j5\Omega$ and $Z_a = 11.5+j5\Omega$. Find the value of the capacitor to be connected in series with the auxiliary winding to give a quadrant phase displacement between the currents in two windings. Draw the circuit and phasor diagram for motor.
 9. Derive the torque equation of permanent magnet BLDC motor. And also explain torque-speed characteristics of the same motor.
 10. Discuss the construction and working principle of switched reluctance motor.

TRIBHUVAN UNIVERSITY
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2082 Bhadra

Exam.	Regular (New Course)	
Level	BE	Full Marks 30
Programme	BEL	Pass Marks 12
Year / Part	II / II	Time 3 hrs.

Subject: - Electrical Machines II (ENEE 253)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Describe the constructional details of 3 ϕ synchronous machine. [3]
2. What do mean by armature reaction? How does armature reaction vary in a synchronous generator when supplying loads at different power factors? [3]
3. Two station generators A and B operate in parallel. Station capacity of A is 50 MW and that of B is 25 MW. Full load speed regulation of station A is 3% and B is 3.5%. Calculate the load sharing if the connected load is 50 MW, no load frequency is 50 Hz. Comment on the answer. [3]
4. With the help of relevant curves and diagram, explain the Potier method for determining the voltage regulation of a synchronous generator. [4]
5. Define excitation system in synchronous motor. Explain briefly with neat phasor diagram about the effect of changing excitation with constant load in synchronous motor. [3]
6. A 3 phase, 100hp, 440V, star connected synchronous motor has a synchronous impedance per phase of $0.1 + j1\Omega$. The excitation and torque losses are 4 kW and may be assumed constant. Calculate the current, power factor and efficiency when operating at full load with an excitation equivalent to 400line volts. [3]
7. Write 3 advantages of abc to dq0 transformation. Prove that $I_{abc} = [T] i_{dq0}$ [3]
8. At starting, the windings of a 230 V, 50 Hz, split-phase induction motor have the following parameters: [3]

Main winding: $R = 4\Omega$; $X_1 = 7.5\Omega$
 Starting winding: $R = 7.5\Omega$; $X_1 = 4\Omega$
 Find

 - a) Current in the main winding
 - b) Current in the starting winding
 - c) Phase angle between I_s and I_m and
 - d) Line current and
 - e) Power factor of the motor.
9. Describe operating principle and characteristics of shaded pole single phase motor with necessary diagrams. [2]
10. What are the constructional features of brushless DC motor? How is it different from induction motor? State two applications of BLDC motor. [3]
