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

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**End Semester Examination – Nov/Dec– 2018**

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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. | Explain clearly how a rotating magnetic field is setup around the stator of a 3-phase induction motor when a 3-phase supply is given to it. | CO1 | 8 |
| b. | A 2-pole, 3-phase induction motor runs at 2910 rpm on a 50 Hz supply. Find the frequency of rotor emf. | CO1 | 6 |
| c. | Draw the power stages diagram of a 3-phase induction motor. | CO1 | 6 |
| (OR) | | | | |
| 2. | a. | Develop an approximate equivalent circuit for a 3-phase induction motor. | CO2 | 8 |
| b. | The rotor resistance and standstill reactance per phase of a 6-pole, 50 Hz, 3-phase induction motor are 0.001 Ω and 0.005 Ω respectively. Determine the speed at which maximum torque is obtained. | CO2 | 6 |
| c. | Explain braking by plugging for a 3-phase induction motor. | CO2 | 6 |
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| 3. | a. | Using double revolving field theory, explain why a single-phase induction motor is not self-starting. | CO1 | 10 |
| b. | A single-phase induction motor delivers an output of 250 W at 5 % slip. Its mechanical and rotor copper losses are 15 W and 35 W respectively. Find (i) the total torque developed (ii) torque developed in forward direction and (iii) torque developed in backward direction. | CO1 | 7 |
| c. | What will be the direction of rotation of a shaded-pole induction motor? | CO1 | 3 |
| (OR) | | | | |
| 4. | a. | What are the disadvantages of single-phase induction motor compared to 3-phase induction motor? | CO1 | 4 |
| b. | Explain the constructional features and operation of a capacitor-start single-phase induction motor. | CO1 | 8 |
| c. | A 250 W, 230 V, 50 Hz, single-phase capacitor-start induction motor has the following constants for its main and starting windings: ; . Determine the value of the starting capacitor that will place the main and staring winding currents in quadrature at starting. | CO1 | 8 |
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| 5. | a. | Explain why a stationary armature type of construction is preferred for alternators. | CO2 | 8 |
| b. | A 4-pole AC machine has a 3-phase winding wound in 36 slots with coil-span of electrical. Compute (i) the pitch factor  (ii) distribution factor and (iii) winding factor. | CO3 | 6 |
| c. | Mention the factors that govern the sharing of load between two alternators operating in parallel. | CO2 | 6 |
| (OR) | | | | |
| 6. | a. | Describe with diagram the effect of armature reaction when an alternator delivering a load current at purely lagging power factor. | CO1 | 7 |
| b. | A 50 kVA, 415 V, 50 Hz, star-connected alternator has an effective resistance of 0.2 Ω per phase. A field current of 8 A causes an emf of 415 V on open circuit and a current of 185 A on short-circuit. Calculate the full-load voltage regulation at 0.8 lagging p.f. | CO1 | 6 |
| c. | Describe any one method of synchronizing alternators. | CO1 | 7 |
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| 7. | a. | Mention the characteristic features of synchronous motors. | CO1 | 4 |
| b. | Show that the starting torque of a synchronous motor is zero. | CO2 | 8 |
| c. | A 2.2 kV, 3-phase star-connected synchronous motor has a resistance of 0.6 Ω and a synchronous reactance of 6 Ω. Find the generated emf and the angular retardation of the rotor when the input is 200 kW at UPF. | CO1 | 8 |
| (OR) | | | | |
| 8. | a. | Draw the torque-angle characteristic of a synchronous motor. | CO2 | 4 |
| b. | Explain what is meant by V-curves. | CO2 | 8 |
| c. | Explain the phenomena of hunting in synchronous motors and the methods adopted to minimize the effect of hunting. | CO1 | 8 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Mention the advantages of salient-pole machines. | CO1 | 4 |
| b. | Explain the terms direct-axis and quadrature-axis reactances of an alternator. | CO3 | 8 |
| c. | A 415 V, 3-phase, star-connected synchronous motor with and is operating on indefinite bus-bars. If its field current is reduced to zero, find the maximum power the motor can develop. | CO3 | 8 |