Course: Electric Drives I **Code:** EE424 **Semester:** 2nd 2014/2015

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Sheet (3)

DC Motor PE Control

Q.1 (Kirshnan Ex2.1 P.24)

A separately-excited dc motor with the following parameters: $R_a = 0.5\ \Omega$, $L_a = 0.003$H, and $K_b = 0.8$ V/rad/sec, is driving a load of $J = 0.0167$ kg-m^2, $B_l = 0.01$ N·m/rad/sec with a load torque of 100 N·m. Its armature is connected to a dc supply voltage of 220 V and is given the rated field current. Find the speed of the motor.

A dc motor whose parameters are given in example 2.3 is started directly from a 220-V dc supply with no load. Find its starting speed response and the time taken to reach 100 rad/sec.

Q.2 (Kirshnan Ex3.1 P.40)

A separately-excited dc motor has the following ratings and constants:

2.625 hp., 120V, 1313 rpm, $R_a = 0.8\ \Omega$, $R_f = 100\ \Omega$, $K_b = 0.764$ V.s / rad, $L_a = 0.003$ H, $L_f = 2.2$ H

The dc supply voltage is variable from 0 to 120 V both to the field and armature, independently. Draw the torque–speed characteristics of the dc motor if the armature and field currents are not allowed to exceed their rated values. The rated flux is obtained when the field voltage is 120 V. Assume that the field voltage can be safely taken to a minimum of 12 V only.

Q.3 (Kirshnan Ex3.2 P.41)

Consider the dc motor given in Example 3.1, and draw the intermittent characteristics if the armature current is allowed to be 300% of rated value.

Q.4 (Kirshnan Ex3.3 P.61)

Consider a motor drive with $R_{an} = 0.1$ p.u., $\phi_{fn} = 1$ p.u., $V_n = 1.1$ p.u. and extreme load operating points $T_{e1(min)} = 0.1$ p.u., $\omega_{mn(min)} = \omega_{mn1} = 0.1$ p.u., $T_{e2(max)} = 1$ p.u., and $\omega_{mn(max)} = \omega_{mn2} = 1$ p.u.

(i) Find the normalized control voltages to meet these operating points.

(ii) Compute the change in control voltages required for a simultaneous change of $\Delta T_{en} = 0.02$ p.u. and $\Delta\omega_{mn} = 0.01$ p.u. for both the extreme operating points. From this, calculate the resolution required for the control voltage.