Printed Pages: 03 **Sub Code: REE409**
Paper Id: 120416 **Roll No.**

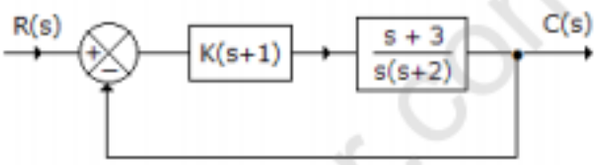
B TECH
(SEM IV) THEORY EXAMINATION 2017-18
ELECTRICAL MACHINES AND CONTROLS

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 testfrom 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 0.25 Ω 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.

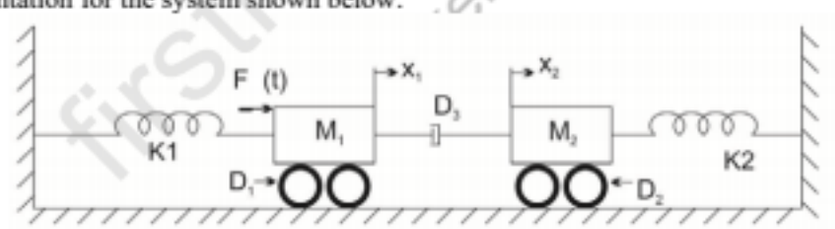
Q.4- Attempt any one questions **(7*1=7)**

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 jω-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 NyquistCriterian 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 wr, resonant peak Mp and Bandwidth of system whose T.F is given by

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