Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

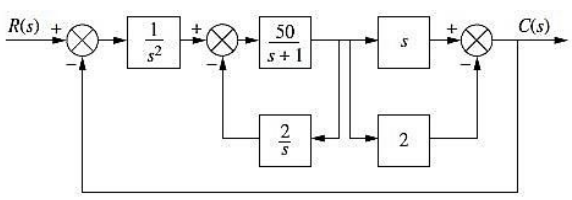
Programme Name: B. Tech ASE+AVE | **Semester : VII**
Course Name : Digital Avionics | **Time : 03 hrs**
Course Code : AVEG 433 | **Max. Marks : 100**
Nos. of page(s) : 03

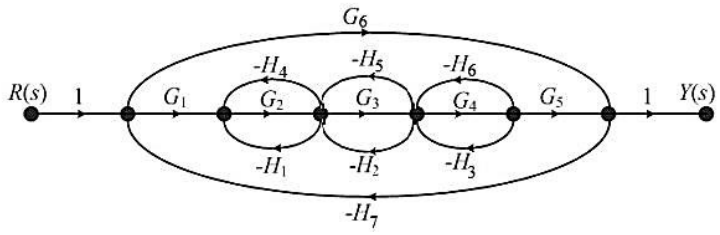
Instructions: Make use of *sketches/plots* to elaborate your answer. Brief and to the point answers are expected.
The Question paper has three sections: Section A, B and C, Section B and C having internal choices.

SECTION A

S. No.	Questions	Marks	CO
Q 1	Define transfer function ? Give two examples of closed loop control systems	**4**	**CO1**
Q 2	Differentiate between **Fly-By-Wire** Vs. **Fly-By-Light** aircraft systems	**4**	**CO2**
Q 3	Write shorts note on fibre optic Databuses **DOD-STD 1773**	**4**	**CO3**
Q 4	Why using two differents speed of operation in civil aircraft ARINC 429 standards	**4**	**CO3**
Q 5	Explain the Doppler Navigation system	**4**	**CO5**

SECTION B

Q 6	a) A unity feedback of aircraft control system has an amplifier with gain $\mathbf{K_A = 10}$ and gain ratio $G(s)=\frac{1}{S(S+2)}$ In the feed forward path. A derivative feedback $\mathbf{H(s) = sk_0}$ is introduced as a minor loop around G(s) Determine the derivative feedback constant $\mathbf{K_0}$ so that the System damping factor is **0.6** b)The response of a servomechanism is $\mathbf{c(t) = 1+ 0.2\, e^{-60t} - 1.2\, e^{-10t}}$ when subject to a unit step input. Obtain an expression for the system.	**10**	**CO4**
Q7	Reduce the block diagram shown in Figure (1)  **Figure (1)** a. Block diagram reduction b. MATLAB Programming	**10**	**CO2**

Q8	Define Doppler effects? Calculate the Doppler shift in each of the beam in a Doppler RADAR Janus-X type, For given α_0 = **60^0,** θ_0 = **45^0**, frequency of operation 9 G Hz and assuming that the aircraft is on level flight with aforword velocity of 500 km/h and a drift velocity of 100km/h.	10	CO1
Q 9	Convert the following digital number Systems i) $(79.515)_{10}$ to Binary ii) $(753)_8$ to Decimal iii) $(0.011000001)_2$ to Octal iv) $(7D.3374B)_{16}$ to Decimal v) $(0.256)_{10}$ to Octal **(Or)** Design and integration of the military aircraft communication using by MIL-STD-1553B architecture, Also Discuss the following i) Half Duplex Communication ii) Bus Controller, Remote Terminal. iii) Command Word iv) Status Word	**10**	**CO3**
	SECTION-C		
Q 10	**a)** Consider the control system whose signal flow graph is shown in Figure (2). Determine the system transfer function using Mason's formula  **Figure (2)** **b)** Design the Head-Up Display ? Find the required effective focal length *F*,	**(10+10 = 20)**	**CO4**

	Head up display (**HUD**) for civil aircraft TFOV of 20^0 and a CRT diameter of 50 mm.		
Q 11	How GPS system works? A satellite transmit a signal at the nominal GPS time (by its clock) of $t_{sv,}$ However, the clock corrections broadcast in the data stream indicates a corrections $\Delta t_{sv,}$ to be added to the satellite clock time. The signal is received by the user at time $\Delta t_{u,}$ By the user clock, which has got an error indicated by $t_{bias,}$ Write the range equations for the satellite which takes these into consideration. Show by a sketch how these factors affect the measured delay. **(Or)** a) Why are the transmitted and received frequencies different in the interrogator and transponder beacon in DME? b) Suppose 50 aircraft are interrogating a DME beacon and of these 10 are in search mode. How many response and filter pulses does the beacon transmit per seconds?	**20**	**CO5**

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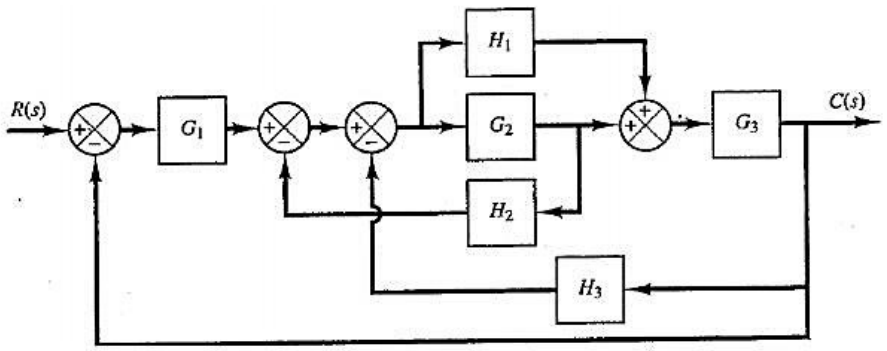
SECTION A

S. No.	Questions	Marks	CO
Q 1	Define : Flight Managnement Systems	**4**	**CO1**
Q 2	Explain the damping Ratio? Clasify the types of damping.	**4**	**CO2**
Q 3	Draw and explains the Manchester Bi-Phase Encoding techniques in military aircraft.	**4**	**CO3**
Q 4	Find the required effective focal length *F*, Head up display (HUD) for civil aircraft TFOV of 20^0 and a CRT diameter of 50 mm.	**4**	**CO4**
Q 5	Discuss about the Global Position Navigation System	**4**	**CO5**

SECTION B Q9 having an internal choice

Q 6	For the block diagram shown below, a) Draw the corresponding signal flow graph b) Using Mason's formula, obtain the system T.F. C(s)/R(s) 	**10**	**CO4**

Q 7	Design and integration of the military aircraft communication using by MIL-STD-1553B architecture, Also Discuss the following **a)** Half Duplex Communication **b)** Bus Controller, Remote Terminal. **c)** Command Word **d)** Status Word	**10**	**CO3**
Q 8	Convert the following digital number Systems **a)** $(83.632)_{10}$ to Binary **b)** $(462)_{8}$ to Decimal **c)** $(0.111100011)_{2}$ to Octal **d)** $(2A.44C)_{16}$ to Decimal **e)** $(0.473)_{10}$ to Octal	**10**	**CO4**
Q 9	The frequency in aperticular Doppler RADAR using Janus-X antenna is 13.5 GHz. Radio navigation. The beam are depressed by 70^0 with respect to the horizondal plane and the angle θ is 40^0. The antenna is heading –stabilized and the instrumentation for Doppler frequency measurement employs the determination of the difference in frequency between opposite beams. Determine the Doppler frequency obtained when forword velocity of the aircraft is 200 km/h and 600 km/h and drift velocity is (a) Zero (b) When it is 50 km/h (Or) Design the aircraft navigation system with suitable diagram a) Visual navigation (or) pilotage navigation b) Celestial navigation (or) Astronomical navigation c) DR navigation d) VOR navigation	**10**	**CO5**

SECTION-C (Q10 having an internal choice)			
Q 10	a) Define Doppler effects? Calculate the Doppler shift in each of the beam in a Doppler RADAR Janus-X type, For given $\alpha_0 = \mathbf{60^0}$, $\theta_0 = \mathbf{45^0}$, frequency of operation 9 G Hz and assuming that the aircraft is on level flight with aforword velocity of 500 km/h and a drift velocity of 100km/h. b) Perform the following operation by using 1's Compliment method (-42-20) 2's Compliment method (21-42)	**(10+10 =20)**	**CO1** **CO3**
Q 11	How GPS system works? A satellite transmit a signal at the nominal GPS time (by its clock) of $t_{sv,}$ However, the clock corrections broadcast in the data stream indicates a corrections $\Delta t_{sv,}$ to be added to the satellite clock time. The signal is received by the user at time $\Delta t_{u,}$ By the user clock, which has got an error indicated by $t_{bias,}$ Write the range equations for the satellite which takes these into consideration. Show by a sketch how these factors affect the measured delay. **(Or)** Describe the operation of the DME beacon transmitter. The beacon has a delay of 50 μs and a recovery period 100 μs after each transmission. How does this affect the operation of beacon? Discuss the various different platforms in Inertial Navigation System.	**20**	**CO5**