**Printed Pages : 4**

**EEE409**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : **140401**

Roll No. | | | | | | | | | | |

# B. Tech.

## (SEM. IV) THEORY EXAMINATION, 2014-15

## ELECTRICAL MACHINES & AUTOMATIC CONTROL

Time : **3** Hours] [Total Marks : **100**

Note: (i) Attempt all questions.
(ii) All question carry equal marks.
(iii) Be precise in your answer.

### Section - A

Attempt any two parts of the following: (10x2=20)

(a) A 12 kVA, 220/440V, 50Hz, 1-phase transformer gave the following test data.

No Load: 220V, 2A, 16.5W (LV side)

SC Test: 12V, 15A, 60W (HV side)

Draw the equivalent circuit as referred to LV side and insert the appropriate values. Find voltage regulation and secondary terminal voltage on full load at 0.8 pf. lagging.

(b) What is an Auto-Transformer? Derive expression for copper saving in auto transformer comparison to two winding transformer of same voltage ratio.A 2200/220V, 20kVA, two winding transformer is connected as an auto transformer to transform 2200 V to 2420V. Find currents in various parts of the winding.

(c) Why is starter necessary for starting a D.C. motor? Explain briefly working principle of a 3-point starter with schematic diagram.

A 220V D.C. shunt motor having an armature resistance of 0.25 Ω carries an armature current of 50A and runs at 600 rpm if the flux is reduced by 1% by field regulator, find the speed of motor, assuming the torque to remain same.

## Section - B

Attempt any Two of the following: (10×2=20)

(a) What is a two phase servomotor? Explain its construction and one application of servomechanism in detail. Draw its speed torque characteristics for various control voltages.

(b) Draw the phasor diagrams of an alternator at unity, lagging, leading power factor. Also write notes on synchronous condenser.

(c) A 400V, 4 poles, 3phase, 50Hz induction motor has a rotor resistance and reactance per phase of 0.01 Ω and 0.1 Ω respectively. Determine:

i) Maximum torque in N-m &the corresponding slip.

ii) The full load slip and power output in Watts, if the maximum torque is twice the full load torque and the ratio of stator to rotor turns 4.

## Section - C

Attempt any four parts of the following: (5×4=20)

(a) Compare the open loop and closed loop control system.

(b) Develop the differential equation model for mechanical system shown in fig. 1

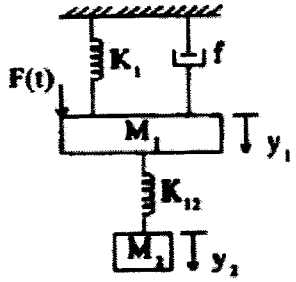


Figure - 1

(c) Find out the transfer function of the network shown in fig. 2.

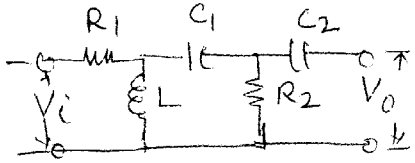


Figure - 2

(d) Write the mathematical expression and draw the characteristics for input test signals (unit step. unit parabolic unit impulse).

(e) Define F-V and F-I analogy for translational mechanical system with suitable example.

(f) Explain position error and velocity error constant & their significance.

## Section - D

Attempt any two parts of the following: (10×2=20)

(a) A unity feedback control system is characterized by an open loop transfer function

$$G(S) = \frac{K}{s(s^2 + s + 1)(s + 4)}$$ Find the range of K for the system to be stable. Also find steady state error for unit step, ramp and parabolic input signal

(b) The open loop transfer function of unity feedback system is given by

$$G(s) = \frac{K}{s(1+sT)}$$

Where, K and T are positive constants. By what factor should the amplifier gain be reduced so that the peak overshoot of unit step response of the system is reduced from 75% to 25%?

(c) Draw polar plot and check stability for the open loop transfer function of a unity feedback control system given below

$$G(s) = \frac{K}{s(s+1)(s+3)}$$

## Section - E

Attempt any two parts of the following: (10×2=20)

(a) The open loop transfer function of a control system is given by

$$G(s).H(s) = \frac{K}{s(s+6)(s^2+4s+13)}$$

Sketch the root locus and determine the breakaway point, the angle of departure from complex poles and stability condition.

(b) Write short notes on proportional control action, integral control action and derivative control action.

(c) Draw the bode plot for a feedback system with

$$G(s).H(s) = \frac{100(s+4)}{s(s+0.5)(s+10)}$$

Find: i) Gain Margin
ii) Phase margin
iii) Gain cross over frequency
iv) Phase cross over frequency.