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



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

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| **Code :** | **14EE2007** | **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. | Sketch the torque – slip characteristics of a three phase Induction motor for various rotor resistance. | CO1 | 4 |
| b. | Prove that the maximum torque of the motor depends on the value of slip and independent of rotor resistance. Discuss the influence of rotor resistance on the starting torque of the motor. | CO1 | 10 |
| c. | Discuss the effect of Stator Voltage and frequency on the speed of three phase Induction motor. | CO1 | 6 |
| **(OR)** | | | | |
| 2. |  | Draw the circle diagram for a 20hp, 415 V, 50 Hz, 4 pole, 3 ϕ delta connected induction motor from the following test data:  No-load test : Line Voltage 415V, Line current 9 A, cos() = 0.2,  Blocked rotor: Line voltage 200 V, Line current 50 A, cos() = 0.4  Estimate from the diagram for full-load condition, line current, power factor and also maximum torque in-terms of full-load torque.The rotor Cu loss at standstill is half the total Cu loss. | CO1 | 20 |
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| 3. | a. | ‘A Single Phase Induction Motor is not a self starting motor’ – Justify the statement using Double Field Revolving Theory. | CO2 | 10 |
| b. | Derive the torque equation of a single phase induction motor. Draw the torque-slip curve also. | CO2 | 8 |
| c. | Draw the equivalent circuit of a Single Induction Motor. | CO2 | 2 |
| **(OR)** | | | | |
| 4. | a. | Discuss the construction, working of a Variable Reluctance Stepper Motor. Brief the operation in One Phase ON and Two Phase ON. | CO2 | 14 |
| b. | List the applications of a Stepper Motor. | CO2 | 03 |
| c. | Define Resolution and Step Angle. | CO2 | 03 |
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| 5. | a. | Compare Salient Pole Alternator and Non-salient Pole Alternator. | CO2 | 04 |
| b. | Derive the EMF equation of an alternator. | CO2 | 06 |
| c. | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | A 11MVA, 2.2kV, three phase Alternator gave the following test results:   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Field Current (A) | 10 | 20 | 30 | 40 | 50 | | OC Voltage (kV) | 0.88 | 1.65 | 2.20 | 2.585 | 2.86 | | Short Circuit current (A) | 200 | 400 | - | - | - |   A field current of 30A is found to cause the full load current to flow through the winding during short circuit test. The effective resistance of the three phase winding is 0.22Ω/phase. Predetermine the full load voltage regulation at 0.8pf lag by (i) MMF method (ii) EMF Method. | | CO2 | 10 |
| **(OR)** | | | | |
| 6. | a. | Discuss any two methods of synchronization of alternators. | CO3 | 08 |
| b. | Derive the expression of Synchronizing Power and Synchronizing Torque of a three phase alternator. | CO3 | 12 |
|  |  |  |  |  |
| 7. | a. | Discuss the working of a three phase Synchronous motor. Write notes on the methods of starting the synchronous motor. | CO2 | 10 |
| b. | Derive the expression for power developed in a three phase Synchronous Motor. | CO2 | 10 |
| **(OR)** | | | | |
| 8. | a. | Discuss the phenomena of hunting in Synchronous Machines and methods adopted to minimize the effect of hunting. | CO2 | 06 |
| b. | Discuss how a Synchronous motor can be used as a Power factor correcting device. | CO2 | 14 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Discuss the laboratory procedure for obtaining the direct-axis and quadrature -axis synchronous reactances of a Salient Pole Synchronous machine. | CO3 | 16 |
| b. | Sketch the power angle curve of a Salient Pole Synchronous machine. | CO3 | 02 |
| c. | List the advantages of Salient Pole Synchronous machine. | CO3 | 02 |