UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination

Programme Name: B. Tech ASE+AVE | **Semester : VIII**
Course Name : Satellite System Engineering | **Time : 03 hrs**
Course Code : AVEG 471 | **Max. Marks : 100**

Part A : Each questions carries two marks (15*2=30)

Multiple Choice Questions

1. Is a loss of power of a satellite downlink signal due to earth atmosphere?

a) Atmospheric loss b) Path loss

c) Radiation loss d) Rain loss

2. As the height of a satellite orbits get higher, the speed of the satellite

a) Increases b) Decreases c) Remains the same d) None of the above

3. A satellite signal transmitted from a satellite transponder to earth's station

a) Uplink b) Earthbound c) Terrestrial d) Downlink

4. Repeaters inside communications satellites are known as

a) Transceivers b) Transducers c) Transponders d) PWT

5. What is the local oscillator (mixer) frequency of the satellite with an uplink frequency in GHz band?

a) 3500 MHz b) 4500 MHz c) 2225 MHz d) 2555 MHz

Fill in the blank Questions

6. Basically, poles of transfer function are the Laplace transform variable values which causes the transfer function to become _____

7. The output signal is fed back at the input side from the _____ point

8. Conventional satellite control theory is applicable to _____ systems

9. If a signal is passed through an integrator, it _____the amplitude of noise signal.

10. In P-D controller, the derivative action plays a significant role in increasing _____ of response.

True or False Questions

11. If 'ξ' approaches to zero, the peak resonance would become equal to peak overshoot.

12. The downlink frequency is lower than the uplink frequency.

13. Is Geosynchronous satellite is a satellite that rotates around the earth in a low-altitude elliptical or circular pattern.

14. The EIRP of a satellite is the same anywhere reception is possible.

15. In the Northern Hemisphere, an antenna must face south to reach a satellite.

Part B : Each questions carries ten marks (5*10=50) having internal choices in Q20

16. Explain the configuration definition phases for small satellite? Discusses the Indian Mini Satellite (IMS-2) spacecraft / Sub system requirements and trade off analysis

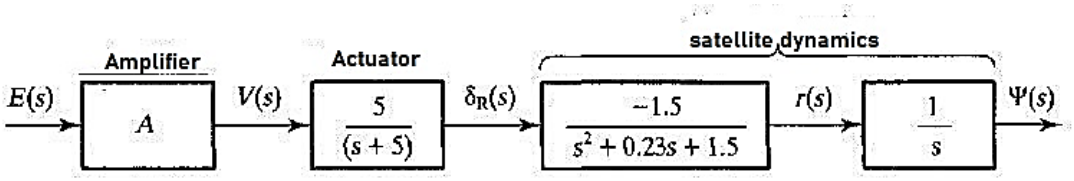
a) IMS-2 Bus

b) TM/TC Data

c) Electrical & Mechanical Interface

d) Satellite Attitude determination and control system (ADCS)

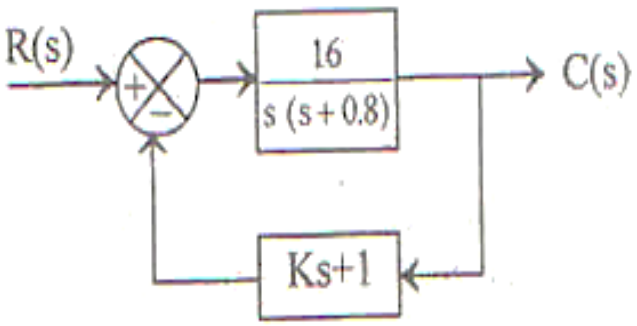
17. Write the MATLAB Programming for satellite system



a) Use MATLAB commands satellite Pole-Zero plots
b) Consider step input
c) Stability analysis commands

18. Explain the EIRP and FSL? A satellite link operating at **15 GHz** has receiver feeder losses of **1.8 dB** and a free space loss of **210 dB**. The atmospheric absorption loss is **0.6 dB** and the antenna pointing loss is **0.6 dB**. EIRP = **60 dbW**, Gain of the Antenna is **50dB**. Depolarization losses may be neglected. Calculate the Received power and total loss for clear sky conditions.

19. A satellite positional control system with velocity feedback is shown in below figure. What is the response c(t) to the unit step input. Given that damping ratio 0.5. Also, explain the transient responses.



Find the satellite

a) Rise time
b) Peak time
c) Maximum overshoot
d) Settling time

20. Explain the following:

a) Resonant peak & Resonant frequency
b) Bandwidth
c) Cut-off rate
d) Gain margin
e) Phase margin

(Or)

Briefly explain the following

a) PID controller
b) Lag-Lead compensator

Also, compare the satellite transient's responses with controller/compensator.

Part C (20 Mark question having internal choices)

21. a) Consider Routh array and determine the stability of the system represented by the characteristic equation $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5$. Comment on the location of roots of the characteristic equation.

b) Determine the stability of the system whose characteristic equation is $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Also determine the no of roots lying on the left half of the s-plane, right half of the s- plane, on the imaginary axis

(Or)

For given satellite system A) $\frac{\mathbf{4}}{\boldsymbol{S}(\mathbf{1}+\mathbf{0.5}\boldsymbol{S})(\mathbf{1}+\mathbf{0.08}\boldsymbol{S})}$ B) $\frac{\mathbf{2}\boldsymbol{e}^{-\mathbf{0.5}\boldsymbol{s}}}{\boldsymbol{S}(\mathbf{0.5}\boldsymbol{S}+\mathbf{1})(\mathbf{0.125}\boldsymbol{S}+\mathbf{1})}$ Find the gain $|G\ (j\omega)|$ in dB and phase angle G (jω) in degree for given frequency

Satellite System A	ω (rad/Sec)	1	2	8	10	20	50
Satellite System B	ω (rad/Sec)	1	2	3	4	5	6