B.Tech.
(SEM V) THEORY EXAMINATION 2018-19
Electrical Machines II

Time: 3 Hours   **Total Marks: 70**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt all questions in brief.**   **2 x 7 = 14**
    a. What is a distributed winding and distributed factor?
    b. Write a short note on two phase rotating field.
    c. Draw V curve of 3 phase synchronous motor and state their significance.
    d. What is the capability curve of a synchronous generator?
    e. What do you mean by torque in synchronous watt?
    f. Explain how the rotor resistance starting of slip ring induction motor reduces starting current and increase starting torque.
    g. What is the role of compensating winding in universal motor?

SECTION B

2. **Attempt any three of the following:**   **7 x 3 = 21**
    a. The OCC of a 3 phase , 50 Hz synchronous machine is given by the following data;

Field current (Amp)	40	80	100	120	140	170	240
Voc (line)	1000	1900	2200	2450	2600	2750	3000

Under short circuit condition a field current of 40 A gives the full load stator current. The armature resistance and leakage reactance per phase are known to be 0.01 and 0.12 pu. When the machine is operating as motor drawing full load current at the rated terminal voltage of 3.3 kV and 0.8pf leading , calculate the field current required.

    b. Derive an expression for finding regulation of salient pole synchronous alternator using two reaction theory Draw its phasor diagram.
    c. Explain the procedure of no load and block rotor tests on a 3 phase induction motor. How are the parameters of equivalent circuit determined from test results.
    d. A three phase, wound rotor induction motor has a star connected rotor winding with a rotor resistance of 0.12 Ω/phase. With the slip rings shorted, the motor develops a rated torque at a slip of 0.04 and a line current of 100A. What external resistance must be inserted in each rotor phase to limit the starting current to 100A? What pu torque will be developed with rotor resistance starting.
    e. Explain revolving field theory of single phase induction motor.

SECTION C

3. **Attempt any one part of the following:**   **7 x 1 = 7**
    (a) Two 50 MVA, 3 phase alternator operate in parallel. The setting of governors are such that the rise in speed from full load to no load is 2% in one machine and 3 % in the other, the speed load characteristic being straight lines in both cases. If each machine is fully loaded, when the total load is 100 MW, What would be the load on each machine when the total load is 60W.
    (b) Explain power angle characteristic of the synchronous machine and describe the operation of synchronous machine at constant load with variable excitation.

4. **Attempt any one part of the following:** 7 x 1 = 7
   (a) A 1500 kVA, star connected, 2300 V, 3 phase salient pole synchronous generator has reactances $X_d = 1.95\Omega$ and $X_q = 1.40\ \Omega$ per phase . All losses may be neglected. Find the excitation voltage for operation at rated kVA and power factor of 0.85 lagging
   (b) Explain the effect of varying excitation on armature current and power factor in a synchronous motor also draw phasor diagram.

5. **Attempt any one part of the following:** 7 x 1 = 7
   (a) Develop the equivalent circuit for a 3 phase induction motor and explain how the mechanical power developed is taken care in the equivalent circuit.
   (b) A pole , 3 phase ,50 Hz induction motor is running at a speed of 710 rpm with an input power of 35 KW. The stator copper loss at this operating condition is known to be 1200W while the rotational losses are 600 W. Find (a) the rotor copper loss, (b) the gross torque developed, (c) the gross mechanical power developed, and (d) the net torque and mechanical power output.

6. **Attempt any one part of the following:** 7 x 1 = 7
   (a) A six pole 400V double cage induction motor has a delta connected primary winding of impedance $(1+2j)\ \Omega$ per phase. The corresponding referred impedances of the cages are $(2+j1)$ and $(1+j4)\ \Omega$ per phase. The full load slip is 5%. Determine the ratio of starting torque to full load torque for direct on line starting.
   (b) Explain pole amplitude modulation technique of speed control of 3 phase induction motor.

7. **Attempt any one part of the following:** 7 x 1 = 7
   (a) Develop the circuit model of brushless dc motor and its phasor diagram. And derive the equation of torque exerted by the motor
   (b) Explain the production of torque in repulsion motor.