**M. TECH.-II (MECHANICAL CAD/CAM) (CBCS – 2015 COURSE) : SUMMER - 2018**

**SUBJECT : CONTROL SYSTEMS**

Day : **Wednesday** | **S-2018-3011** | Time : **11.00 AM TO 02.00 PM**

Date : **13/06/2018** | Max. Marks : 60

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**N.B.**

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in **SEPARATE** answer books.
4) Draw neat and labelled diagram **WHEREVER** necessary.
5) Use of non-programmable calculator is **ALLOWED**.
6) Assume suitable data, in necessary.

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## SECTION – I

**Q. 1** Derive a system differential equation and obtain transfer function for the system shown in fig. 1. The displacement of mass is "y" and the input displacement is "x". **(10)**

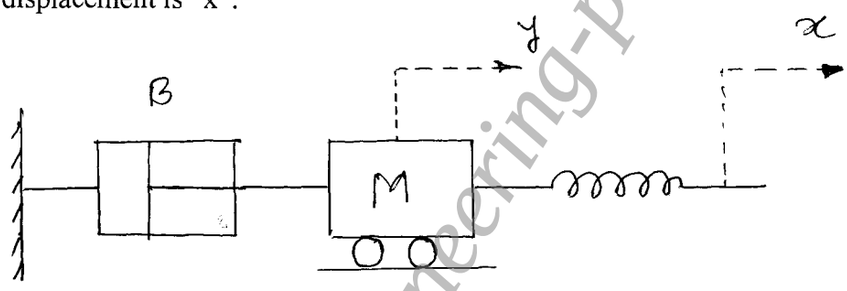


Fig. Simple second order system

**OR**

Draw and explain the block diagram of a closed loop system with controllers. Also compare different control actions with merits and demerits of it. **(10)**

**Q. 2** What is the need of time response analysis of any control system? Explain the terminology associated with time domain analysis. **(10)**

**OR**

Derive the expression representing the output response of a second order system with input as a free response. **(10)**

**Q. 3** Using Routh-Hurwitz's criteria, find stability of the system whose characteristic equation is given by: **(10)**

$$F(s) = s^8 + 5s^6 + 2s^4 + 3s^2 + 1 = 0.$$

**OR**

Differentiate between absolute stability and relative stability of a control system. **(10)**

**P. T. O.**

## SECTION - II

**Q. 4** Write a note on Nyquist plots stability in frequency domain. **(10)**

**OR**

Define frequency response of a system. Draw some typical frequency response curves of various systems. **(10)**

**Q. 5** Explain the state space representation using phase variables. State its advantages and limitation's. **(10)**

**OR**

Find the controllability and observability of the system described by the state equation **(10)**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x.$$

**Q. 6** Differentiate between synchros and encoders. Also state applications of each in control systems. **(10)**

**OR**

Write a short notes on : **(10)**

**a)** Phase portrait

**b)** Singular points

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