Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

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

Course: Mathematical Modelling and Simulation **Semester: VIII**
Program: B.Tech ASEA **Time 03 hrs.**
Course Code: AVEG 452 **Max. Marks: 100**

Instructions: solve the problems mentioned and provide the values where ever necessary

SECTION A

1	Laplace transform of integral of df/dt is _____.	**5**	**1**
2	The torque T1 is transferred from a gear with N2 teeth to gear with N1 teeth, the value of the torque received at the shaft of second gear is _____.	**5**	**1**
3	The value of damping ratio of 0.9 in the step response of a second order system results in the maximum overshoot of _____.	**5**	**2**
4	The unit step response of second order underdamped system exhibits the peak overshoot of 10%. If the magnitude of the input is doubled, the peak overshoot will be _____.	**5**	**2**
5	The characteristic equation of a unity feedback control system is described by $s^2 + s + 5 = 0$. the steady state error due to unit ramp input will be ____.	**5**	**2**
6	For a matrix A = $\begin{bmatrix} 2 & 5 \\ -1 & -3 \end{bmatrix}$ the eigen values will be _____.	**5**	**1**

SECTION B

7	Explain the process of mathematical representation of open loop system and closed loop system with examples Or Explain the process of mathematical representation of mechanical translational system and mechanical rotational system examples	**10**	**3**
8	Describe the following with respect to time domain analysis a. Transient response b. Steady state response	**10**	**3**

9	For the electrical network for lag compensator determine T and α for the networks	**10**	**3**
10	Express the given complex function in pole-zero form. Identify the zeros and poles $$G(s) = \frac{3s+4}{s(s+5)^2(5s+2)}$$	**10**	**2**
11	Obtain the following for the complex quantity $$\frac{2+3j}{5+7j}$$ a. Real and imaginary parts b. The magnitude c. The angle		**1**
	SECTION-C		
12	A unity feedback control system has an open loop transfer function $$G(s) = \frac{k}{s(s+4)}$$ Using the root locus plot of the system, determine the following (**<u>give values</u>**): a. Centroid, number and angle of asymptotes b. Angle of departure of root loci from the poles c. Breakaway points if any d. Value of k and the frequency at which the root loci cross the jω axis **Or** A feedback aircraft pitch dynamics control system is shown below. $$P(s) = \frac{\Theta(s)}{\Delta(s)} = \frac{1.151s + 0.1774}{s^3 + 0.739s^2 + 0.921s}$$ Calculate the following: 1. Obtain closed loop steady state response with pitch angle reference is a 0.2 radian (11 degree) step 2. In the rootlocus plot give the following values: a. Centroid, number and angle of asymptotes b. Angle of departure of root loci from the poles c. Breakaway points if any	**20**	**4**