

$$(i) \quad \frac{a}{(s+b)^2 + a^2}$$

$$(ii) \quad \frac{a}{s^2 + w^2} \quad (2)$$

4[a] Find the diagonal system that is similar to following system.
Use diagonalization technique.

$$\dot{X} = \begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix} X + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u$$

$$Y = [2 \ 3] X \quad (2)$$

[b] Determine the controllability and observability of the system described by the state equation. Find out the transfer function and draw the block diagram.

$$\dot{X}(t) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} X(t) + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u(t)$$

$$y(t) = [1 \ 0 \ 2] X(t) \quad (3)$$

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EIGHTH SEMESTER

B.E. (EE)

MID SEMESTER EXAMINATION **MARCH 2005**

EE-411/412 CONTROL SYSTEM

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.
Assume suitable missing data, if any.

- 1[a] For a system represented by the state equation $\dot{X}(t) = A X(t)$
the response of $X(t) = \begin{bmatrix} e^{-2t} \\ -2e^{-2t} \end{bmatrix}$ when $X(0) = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$ and
 $X(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix}$ when $X(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$
Determine the system matrix A and the state transition matrix.
(4)
- [b] Drive the state model for a separately excited dc motor with
armature voltage control.
(3)
- 2[a] Find the response $x(k)$ of the following system :
 $x(k+2) - 3x(k+1) + 2x(k) = u(k)$
where $x(k) = 0$ for $k \leq 0$
 $U(k) = 1$ for $k \geq 0$
 $U(k) = 0$ for $k < 0$.
(3)
- [b] Find the initial and final value of sequence $x(k)$ for above
system.
(2)
- 3[a] Find Z transform of Discrete ramp function.
(1)
- [b] Find the Z-domain transfer function of the following S-domain
transfer functions

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EIGHTH SEMESTER

B.E. (EE)

MID SEMESTER EXAMINATION **MARCH**

2005

EE-411/412 ELECTRIC TRACTION & DRIVES

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Attempt **ALL** questions.
Answer Q. No. **FIVE** on the format provided.
Assume suitable missing data, if any.

1. Explain in brief why? 5
 - [a] Induction motors are suitable most for fan loads.
 - [b] Regenerative braking can not be achieved for semi converter fed DC drive.
 - [c] For intermittent duty loads, load equalization (by fly wheel) provides efficient solution.
 - [d] Switching frequency varies for modulation of pulse width under constant band hysteresis current control.
 - [e] Loss of energy during breaking by plugging is more than dynamic braking of DC motors.
2. A 500V, 45 kW, 600 rpm DC shunt motor has full load efficiency of 90%. The field resistance is 200Ω and armature resistance is 0.2Ω . The field current is maintained constant. Armature reaction & brush drop may be neglected. Calculate the rated armature current and hence, find the speed under following conditions at which the m/c develops and electromagnetic torque equal to rated value. 4
 - [a] Plugging : external resistance of 5.5Ω inserted
 - [b] Dynamic Breaking: external resistance of 2.6Ω connected

3. A small separately excited DC motor is supplied by a single phase semi converter. The input supply is 240 V, 50 Hz. The thyristors are fired at 110° and armature current continuous to flow for 50° beyond the zero voltage. Determine the motor speed at a torque of 1.8 Nm. Given the motor torque characteristics as 1.0 Nm/A and its armature resistance is 6Ω . Neglect all switching & conduction losses of the converter. Also draw a neat diagram for terminal voltage & armature current. 4

4. For four quadrant speed torque curve of motor & load given in Fig.1 indicate the path for fastest

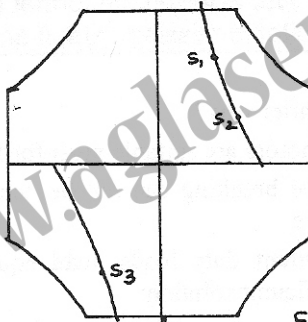


Fig.1.

- (i) speed reversal (S_1 - S_3)
 - (ii) speed increase from S_2 - S_1
 - (iii) speed decrease from S_1 - S_2
- under full converter for all conditions & semi converter for conditions (ii) & (iii). 3

5. Draw a neat diagram of voltage & current waveform for a separately excited DC motor feed from three phase thyristor converter bridge for all modes of motoring & braking operation. Given. $E = 280V$ and $V = 23V$. 4

- (i) Firing angle $\alpha = 90^\circ$, $\beta = 60^\circ$ (for discontinuous conduction) Motoring
- (ii) Firing angle $\alpha = 210^\circ$, $\beta = 180^\circ$ (for discontinuous conduction) Braking.

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EIGHTH SEMESTER

B.E. (EE)

MID SEMESTER EXAMINATION **MARCH 2005**

EE-411/412 POWER SYSTEM STABILITY

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.
Assume suitable missing data, if any.

- 1[a] Distinguish between steady state, transient and dynamic stability. Derive power angle equation. Define transfer reactance. (3)
- [b] A 100 MVA, 11 kV, 16 pole, 50 Hz water wheel generator has an inertia constant of 3 MJ/MVA (a) Find the stored energy in the rotor at synchronous speed. (b) The machine is operating at a load of 50 MW when the load suddenly increases to 80 MW. Find the rotor retardation. Neglect losses. (c) The rotor retardation is maintained for 5 cycles. Find the change in power angle during this period. (4)
- 2[a] Starting from the first principles, derive the swing equation of a synchronous machine. Define inertia constant. (3)
- [b] A 50 Hz generator of reactance 0.8 p.u is connected to an infinite bus through a line of 0.4 p.u reactance. $E = 1.05$ p.u, $V = 1.0$ p.u. The inertia constant is 4 MJ/MVA. The generator is loaded to 70% of maximum power limit. Find the frequency of natural oscillations. (4)
- 3[a] Explain the concept of equal area criterion. How can it be used to study transient stability. (3)
- [b] Discuss the role of FACTS Technology in improving power system stability. (3)

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EIGHTH SEMESTER

B.E. (EE)

MID SEMESTER EXAMINATION **MARCH 2005**

EE-413 HIGH VOLTAGE ENGINEERING

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.
Assume suitable missing data, if any.

- 1 Show graphically the relation between the breakdown voltage of a gas and the gas pressure for a uniform field with a constant electrode separation. Give the physical explanation of the curve. (3)
- 2 Is there any anomaly between the Townsend's and streamer mechanisms? Show that the later is a transition from the former. (3)
- 3 Explain why the impulse breakdown voltage is higher than the power frequency breakdown voltage for a gaseous gap subjected to a uniform field. (3)
- 4 What do you mean by 'back-flash over' and what is the role of counter poise wires to prevent it. (3)
- 5 Explain what is meant by insulation co-ordination. How are the protective devices chosen for optimal insulation level in a power system? (4)
- 6 A 132 kV transmission line having a surge impedance of 450 ohm terminates at a 7.5 MVA, 132/33 kV transformer which may be represented by a lumped inductor of 15 H and lumped capacitance of 0.003 μ F in parallel. A rectangular surge of 1500 kV travels along the line towards the transformer. Calculate the refracted voltage into the transformer when the incident wave reaches the transformer terminals. (4)