UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Control system Engineering, GNEG 274   **Semester: IV**
Program: B.Tech PSE
Time: 03 hrs.   **Max. Marks: 100**

Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Differentiate the transfer function and state space approach for a system.	5	CO2
Q 2	Define the role of PD controller cascaded with plant transfer function in terms of stability and steady state error.	5	CO3
Q 3	Describe the gain margin and phase margin from sinusoidal response of system.	5	CO2
Q 4	Derive the transfer function representation from the generalized state space model.	5	CO5

SECTION B

Q 5	The forward path transfer function of a unity feedback control system is given by: $$G(s)=\frac{K(s+2)}{s^3+\beta s^2+4s+1}$$ Determine the value of K and β such that the system exhibits sustained oscillations having a frequency of 4.0 rad/sec.	10	CO1, 2
Q 6	The overall transfer function of a unity feedback control system is given by $$G(s)=\frac{10}{s^2+6s+10}$$ Find (a) K_p, K_v and K_a (b) Determine the steady state error if the input is $\qquad$ r(t) = 1 + t +t^2	10	CO2,3
Q`7	The following facts are known about the linear system: $\dot{x}=Ax(t)$ If $x(0)=\begin{bmatrix}1\\-2\end{bmatrix}$, then $x(t)=\begin{bmatrix}e^{-2t}\\-2e^{-2t}\end{bmatrix}$ If $x(0)=\begin{bmatrix}1\\-1\end{bmatrix}$, then $x(t)=\begin{bmatrix}e^{-t}\\-e^{-t}\end{bmatrix}$	10	CO4,5

	Find e^{At}		
Q 8	Dynamic behavior of control systems can be adequately judged and compared under application of standard test signals. Describe various standard test signals commonly used in control system design. Give time domain, s-domain, and graphical representation of the signals.	10	CO1

<div align="center">SECTION-C</div>

Q 9	Sketch the root locus plot for the system when open loop transfer function is given by $$G(s)H(s)=\frac{K}{s(s+4)(s^2+4s+13)}; \text{ (-2 is the one of the root of dk/ds equation).}$$ Also determine (i) The value of K such that system become marginally stable. (ii) Frequency value for sustain oscillation.	20	CO3,4
Q 10	The open loop transfer function of a unity feedback control system is given by $$G(s)=\frac{K}{s(1+0.5s)(1+0.2s)}$$ It is desired that (i) For a unit step input the steady state error of the output position be less than 0.125 degrees/(degree/second) (ii) P.M. $\geq 40^0$. Design a suitable compensation network.	20	CO5