Registration no: | | | | | | | | | | |

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M.TECH
PEPC103

1st Semester Back Examination – 2016-17
ELECTRIC DRIVE - 1
BRANCH(S): Power Electronics & Drives
Time: 3 Hours
Max marks: 70
Q.CODE:Y894

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

a) Give an example, where electric drive is operated at rated torque and zero speed.
b) What are the characteristics of active load? How does it differ from passive load?
c) A single phase uncontrolled rectifier is feeding a resistive load. Draw the input and output current waveform with a common reference axis.
d) A motor having moment of Inertia J_o is connected to the load having moment of inertia J_m through a set of gear having a teeth ratio N_1 : N_2. Calculate the equivalent Moment of Inertia referred to the load side.
e) Derive the normalized torque equation for a chopper controlled dc motor drive.
f) Draw the circuit diagram for a voltage-controlled induction motor drive.
g) How regenerative braking can be applied to an Induction Motor drive?
h) Draw the output voltage, armature current and supply current waveform of the first quadrant operation of chopper circuit feeding the armature of a separately excited dc motor drive.
i) A 3-phase fully controlled rectifier is feeding a resistive load. Draw the output phase and line voltage with a common reference axis.
j) Draw the gating pulses for a three-phase thyrister converter fed to a resistive load.

Q2 a) Determine the stable operating speed of a three phase Induction Motor drive for (i) constant torque load and (ii) Fan load torque. (5)
b) Give an example of a mechanical load, where torque is negative but speed is positive. Justify. (5)

Q3 a) Derive the expression for normalized torque of the three phase converter controlled by the DC motor drive in steady state. (5)
b) Consider a motor drive with R_{an}=0.1p.u, ϕ_{fn}=1 p.u, V_n=1.1 p.u. and extreme load operating point $T_{e1(min)}$ = 0.1 p.u., $w_{mn(min)}$ =0.1 p.u., $T_{e2(max)}$ =1 p.u., and $w_{mn(max)}$ =w_{mn2}=1p.u. Find the normalized control voltage to meet these operating points. (5)

Q4 Derive the output current equation for a chopper controlled dc motor drive in (10)

just-continuous conduction mode.

Q5 a) Explain with the suitable block diagram the control circuitry for a four quadrant dc motor drive. (5)

b) A dc motor is driven from a chopper with a source voltage of 24V dc and at a frequency of 1kHz. Determine the variation in duty cycle required to have a speed variation of 0 and 1 p.u. delivering a constant 2 p.u. load. The motor details are as follows (5)
1hp, 10V, 2500rpm, 78.5% efficiency, Ra=0.01Ω, La=0.003H, Kb=0.038V/rad/sec.
The chopper is one-quadrant, and the on-state drop voltage across the device is assumed to be 1V regardless of the current variation.

Q6 a) Explain with a suitable block diagram, how to decouple the inner current loop from the dc motor-inherent induced-emf loop. (5)

b) Explain the working of a unipolar sinusoidal pulse width modulated –VSI feeding an induction motor drive for a modulation index = 1 and modulating frequency = 7. (5)

Q7 a) Derive the output current equation of a 3-phase converter feeding a dc motor drive in steady state. Neglect the commutation effect. (5)

b) Explain the speed control of 3-phase Induction motor drive using constant volts/Hz control. (5)

Q8 Answer any two. (5 x 2)

a) Slip-power recovery scheme.

b) Variable frequency VSI Drives

c) Efficient braking in an Induction motor drive.