

CS/M.TECH(EE)/SEM-1/MPS-038/2011-12

## 2011

## ADVANCED TOPICS OF ELECTRICAL MACHINES

Time Allotted : 3 Hours
Full Marks : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

## Answer any five questions. $\quad 5 \times 14=70$

1. a) Describe with schematic diagram the generalised machine of the first kind.

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b) Develop of impedance matrix of the generalised machine of the first kind acting in generator mode rotating in clock-wise direction.8
2. a) Write down the rotation matrix. Show that operating on a row or column matrix, the rotation matrix rotates the same by $90^{\circ}$.
b) Show that the torque matrix of the generalised machine of the first kind is $90^{\circ}$ out of space with respect to the inductance matrix under certain assumptions. 8
c) State the assumptions made in the above case. 2
3. Find the connection matrix transforming the stationary $d-q$ axes to stationary real axes reference frame in generalised theory of electrical machine.
4. a) Develop the impedance matrix of a d rotating in clock-wise direction.

b) Hence determine the expressions of shunt field and armature currents in transient and steady state conditions.

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c) Suggest an experimental method of finding the speed inductance of a d.c. shunt motor. 4
5. a) Develop the impedance matrix of a repulsion motor. 4
b) Derive the steady state performance equations of the same.

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c) Find the expression of real torque of the same machine.

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6. "The division of a voltage vector into induced and generated voltages is a relative concept that depends entirely on the reference frame. A certain voltage vector may be entirely induced or entirely generated voltage or partly induced and partly generated depending on the relative velocities of the reference frame, the fluxes and the conductors. However, the sum of the induced and generated voltages is a constant no matter whatever may be the reference frame selected." Explain the statement developing the equation of voltage along the general rotating axes.
7. a) Develop the Maxwell's equation of voltage in holonomic reference frame.
b) Develop the equation of torque of the first generalised machine from that of the second generalised machine.

