Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

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

Course: Control systems **Semester: IV**
Program: B.tech Electrical Engineering **Time 03 hrs.**

Course Code: ECEG 2031 **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 40 Marks

S. No.		Marks	CO
Q 1	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.	**15**	**CO1,2**
Q 2	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 r(t) = t	**15**	**CO 2**
Q 3	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**	**CO 1**

SECTION B 60 Marks

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

Q 4	Sketch the root locus plot for the system when open loop transfer function is given by $G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+13)}$; Also determine (i) The value of K such that system become marginally stable. (ii) Frequency value for sustain oscillation.	**20**	**CO3**
Q5	The open loop transfer function of a unity feedback control system is given by $$G(s) = \frac{K}{s(1+0.5s)(1+0.2s)}$$ Sketch bode plot for the transfer function and find out Phase margin & gain margin.	**20**	**CO4**
Q 6	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 $x(0) = \begin{bmatrix} 1 \\ -1 \end{bmatrix}, then\ x(t) = \begin{bmatrix} e^{-t} \\ -e^{-t} \end{bmatrix}$ Find e^{At}	**20**	**CO4**

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