Hall Ticket No | | | | | | | | | | |

Question Paper Code: AEC522

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

Four B.Tech VI Semester End Examinations, April - 2019

Regulations: IARE-R16

SATELLITE COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Answer 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)	State and explain Kepler's three laws of planetary motion.	[7M]
	b)	A satellite is orbiting in the equatorial plane with a period from perigee to perigee of 12 h. Given that the eccentricity is 0.002, calculate the semi-major axis. The earth's equatorial radius is 6378.1414 km.	[7M]
2	a)	Demonstrate the orbital aspects, which are of importance in synchronous satellite communications. Explain these aspects in brief?	[7M]
	b)	The space shuttle orbits at an altitude of 250Km above the earth's surface. Calculate the period of shuttle orbit when the altitude is 250Km and the orbit is circular. Find the linear velocity of the shuttle along its orbit.	[7M]

UNIT – II

3	a)	Discuss the allocations of frequencies for satellite communications.	[7M]
	b)	In a link-budget calculation at 12 GHz, the free-space loss is 206 dB, the antenna pointing loss is 1 dB, and the atmospheric absorption is 2 dB. The receiver [G/T] is 19.5 dB/K, and receiver feeder losses are 1 dB. The EIRP is 48 dBW. Calculate the carrier-to-noise spectral density ratio.	[7M]
4	a)	Explain in detail about Telemetry, Tracking and Command subsystem with relevant diagrams.	[7M]
	b)	A satellite at a distance of 20000 km from a point on the earth's surface radiates a power of 10W from an antenna with a gain of 17 dB in the direction of the observer and operates at a frequency of 11GHz. The receiving antenna has a gain of 52.3 dB, find the received power.	[7M]

UNIT – III

5	a)	Describe the ways in which demand assignment may be carried out in an FDMA network	[7M]
	b)	Assume that the TDMA system uses a 125 μs frame time. Find the number of channels that each earth station can send within the TDMA frame when a 5 μs preamble is added and 2 μs guard band is used.	[7M]

6	a)	Explain in detail the concept of intermodulation. Explain the significance of intermodulation noise.	[7M]
	b)	The IF bandwidth for a CDMA system is 3 MHz, the roll off factor for the filter being 1. The information bit rate is 2.4 kb/s, and an [Eb/No] of 11 dB is required for each channel accessing the CDMA system. Calculate the maximum number of accesses permitted.	[7M]

UNIT – IV

7	a)	Explain what mesh and star architectures are in a VSAT network. State two advantages and disadvantages of each.	[7M]
	b)	The range between a ground station and a satellite is 42000 km. Calculate the free space loss a frequency of 6 GHz.	[7M]
8	a)	Explain the block diagram representation of a typical earth station transmitter.	[7M]
	b)	Determine the visibility arc on earth equator from the satellite located at 870 E in the geostationary orbit.	[7M]

UNIT – V

9	a)	Differentiate pure ALOHA satellite packet switching with slotted ALOHA packet switching?	[7M]
	b)	A (6, 3) block code has a minimum distance of two. i) How many errors can be detected in a codeword? ii) How many errors can be corrected in a codeword?	[7M]
10	a)	What is Mobile satellite service? Explain. Write short note on the applications of satellites.	[7M]
	b)	Analyze the instability of aloha protocol can be resolved by using tree algorithm.	[7M]

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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**