Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

Course: Control System Engineering **Semester: VI**
Program: B.Tech electronics and communication engineering **Time 03 hrs**
Course Code: ECEG 4007 **Max. Marks: 100**

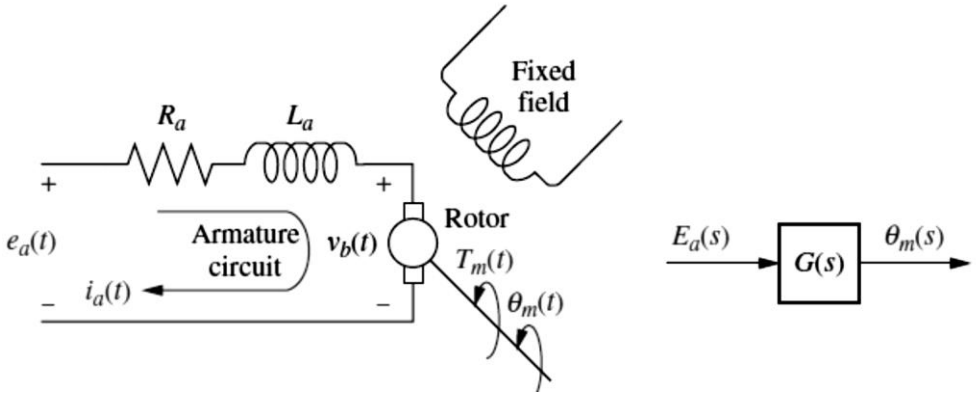
Instructions:

1. **Attempt all the questions (Theory, Numerical, Case study etc.) on A4 size blank sheets.**
2. **Attempt all questions serially as per question paper.**
3. **Answer should be neat and clean. Draw a free hand sketch for circuits/tables/schematics wherever required.**
4. **Scan the whole answer script and check the resolution carefully before upload on the blackboard. Note that answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.**
5. **You are expected to be honest about each attempt which you make to progress in life**

SECTION A [Case Based Study/design] 40 Marks

S. No.		Marks	CO
Q 1	Design the complete root locus for $G(s)H(s) = \frac{K}{s(s+2)(s+4)} (K > 0)$ From the root locus plot find the range of value of K for which the system will have damped oscillatory response.	**20**	**CO4**
Q 2 (a)	Obtain the transfer functions for the following systems with state-space models available as: a. $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u ; \quad y = [1 \quad 0] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + [0]u$	**20**	**CO 4**
(b)	Explain the concepts of observability and controllability with reference to linear time invariant systems. Find the controllability of the system described by the state		

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hhrs from the scheduled time (*exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
No Submission will be entertained after 24 Hrs

	equation. $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} \begin{pmatrix} 0 & 1 \\ -2 & 0 \end{pmatrix} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 3 \end{bmatrix} u$		
SECTION B [Numerical and Short/broad Answers] 60 Marks			
Q 3	Obtain mathematical model for speed control of Armature controlled DC Servomotor. Consider the model as shown in figure 1.  Figure 1 . Armature controlled DC Servomotor	**10**	**CO2**
Q 4	The characteristics equation of a system in differential form is $\ddot{x} - (K+2)\dot{x} + (2K+10)x = 0$ Find the values of K for which the system is (i) stable (ii) limited stable and (iii) unstable. For stable case, for what values of K is the system (i) underdamped (ii) overdamped	**10**	**CO2**
Q 5	Elucidate the mathematical equation of PID controller. What is the advantage of PI controller over PD controller?	**10**	**CO3**
Q 6	Find the transfer function of a second-order system that yields a 12.3% overshoot and a settling time of 1 second?	**10**	**CO 1**
Q 7 (a) (b)	For the block diagram shown in figure 2? Find the value of transfer function Classify the system output behavior based on the value of damping ratio.	**5**	**CO1**

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	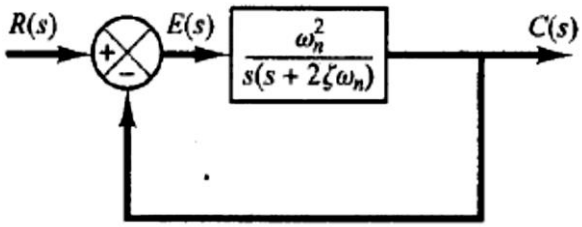 Figure 2 Block Diagram		
Q 8	Differentiate between transient and steady state stability?	**5**	**CO3**
Q 9	What do you understand by frequency response analysis? What is minimum phase system.	**5**	**CO 3**
Q 10	What do you understand by control system design. Explain the types of control system design?	**5**	**CO2**

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