University	:	*Menoufia*	*Date*	:	*30/3/2019*
Faculty	:	*Electronic Engineering*	*Time*	:	*1 hour*
Academic year	:	*3rd Year*	*No. of pages*	:	*1*
Course Name	:	*Nonlinear Control Systems*	*No. of Questions*	:	*2*
Course Code	:	*ACE 321*	*Full Mark*	:	*30 Marks*
Department	:	*Industrial Electronics & Control Eng.*	*Exam*	:	*Midterm*
			Examiner	:	*Dr. H. Shohla*

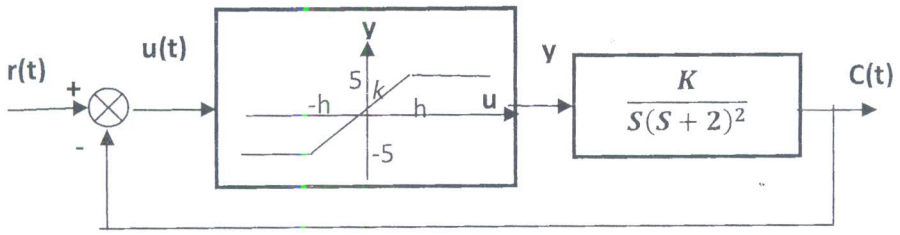
Name : *Acd no :* *Sec :*

Answer all the following questions:

Question no (1) : *(20 Marks)*

For the system shown in Fig. ,

- Determine the ***describing function*** N of the saturation element shown in Fig. *(10 Marks)*
- Determine the value of the ***gain K*** of the linear element required for oscillation with magnitude $U = 8$, and corresponding frequency where $k = 1$ is the slope of the saturation, $h = 5$, , and u is the amplitude of the input signal. *(10 Marks)*



Question no (2) : *(10 Marks)*

For a system described by the following differential equation,

$$\ddot{X} + 2\zeta\omega\dot{X} + \omega^2 X = 0$$

Sketck handly the phase trajectory, for values of ζ equal to 0, 0.4 and 3. Using the solving of the differential equation with initial condition (2, 0).