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B TECH
(SEM IV) THEORY EXAMINATION 2017-18
ELECTRICAL MACHINES AND CONTROLS

MM.-70

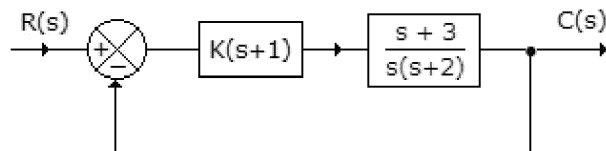
TIME: 3:00HRS

SECTION A

Q.1-Attempt all the question: -

(2*7=14)

- a) Write down the equation for frequency of emf induced in an Alternator.
- b) Why are Alternators rated in kVA and not in kW?
- c) What is meant by armature reaction in Alternators?
- d) What is meant by synchronous impedance of an Alternator?
- e) Name the various methods for predetermining the voltage regulation of 3-phase Alternator.
- f) What are different types of Control Systems?
- g) For the system in the given figure the characteristic equation is



SECTION B

Q.2- Attempt any three questions

(7*3=21)

- a) A 10 KVA, 200/400 V, 50 Hz, single phase transformer gave the following test results:
Open circuit test from L.V. side: 200 V, 1.3 A, 120 W
Short circuit test from H.V. side: 22 V, 30 A, 200 W
 - i. Draw the equivalent circuit of the transformer referred to H.V. side.
 - ii. The efficiency of the transformer at 90% loading with load 0.8 power factor.
- a) What is an autotransformer? State its merits and demerits over two winding transformer. An 1100/2200 V single phase transformer is rated at 1000KVA; if the two winding are connected in series to form an autotransformer determine its voltage and power.
- b) Why is starter necessary for starting of a dc motor? Explain briefly working of 3-point starter. A 220 V d.c. shunt motor having an armature resistance of 0.25Ω carries an armature current of 50 A and runs at 600 r.p.m. if the flux is reduced by 1% by field regulator, find the speed of motor, assuming the torque to remain same.
- c) Derive the equation for the torque developed by a 3-phase induction motor. Draw a typical torque-slip curve and deduce the condition for maximum torque.
- d) Determine the voltage regulation of 3-phase, star connected alternator of terminal voltage $2000\sqrt{3}$ Volt producing a current of 100 A at
 - (i) 0.8 load p.f. lagging
 - (ii) 0.707 p.f. leading

The full load current of 100 A is produced on short-circuit test on a field excitation of 2.5 Amp. An emf of 500 V is generated on open circuit test on the same excitation current of 2.5 Amp. (Given $R_a = 0.8 \Omega$)

SECTION C

Q.3- Attempt any one questions

(7*1=7)

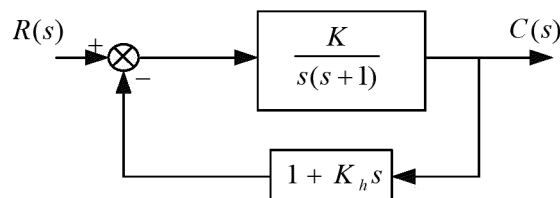
- a) What is two-phase servomotor? Draw its torque-speed characteristics for various control voltages.
- b) A unity feedback control system $G(s) = \frac{K(s+1)(s+2)}{(s+0.1)(s-1)}$ has an open loop transfer function.

Using the Routh stability criterion, determine the range of value of K for which the close loop system has 0, 1 or 2 poles in the right half of s-plane.

Q.4- Attempt any one questions

(7*1=7)

- a) For the system shown below, determine the values of gain K and velocity feedback constant K_h so that the maximum overshoot is 0.2 and the peak time is 1 sec. With the obtained values of K and K_h , obtained the rise time and settling time.

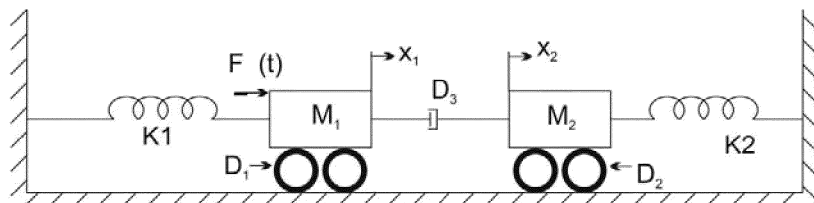


- b) Differentiate between open loop and closed loop system with suitable examples. What are the advantages of feed-back?

Q.5- Attempt any one questions

(7*1=7)

- a) Obtain the differential equation of the mechanical system and Sketch the mechanical equivalent representation for the system shown below.



- b) A unity feedback system has an open-loop transfer function

$$G(s) = \frac{K}{s(s^2 + 4s + 13)}$$

Sketch the root locus plot of the system determining the following:--

- (i) Centroid, number and angle of asymptotes.
- (ii) Break away point if any
- (iii) The value of K and the frequency at which the root locus cross the $j\omega$ -axis.
- (iv) Angle of departure of root locus from the poles

Q.6- Attempt any one questions

(7*1=7)

- a) Discuss the affect of following controllers on the second order control system:
 - (i) PI controller
 - (ii) PD controller
 - (iii) Rate-feedback controller.

- b) Consider the system with the following open loop Transfer function

$$G(S) = \frac{K}{S(T_1 S + 1)(T_2 S + 1)}$$

Determine stability of system using Nyquist Criterion for

- i) the gain K is small.
- ii) The gain K is large

Q.7- Attempt any one questions

(7*1=7)

- a) Draw the Bode plot for the transfer function

$$G(s) = \frac{75(1 + 0.2s)}{s(s^2 + 16s + 100)}$$

- (i) Gain cross over frequency
 - (ii) Phase cross over frequency
 - (iii) Gain Margin and Phase margin
 - (iv) Stability of the given system
- b) Determine the resonant frequency ω_r , resonant peak M_p and Bandwidth of system whose T.F is given by

$$\frac{C(S)}{K(S)} = \frac{5}{S^2 + 2S + 1}$$

