Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec– 2019**

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| **Code :** | **17EE2004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **INDUCTION AND SYNCHRONOUS MACHINES** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q.**  **No.** | **Sub**  **Div.** | **Questions** | **Course**  **Outcome** | | **Marks** |
| 1. | a. | A 400V, 3-Phase, 50Hz, 4 Pole star connected induction motor takes a line current of10 A with 0.86 pf lagging. Its stator losses are 5% of the input. Rotor copper losses are 4% of the input to the rotor, and mechanical losses are 3% of the input of the rotor. Calculate:  (i) Slip and rotor speed  (ii) Torque developed in the rotor  (iii) Shaft-torque  (iv) Efficiency of the motor it draws 10A at 0.86 pf lagging. | CO1 | | 08 |
| b. | Write short notes on the following:  (i) Universal motor (ii) Hysteresis Motor | CO2 | | 12 |
| **(OR)** | | | | | |
| 2. | a. | Discuss the working principle of a single phase induction motor using double revolving field theory with torque equations. Mention its Applications. | CO2 | | 12 |
| b. | Draw the circle diagram from no-load and short circuit tests of a 3Phase,14.92kW, 400V, 6-pole induction motor from the following test results:  **No load :** 400V 11A pf = 0.2  **Short circuit :** 100V 25A pf = 0.4  Rotor copper loss at stand still in half the total copper losses from the diagrams find:  (i) Line current, Slip, Efficiency, power factor at full load.  (ii) Maximum Torque. | CO1 | | 08 |
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| 3. | a. | A 600V,60kVA,single phase alternator has an effective resistance of 0.2 Ω.A field current of 10A produces an armature current of 210 A on short circuit and an emf of 480V on open circuit. Find:  (i) Synchronous impedance and reactance.  (ii) Regulation with o.8 pf lagging, unity power factor  and 0.6 pf leading. | CO3 | | 12 |
|  | b. | Draw the suitable diagram and explain the working of Capacitor- start and Capacitor- run induction motor with relevant phasor diagram. | CO2 | | 08 |
| **(OR)** | | | | | |
| 4. | a. | Write short notes on the following:  Crawling and Cogging of a three phase induction motor. | | CO1 | 06 |
| b. | Explain the operation of salient pole synchronous machine with two reaction theory. | | CO4 | 10 |
| c. | What is meant by synchronization? What are the conditions to be met while synchronizing two alternators? | | CO3 | 04 |
| 5. | a. | The input to a 11,000V,3 phase star connected synchronous motor is 60 A. The effective resistance and synchronous reactance per phase are 1Ω and 30Ω respectively. Find:  (i) Power supplied to the motor.  (ii) Mechanical power developed.  (iii) Induced emf for a power factor of 0.8 pf leading. | | CO4 | 10 |
| b. | A 3-phase,16 pole alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03wb,sinusoidally distributed and the speed is 375 rpm. Find the frequency and phase induced emf. Assume full pitched coil. | | CO3 | 06 |
|  | c. | Derive the power output equation of synchronous motor. | | CO4 | 04 |
| **(OR)** | | | | | |
| 6. | a. | Develop the equivalent circuit of single phase induction motor. | | CO2 | 04 |
| b. | Derive the emf equation of an alternator | | CO3 | 04 |
| c. | Briefly explain about hunting and its suppression in a synchronous motor. | | CO4 | 06 |
|  | d. | Explain synchronous motor on load with constant excitation. | | CO4 | 06 |
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| 7. | a. | With relevant diagrams explain about the armature reaction in alternator. | | CO3 | 08 |
| b. | Write in detail how Xd and Xq is determined using slip test. | | CO3 | 12 |
| **(OR)** | | | | | |
| 8. | a. | Write short notes on the following:  (i) Pump for irrigation and sewage plants.  (ii) Hybrid electric vehicle. | | CO5 | 12 |
| b. | Draw the neat diagram and explain the principle and working of a PMSM. | | CO5 | 08 |
| **Compulsory:** | | | | | |
| 9. | a. | Draw power stages of a three phase induction motor and derive the relation betweenP2, Pc and Pm. | | CO1 | 06 |
| b. | Discuss about V curves and inverted V curves of a synchronous motor. Explain how to determine it with the help of an experimental setup. | | CO4 | 10 |
| c. | Write short notes on synchronous reluctance motor. | | CO2 | 04 |