Course: Electric Drives I	**Code:** EE424	**Semester:** 2nd 2014/2015
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Sheet (2)
DC Motor Classic Control

Q.1

A 1 hp, dc shunt motor is loaded by a constant torque of 10 Nm. The armature resistance of the motor is 5 Ω, and the field constant $K\phi = 2.5$ V sec. The motor is driven by a half-wave SCR converter. The power source is 120 V, 60 Hz. The triggering angle of the converter is 60°, and the conduction period is 150°. Calculate the motor speed and the developed power.

Q.2

For the motor in   Question 1   assume that the converter is a full-wave type. The triggering angle of the converter is 60°, and the conduction period is 150°. Calculate the motor speed and the developed power delivered to the load.

Q.3

The power amplifier which supplies the motor is a single-phase fully controlled rectifier bridge which has a voltage drop of 2.5 V. The input to the bridge is 115 V a.c.r.m.s, at 50 Hz and the transformer has a leakage inductance of 2 mH. Calculate the bridge firing-delay angle which will produce a load acceleration of 5 rad/s z when the load speed is 15 rad/s. The load is now a frictional (constant) torque of 30 Nm but the total inertia referred to the load shaft is still 10 kgm2, with a gear ratio of 10:1, and kϕ=0.54.

Q.4

A d.c. motor is supplied from a three-phase power system at 415 V r.m.s, line-to-line via a dual fully controlled bridge converter system which has 4V device voltage drop. The motor armature resistance is 0.2 fl and supply inductance may be neglected. Find the firing angles and d.c. machine e.m.f.s for the following conditions:

(a) Machine motoring from converter 1 at 100A and a terminal voltage of 500V.

(b) Machine regenerating through converter 2 at 100A and the same terminal voltage.
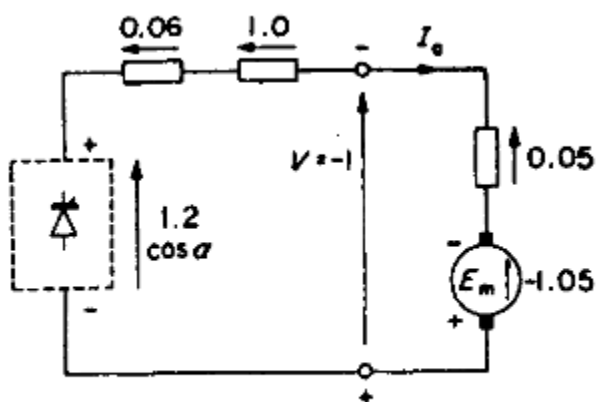
Q.5

   Determine, for the following conditions, the appropriate firing angles and d.c. machine e.m.f.s for a d.c. machine/thyristor-bridge system for which Edo = 300 V, the bridge circuits absorb 15 V, including overlap voltage drop at rated motor current and the machine has a per-*unit* resistance of 0.05 based on its rated voltage of 250 V.
(a) Machine motoring at rated load current and with its terminal voltage at 250 V.
(b) Machine generating at rated load current and with its terminal volt:age at 250V.
(c) Machine plugging at rated load current and with its terminal voltage at 250 V.
(d) For condition (a), what would be the torque and speed if:
        (i) flux is at rated value?
        (ii) speed is 1.5 per *unit?*
(e) If the motor load for condition (a) is such that the torque is proportional to (speed)^2, what firing angle would be necessary to have the motor running at half speed with rated flux?
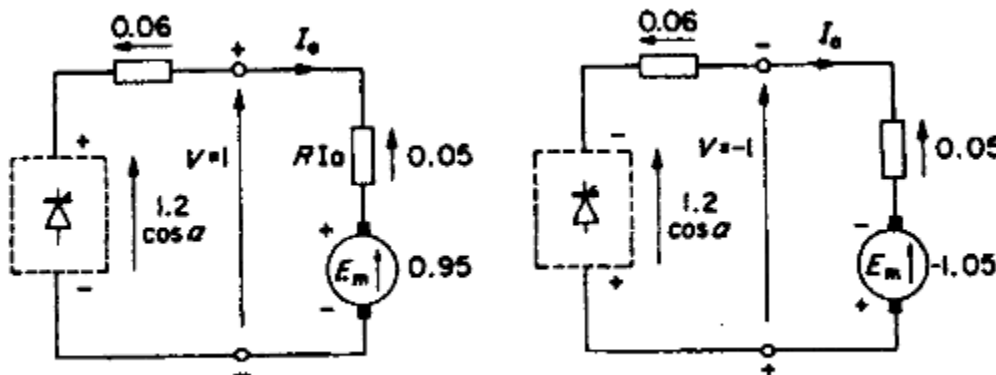
(a) Motoring

(b) Regenerating

(c) Plugging