Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Fourth Semester B. Tech. (Instrumentation)

Summer – 2016

Course Code: INU403

Course Name: Control System Components

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

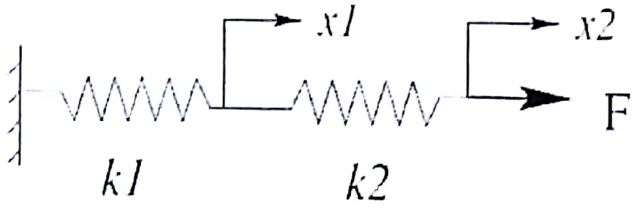
1. Attempt Any FIVE (05X04) 20

a) State working principle of DC servomotor in brief. Describe following characteristics for DC series servomotors: **04**
   i. Torque-current characteristics
   ii. Speed-armature current characteristics
   iii. Torque-speed characteristics

b) What factors should be considered while selecting a Control Valve. State the difference between installed and inherent valve characteristics. **04**

c) Describe function of Hydraulic power supply using hydraulic relief valve **04**

d) Obtain the equivalent stiffness for the following spring networks. **04**



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e) Describe application of synchro pair as an error detector in brief. 04

f) State classification of relays. Describe in brief construction and working of Electromechanical relay. 04

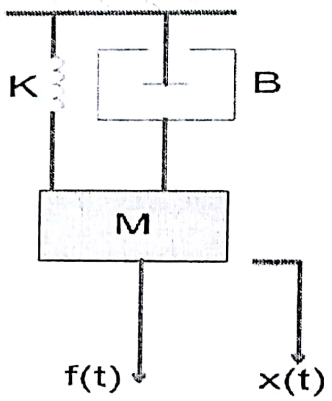
g) State classification of compressors used to compress pneumatic power. Describe construction and working of Centrifugal compressor in brief. 04

2. **Attempt any TWO (02X02)**

a) What is tachometer? State characteristic requirements of Tachogenerator in brief. 02

b) State working principle of Synchros. Describe types of stator core in brief. 02

c) Find the transfer function of the mechanical translational system given in below Figure. 02



d) State applications of stepper motor in Instrumentation field. Describe any one in brief. 02

3. **Attempt Any TWO (06X02)** 12

a) What is gyroscope effect? Describe construction and principle of operation of gyroscope with equation of motion. 06

b) A 2 inch globe valve is allowed a pressure drop of 64 psi when carrying water. How many gallons/minute of oil (specific gravity 0.8, kinematic viscosity 0.82) will it pass and what is the expected pressure drop? The kinematic viscosity of water is 0.93. 06

Table 1: Typical C_v Values for 2 in. Valves

Type	C_v
Angle Valve	64.0
Ball Check Valve	154.5
Ball Valve (Full Port)	228
Ball Valve (Standard Port)	120
Butterfly Valve	145
Coaxial Valve	154.5
Cone Poppet Check Valve	166
Flat Poppet Check Valve	133
Gate Valve	210
Globe Valve	44.34
Pinch Valve	181
Plug, Taper Valve	70
Swing Check Valve	138.2
Y-Valve	
45° Angle	72.0
60° Angle	70.8

c) Describe construction and working of variable reluctance stepper motor in brief. **06**

4. a) What are basic characteristics we have to consider in case of using long hydraulic transmission lines? **03**

b) Describe following terms with respect to control valve: **04**

i. Fail-open
ii. Fail-closed
iii. Fail-safe
iv. Flow-coefficient(Cv)

Contd..

c) **Fill in the blanks:** **05**

i. If a force is acting on rigid body through center of mass in a given direction, the acceleration of rigid body in same direction is..... proportional to the force acting on it and is .....proportional to the mass of body.

ii. Pneumatically operated valves depend on a ..... to take an input signal from a process controller and convert it to valve travel.

iii. Compressibility results in non-positive and non-linear response in .....systems

iv. Gyroscope works on the.....principle.

v. ..... is the condition that occurs in liquid flow where the internal pressure of the liquid, at some point falls below vapour pressure and vapour bubbles form at some other point downstream rises above the vapour pressure again.

5. a) Derive Transfer Function of Field Controlled DC Servomotor. **08**

b) Convert following Electrical Circuit shown in figure below to Mechanical 1 form **04**