Sr. No 518102

January 2023

B.Tech./M.Tech./ B.Sc./M.Sc./BBA/MBA/MCA/BCA- I SEMESTER

Modeling and Analysis of Electrical Machines (MPED-102)

Time: 3 Hours **Max. Marks:75**

Instructions:
1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Any other specific instructions*

PART -A

Q1 (a) Define the concept of virtual work. (1.5)

(b) Differentiate between symmetrical and asymmetrical induction machines (1.5)

(c) Define the term speed voltage and how much is its value for a stationary reference frame. (1.5)

(d) Give various examples of singe-excited and doubly excited electromechanical energy conversion devices. (1.5)

(e) Does a BLDC machine advantageous or not, comment? (1.5)

(f) For a 4-pole, 3-phase star connected salient-pole synchronous machine, write the air gap MMF expression for as, bs and cs winding. (1.5)

(g) List various advantages and disadvantages of Permanent magnet synchronous machines as compared to dc machines (1.5)

(h) What is the purpose of using the concept of equations of transformation (change of variables) for the analysis of ac machines? (1.5)

(i) Enumerate various types of reference frames (1.5)

(j) Define co-energy and give its physical significance (1.5)

PART –B

Q2 (a) For an electromagnetic system, derive the expression for the mechanical work done during the instantaneous movement of the armature from open position to the closed position. (8)

(b) With the aid of the block diagram, explain the principle of Electromechanical energy conversion (7)

Q3 (a) Explain the need of equations of transformation (change of variables). Discuss different equations of transformations suggested by D.S Brereton et.al, R.H Park and H.C Stanley. (8)

(b) If fas = -cost
fbs = (½)t
fcs= sint
Determine fqs, fds and fos. (7)

Q4 (a) Derive an expression or the air-gap MMF of winding as using the developed diagram of a 2-pole, 3-phase, Wye-connected Salient-Pole synchronous machine. (10)

(b) Derive the expression for speed currents in case of capacitive elements. (5)

Q5 (a) Derive the necessary equations required for the computer simulation of a symmetrical 3-phase Induction machine in the arbitrary reference frame. Also draw the block diagram illustrating the computer representation of these equations. (8)

(b) Derive the equations of transformation for the rotor circuit. (7)

Q6 (a) Explain the construction and working of the Sinusoidal Interior Permanent Magnet Machine (IPM). Also, draw its equivalent circuit. (8)

(b) Describe the construction and working of a BLDC motor. (7)

Q7 Write short notes on the followings (any two) (7.5)+(7.5)

(a) Switched Reluctance Motors

(b) Doubly excited system

(c) Unsymmetrical 2-phase induction machine

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