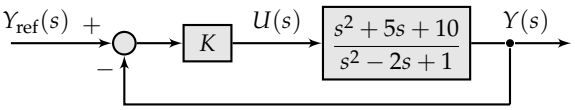
Student's Name: **Roll No.:**

GNU Octave Quiz EE 250 (Control System Analysis) Spring 2011 *

DEPARTMENT OF ELECTRICAL ENGINEERING, IIT KANPUR.

1. In the following, XYZ is your roll number.
2. Wherever a file with the extension .jpg is required, the file must be in the JPEG format.
3. Create on the desktop of your PC a folder named `EE250-Octave-Quiz-XYZ` and save into it the .jpg files and m-files that you will be required to create in this test.

1. Consider the control system



with $K \in [0, +\infty)$.

1.1. **[1 points]** Draw the appropriate Nyquist plot that will help you evaluate the stability of this control system.

1.2. **[1 points]** Display this Nyquist plot between the limits $x_{\min} = -10, x_{\max} = +15, y_{\min} = -10, y_{\max} = +10$.

1.3. **[1 points]** Is this control system conditionally stable? If yes, write `conditionally stable` beginning the location $x = 5$ and $y = 0$ on the figure. If no, write `Not conditionally stable` beginning the location $x = 5$ and $y = -2$.

1.4. **[1 points]** Give this Nyquist plot a heading that contains the following information separated by the forward slash character ("/"):

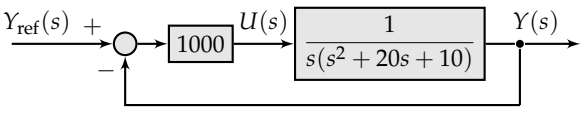
1.4.1. The code that helped you implement parts 1.1 and 1.2.

1.4.2. Your full name and roll number.

1.5. **[1 points]** Write to location $(5, -4)$ on this figure the command that will print this figure (including all the information written on to it thus far) to a file named `EE250-Octave-Part1-XYZ.jpg`.

Print the figure generated thus far to a file named `EE250-Octave-Part1-XYZ.jpg`.

2. Consider the control system



2.1. **[1 points]** Draw the appropriate Bode plot that will help you evaluate the stability of this control system.

2.2. **[1 points]** Determine the gain margin (GM) in dB and phase margin (PM) in degrees. On this figure, write the following information separated by the forward slash character ("/"):

2.2.1. The code that helped you implement part 2.1 (beginning the coordinates $x = 0.1, y = -200$),

2.2.2. The GM and the PM with the correct units (beginning the coordinates $x = 0.1, y = -220$),

2.2.3. Your full name and roll number (beginning the coordinates $x = 0.1, y = -240$).

Print the figure generated thus far to a file named `EE250-Octave-Part2-XYZ.jpg`.

3. **[2 points]** Generate the Bode plot of the transfer function $(s + 10)/(s + 1)$ on a 10-cycle semilog grid.

Provide to the x-axis a label that contains the following information separated by the forward slash character ("/"):

3.1. The code that helped you implement the required generation.

3.2. Your full name and roll number.

Print this figure to a file named `EE250-Octave-Part3-XYZ.jpg`.

4. **[5 points]** Write an m-file named `steppy.m` that will perform the following tasks in the order shown:

4.1. Generates the unit step response of the transfer function $1/\left(s^2 + 2\zeta\omega_n s + {\omega_n}^2\right)$.

4.2. Determines the peak of this step response and labels it `zeta = 0.6`.

The x-coordinate of this peak must be the time instant at which the peak occurs, and the y-coordinate must be the value of the peak.

4.3. Labels the x-axis `t` and the y-axis `y`.

4.4. Generates a grid.

4.5. Gives the figure a heading that contains your full name followed by a "/" followed by your roll number.

4.6. Prints this figure to a .jpg file named `EE250-Octave-Part4-XYZ.jpg`.

4.7. Contains a 2-line space after the part of the code that performs each of the above 5 tasks.

5. **[6 points]** Write an m-file named `sine.m` that will perform the following tasks in the order shown:

5.1. Converts the transfer function $Y(s)/U(s) = (s + 1)/\left(s^2 + s + 3s\right)$ of a certain system into state space form.

5.2. Uses Euler's approximation with step size 0.01 to compute the response of this system to a sinusoid of magnitude 1 and frequency 10 rad/s (can assume initial zero initial conditions).

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5.3. Plots $y(t)$ versus t with a grid, gives the figure a heading that contains your full name followed by a "/" followed by your roll number, and prints this figure to a .jpg file named `EE250-Octave-Part5-XYZ.jpg`.

You have thus far saved the 5 figure files and the 2 m-files that you generated above in the folder named `EE250-Octave-Quiz-XYZ`. Compress this folder into `EE250-Octave-Quiz-XYZ.zip`, and e-mail it to all the following e-mail IDs in only one e-mail:

`shiladri@iitk.ac.in, snaidu@iitk.ac.in,`

`gsnraju@iitk.ac.in, potluri@iitk.ac.in`