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



**End Semester Examination – Nov/Dec– 2017**

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| **Code :** | **14EE2009** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ELECTRICAL MACHINE DESIGN** | **Max. marks :** | **100** |

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

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | Derive the output equation of a DC and AC Machine. | CO1 | 20 |
| (OR) | | | | |
| 2. | a. | Obtain the relationship between real and apparent flux density in the slots of rotating machine. | CO1 | 10 |
| b. | Calculate the apparent flux density at a section of the teeth of an armature of a DC machine from the following data at that section: slot pitch = 30 mm, slot width = tooth width = 12 mm, length of armature core including 5 ducts of 10 mm each = 0.48, iron stacking factor = 0.92. True flux density in teeth at that section is 2.5Wb/m2 for which the mmf is 90000 AT/m. | CO1 | 10 |
| 3. |  | Find the main dimensions and the number of poles of a 37kW, 230V, 1400rpm Shunt motor so that a square pole face is obtained. The average gap density is 0.5wb/m2 and the ampere conductors per metre is 22000. The ratio of pole arc to pole pitch is 0.7 and the full load efficiency is 90%. | CO1 | 20 |
| (OR) | | | | |
| 4. |  | Determine the total commutator losses of a DC machine from the given data. Q = 500kW, 400V, 600rpm, 4 pole, diameter of the commutator = 0.9m, current density at brush contact = 68x10-3A/mm2, brush pressure = 13.8kN/m2, coefficient of friction = 0.28, brush contact drop = 1.9V. | CO1 | 20 |
| 5. | a. | Derive the output equation of single phase Transformer and three phase transformer. | CO2 | 14 |
|  | b. | Calculate the core and window areas required for a 1000kVA, 6600/400V, 50Hz Single phase Core type transformer. Assume a maximum flux density of 1.25wb/m2 and a current density of 2.5A/mm2. Voltage/turn = 30V. Window space factor = 0.32. | CO2 | 6 |
| (OR) | | | | |
| 6. |  | A 250kVA, 6600/400V, three phase core type transformer has a total loss of 4800W on full load. The transformer tank is 1.25m in height and 1mX0.5m in plan. Design a suitable scheme for cooling tubes if the average temperature rise is to be limited to 35◦C. The diameter of the tube is 50mm and are spaced 75mm from each other. The average height of the tube is 1.05m. | CO2 | 20 |
| 7. |  | Determine the D and L of a 70HP, 415V, three phase, 50Hz, star connected, 6 pole induction motor for which ac = 30000 ampereconductor/m and Bav = 0.51wb/m2. Take efficiency = 90% and pf = 0.91. Assume τ = L. Estimate the number of stator conductors required for a winding in which the conductors are connected in two parallel paths. Choose a suitable number of conductors/slots so that the slot loading does not exceed 750ampere conductors. | CO3 | 20 |
| (OR) | | | | |
| 8. |  | Design a cage rotor for a 40HP, three phase, 400V, 50Hz, 6 pole, delta connected induction motor having a full load efficiency of 87% and full load pf of 0.85. Take D = 33cm and L = 17cm. Stator slots = 54. Conductors/slot = 14. | CO3 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | The following is the design data available for a 1250kVA, three phase, 50Hz, 3300V, star connected, 300rpm alternator of salient pole type: Stator bore diameter = 19m,stator core length L = 0.335m, pole arc/pole pitch = 0.66; turns per phase = 150; single layer concentric winding with 5 conductors per slot, short circuit ratio = 1.2. Assume that the distribution of gap flux is rectangular under the pole arc with zero values in the inter polar region. Calculate: i. specific magnetic loading ii. armature mmf per pole iii. gap density over pole arc iv. air gap length. MMF required for air gap is 0.88 times of no load field MMF and the gap contraction factor is 1.15. | CO3 | 20 |

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