Hall Ticket No | | | | | | | | | | | Question Paper Code: AEC522

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech VI Semester End Examinations, April - 2019
Regulation: IARE-R16
SATELLITE COMMUNICATION
(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 70**

Answer any ONE question from each Unit
All questions carry equal marks
All parts of the question must be answered in one place only

UNIT – I

1	a)	Give the mathematical formulation of Kepler's third law of planetary motion. What do the terms perigee and apogee mean when used to describe the orbit of a satellite orbiting the earth.	[7M]
	b)	A satellite is in an elliptical with a perigee of 1000km and an apogee of 4000km. using a mean earth radius of 6378.14km; find the period and the eccentricity of the orbit.	[7M]
2	a)	Derive the coverage angle and slant range to the geostationary satellite in detail. What are the maximum values of the two parameters.	[7M]
	b)	Explain the following terms: (i) LEO (ii) MEO (iii) GEO	[7M]

UNIT - II

3	a)	Formulate a general link equation for satellite communications using basic transmission theory.	[7M]
	b)	Suppose we have a 4GHz receiver with the following gains and noise temperatures, $T_{in} = 25K$, $T_{RF} = 50K$, $T_{IF} = 1000K$, $T_m = 500K$, $G_{RF} = 23dB$, $G_{IF} = 30dB$, Calculate the system noise temperature assuming that the mixer has a gain $G_m = 0dB$.	[7M]
4	a)	Explain telemetry, tracking and command (TT&C) subsystem of a satellite With the help of block diagram.	[7M]
	b)	A constellation of low earth orbit satellites has an altitude of 1000 km. each satellite has two multiple beam antennas that generate 16 beams. One antenna is used to transmit at 2.4 GHz and the other antenna receives at 1.6 GHz. Find the coverage angle of the satellite antenna when the lowest elevation angle for an earth station is 10 degrees.	[7M]

UNIT – III

5 a) Describe the DS spread spectrum transmission and reception in code division multiple access. [7M]

b) In a TDMA network the reference burst and the preamble each requires 560 bits, and the nominal guard interval between bursts is equivalent to 120 bits. Given that there are eight traffic bursts and one reference burst per frame and the total frame length is equivalent to 40,800 bits, calculate the frame efficiency. [7M]

6 a) Mention the types of demand assignment and Explain the demand assignment multiple access (DAMA). [7M]

b) Explain the following terms: [7M]

i) Handover
ii) inter modulation
iii) satellite diversity

UNIT – IV

7 a) Explain with the block diagram the working of transmitter part of a typical earth station. What are the HPA's being used here? [7M]

b) A satellite in earth orbit passes through its perigee point at an altitude of 200 km above the earth's surface and at a velocity of 7,850 m/s. Calculate the apogee altitude of the satellite.. [7M]

8 a) Explain what mesh and star architectures are in a VSAT network state two advantages and disadvantages of each. [7M]

b) With the help of block diagram explain tracking system in earth station of satellite communications. [7M]

UNIT – V

9 a) Differentiate pure ALOHA satellite packet switching with slotted ALOHA packet switching? [7M]

b) Consider a (7,4) cyclic code with $g(x) = 1 + x + x^3$, i) let data word d =(1010) find the corresponding code word .ii) let the code word c = (1100101) find the corresponding data word. [7M]

10 a) Discuss in brief the message transmission by FDMA by using M/G/I Queue? [7M]

b) A (6, 3) block code has a minimum distance of two. [7M]

a) How many errors can be detected in a codeword?
b) How many errors can be corrected in a codeword?.

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE OBJECTIVES:

The course should enable the students to:

I	Understand the communication space craft and orbits.
II	Interpret the access systems in communication satellites.
III	Understand the VSAT system technologies.
IV	Interpret packet communications in satellite.

COURSE OUTCOMES (COs):

CO 1	Discuss the satellite subsystems, spacecraft and orbits
CO 2	Analyze the design of Satellite link budget and discuss the satellite subsystems like telemetry, tracking and command system
CO 3	Discuss the significance of different types of multiple access techniques in communication satellites
CO 4	Analyze the earth station technology and constellation of NGSO
CO 5	Evaluate the future satellite communication systems and error control coding for digital satellite links

COURSE LEARNING OUTCOMES:

AEC522.01	Discuss the different satellite systems like Low earth orbit (LEO), Medium earth orbit (MEO) and Geo synchronous earth orbit (GEO).
AEC522.02	Understand how the satellite is locating with respect to earth and orbital perturbations due to earth's oblateness, moon and sun.
AEC522.03	Understand the satellite sub systems like Telemetry, tracking and command system, power system, satellite antenna equipment, communications subsystem and transponders
AEC522.04	Analyze the design of satellite links for a specified C/N with and without frequency Re-use and link budget.
AEC522.05	Discuss the propagation effects like atmospheric absorption, cloud attenuation, troposphere and ionospeheric scintillation and low angle fading.
AEC522.06	Discuss the effects of rain, rain induced attenuation, rain induced cross polarization and interference.
AEC522.07	Analyze the various multiple access techniques used in communication satellites like FDMA, TDMA and CDMA.
AEC522.08	Analyze the concept of demand assignment multiple access (DAMA), types of demand assignment and characteristics.
AEC522.09	Understand the significance of Spread Spectrum Multiple Access (SSMA), Direct sequence CDMA (DS-CDMA) or DS spread spectrum transmission and reception.
AEC522.10	Understand and analyze the Earth Station technology transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods and lower orbit considerations
AEC522.11	Analyze the Very Small Aperture Terminal (VSAT) network architecture, access control and multiple access selection.
AEC522.12	Analyze the constellation design of Non Geostationary Orbit (NGSO) coverage, frequency bands, delay and throughput.
AEC522.13	Understand the message transmission by FDMA using M/G/1 queue and message transmission by TDMA using pure aloha.
AEC522.14	Apply the error control coding for digital satellite links like block codes and convolution codes.
AEC522.15	Evaluate the future satellite communication systems and introduction to satellite laser communication.

AEC522.16	Apply the concept of satellite communication to understand and analyze real time applications.
AEC522.17	Acquire the knowledge and develop capability to succeed national and international level competitive examinations.

MAPPING OF SEMESTER END EXAMINATION TO COURSE LEARNING OUTCOMES:

SEE Question No.		Course Learning Outcomes		COs	Blooms Taxonomy Level
1	a	AEC522.02	Understand how the satellite is locating with respect to earth and orbital perturbations due to earth's oblateness, moon and sun.	CO 1	Understand
	b	AEC522.02	Understand how the satellite is locating with respect to earth and orbital perturbations due to earth's oblateness, moon and sun..	CO 1	Understand
2	a	AEC522.02	Understand how the satellite is locating with respect to earth and orbital perturbations due to earth's oblateness, moon and sun.	CO 1	Understand
	b	AEC522.01	Discuss the different satellite systems like Low earth orbit (LEO), Medium earth orbit (MEO) and Geo synchronous earth orbit (GEO).	CO 1	Understand
3	a	AEC522.04	Analyze the design of satellite links for a specified C/N with and without frequency Re-use and link budget.	CO 2	Understand
	b	AEC522.04	Analyze the design of satellite links for a specified C/N with and without frequency Re-use and link budget.	CO 2	Understand
4	a	AEC522.03	Understand the satellite sub systems like Telemetry, tracking and command system, power system, satellite antenna equipment, communications subsystem and transponders	CO 2	Understand
	b	AEC522.04	Understand the satellite sub systems like Telemetry, tracking and command system, power system, satellite antenna equipment, communications subsystem and transponders	CO 2	Remember
5	a	AEC522.09	Understand the significance of Spread Spectrum Multiple Access (SSMA), Direct sequence CDMA (DS-CDMA) or DS spread spectrum transmission and reception	CO 3	Understand
	b	AEC522.07	Analyze the various multiple access techniques used in communication satellites like FDMA, TDMA and CDMA.	CO 3	Remember
6	a	AEC522.08	Analyze the concept of demand assignment multiple access (DAMA), types of demand assignment and characteristics.	CO 3	Understand
	b	AEC522.09	Understand the significance of Spread Spectrum Multiple Access (SSMA), Direct sequence CDMA (DS-CDMA) or DS spread spectrum transmission and reception	CO 3	Understand
7	a	AEC522.10	Understand and analyze the Earth Station technology transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods and lower orbit considerations	CO 4	Understand
	b	AEC522.10	Understand and analyze the Earth Station technology transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods and lower orbit considerations	CO 4	Understans

8	a	AEC522.11	Analyze the Very Small Aperture Terminal (VSAT) network architecture, access control and multiple access selection.	CO 4	Understand
	b	AEC522.10	Understand and analyze the Earth Station technology transmitters, receivers, antennas, tracking systems, terrestrial interface, power test methods and lower orbit considerations	CO 4	Understand
9	a	AEC522.13	Understand the message transmission by FDMA using M/G/1 queue and message transmission by TDMA using pure aloha.	CO 5	Understand
	b	AEC522.14	Apply the error control coding for digital satellite links like block codes and convolution codes.	CO 5	Remember
10	a	AEC522.14	Understand the message transmission by FDMA using M/G/1 queue and message transmission by TDMA using pure aloha.	CO 5	Understand
	b	AEC522.14	Apply the error control coding for digital satellite links like block codes and convolution codes.	CO 5	Remember

Signature of Course Coordinator **HOD, ECE**