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| GUJARAT TECHNOLOGICAL UNIVERSITY<br>ME – SEMESTER II– EXAMINATION – WINTER - 2016 |            |   |          |
|---|------------|---|----------|
| Su  | ıbject     | Code: 2720715 Date: 18/11/ 20   | )16      |
| Subject Name: Electrical Machine Modeling and Analysis                            |            |   |          |
| Ti  | me: 2      | 2:30 pm to 5:00 pm Total Marks:   | 70       |
| Instructions:   |            |   |          |
|   | 1.<br>2.   | Make suitable assumptions wherever necessary.   |          |
|   | 3.         | Figures to the right indicate full marks  |          |
| Q.1   | (a)        | Explain the modeling of electromechanical energy conversion that takes place in electromagnetic circuit.  | 07       |
|   | (b)        | Define energy and co-energy in an electromechanical energy conversion. Derive<br>the expression for the field energy in terms of system variables.                                      | 07       |
| Q.2   | (a)        | Derive winding inductances and voltage equations for Synchronous machine.<br>Mention assumptions made for derivation.   | 07       |
|   | <b>(b)</b> | Analysis the steady state operation of synchronous machine.<br><b>OR</b>  | 07       |
|   | (b)        | Discuss the need of dynamic modeling of IM, the necessary assumptions and approximations. Also discuss the shortcoming of the IM dynamic model from view point of losses                | 07       |
| Q.3   | <b>(a)</b> | Explain dynamic performance of a induction during the sudden change in input torque.  | 07       |
|   | <b>(b)</b> | Derive the torque equation in machine variables of PMBLDC machine.<br>OR  | 07       |
| Q.3   | <b>(a)</b> | Explain the significance of reference frame theory, discuss various frames of references thus used and transformation between different refence frames                                  | 07       |
|   | (b)        | Derive the torque equation a three phase IM in synchronously rotating reference frame   | 07       |
| Q.4   | <b>(a)</b> | Obtain the expression of torque for a three phase dynamic model of IM in terms of stator and rotor Flux Linkages in stationary reference frame  | 07       |
|   | <b>(b)</b> | Derive voltage equations for Synchronous machine in rotor reference frame. <b>OR</b>  | 07       |
| Q.4   | (a)        | Analysis the Synchronous machine performance when a three phase fault occurs at the machine terminals using dynamic model   | 07       |
|   | <b>(b)</b> | Derive the per unit model of induction motor using stator and rotor flux linkages   | 07       |
| Q.5   | (a)<br>(b) | Derive the torque equation in machine variables for a synchronous machine<br>Explain the performance of synchronous machine during sudden change in load<br>torque using dynamic model. | 07<br>07 |
| Q.5   | (a)<br>(b) | Explain in brief the procedure of linearization of machine equations<br>Derive the voltage and Torque equation in rotor reference frame variable of BLDC<br>Machine.                    | 07<br>07 |

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