



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
[Central Technological Institute, Maharashtra State]
Matunga, Mumbai-400 019

SEMESTER EXAMINATION	ESE - May 2012	DATE OF EXAM	14 / 05 / 2012
SEMESTER & PROGRAM	SEM-IV, S. Y. B. Tech. (ELE)	TIME	01:30 to 04:30 PM
TIME ALLOWED	03 Hrs.	MARKS	100
COURSE (Course Code)	Electrical Machines – II (EE 0207)		

- Instructions
1. All questions (1 - 5) are compulsory and carry equal marks.
 2. Figures to the right indicate full marks.
 3. Assume suitable data wherever necessary.
 4. Support your answers with neat sketches wherever necessary.
 5. Answer all questions to the point.

- Q1. a) Discuss the nature of armature reaction flux in a salient pole synchronous machine in case armature current i) lags the excitation emf E_f by 90° ii) leads E_f by 90° iii) is in phase with E_f 8
- b) Draw and explain the phasor diagram of a round rotor alternator on open circuit and short circuit. Why short circuit characteristics is a straight line and the open circuit characteristics is a curve. 6
- c) Develop the equivalent circuit of a cylindrical rotor synchronous machine. 6
2. a) A 11 KV, 50Hz, Y connected cylindrical rotor alternator gave the following data on open circuit:
- | | | | | | | | | |
|------------|---|----|-----|----|----|----|------|------|
| I_f in A | 0 | 10 | 15 | 20 | 31 | 39 | 50 | 55 |
| E_f KV | 0 | 5 | 7.5 | 9 | 11 | 12 | 12.8 | 13.4 |
- An excitation of 20A was required to circulate full load current of 160A short circuit. For zero power factor test an excitation of 66A was required to circulate 1.25 times the full load current of 160A at 11KV. Estimate the voltage regulation at full load 0.8 p.f. lagging by z.p.f. method. Neglect armature resistance. 10
- b) From the equivalent circuit of a cylindrical rotor synchronous generator derive expressions for the power input and power output in terms of load angle, Z_s and excitation voltage etc. 5
- c) Describe the effect of varying excitation upon the armature current and p.f. of a synchronous motor when the input power to the motor is maintained constant. 5
- Q3. a) Explain steady state stability and transient stability limit of a synchronous machine How can it be improved? 8
- b) Why synchronous motors are not self starting? Explain the mechanism of starting a synchronous motor. 5
- c) Discuss the points of similarities and differences between a transformer and an induction motor. 7

- Q4 a) Justify the following statements for a 3-ph induction motor :
- i) Rotor leakage impedance at starting is different from its value at normal running conditions.
 - ii) Relative speed between stator field and rotor field is zero.
 - iii) Stator current rises as the shaft load is increased. 6
- b) A 3-ph, 6 pole squirrel cage induction motor is directly driven by the shaft of a 4 pole, 3-ph synchronous motor. If stators of both the machines are given a 50 Hz supply what frequencies are available at the slip rings of the induction motor? 5
- c) A 50 H.P. , 3-ph, 4 pole, 50 Hz induction motor has a full load efficiency of 85% the friction and windage losses are $1/3^{\text{rd}}$ of the no load losses and the rotor copper losses equal to the iron loss at full load. Find the full load speed. 5
- d) The maximum torque of a 3-ph induction motor is twice the full load torque and the starting torque is equal to the full load torque. Calculate the full load slip at which maximum torque occurs. 4
- Q5. a) What are the factors which govern the operating characteristics of poly-phase induction motor?
- OR**
- Show that the maximum internal torque developed by the poly-phase induction motor does depend on the rotor circuit resistance while the slip at which maximum torque occurs depends on the rotor circuit resistance. 8
- b) Write short note on stability of 3-ph induction motor. 5
- c) It is desired to install a 3-ph squirrel cage induction restricting the maximum line current drawn from a 400 V, 3-ph supply to 120 A. If the starting current is 6 times full load current, what is the maximum permissible full load KVA of the motor when
- (i) It is directly connected to the mains
 - (ii) It is connected through an auto transformer with a tapping of 66%
 - (iii) It is designed for use with star Y- Δ starter. 7

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