ROLL NO. _____

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Code: AE22 **Subject: SATELLITE & SPACE COMMUNICA**

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. The first INTEL SAT I (formerly Early Bird) was launched on

(A) April 1965 **(B)** April 1956
(C) April 1962 **(D)** April 1960

b. Mobile satellite system use VHF,UHF,L and S band with carrier frequencies from

(A) 150 to 3000 MHz **(B)** 120 to 2500 GHz
(C) 700 to 300 MHz **(D)** 137 to 2500 MHz

c. One of the following laws governs the moment of artificial satellite

(A) Newtonian Law of mechanics **(B)** Laws of quantum mechanics
(C) Galilean Laws **(D)** Kepler's laws

d. Earth's figure of merit is defined as

(A) 10 log (G/T) **(B)** 10 log (T/G)
(C) 10 log GT **(D)** 20 log (G/T)

e. When the orbit eccentricity (e) equals to zero, the orbit is

(A) Parabolic **(B)** a hyperbola
(C) elliptical **(D)** circular

f. The satellite in which the satellite are mounted on de-spun platform is the

(A) geostationary satellite **(B)** sun synchronous satellite
(C) spin stabilised satellite **(D)** 3-axis body stabilised satellite

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g. The source of primary power for a satellite is

(A) Nickel Cadmium cell **(B)** Solar cells
(C) Inverters **(D)** Load batteries

h. Before transmitting to the satellite, the wide band satellite signal is amplified by

(A) Klystron **(B)** Travelling Wave tube
(C) Tunnel–diode amplifier **(D)** Wave guide

i. The advantage of guard time between pulses is that

(A) It increases the efficiency of transmission
(B) It suppresses the cross talk
(C) Message can be reconstructed with practical filters
(D) None of these

j. The range of Ku band is

(A) 12-18 GHz **(B)** 24-36 GHz
(C) 1-2 GHz **(D)** None of these

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Explain the basic techniques used for placing the satellite in geostationary orbit. **(8)**

b. A low orbit satellite is in a circular polar orbit with an altitude, h, of 1000 km. A transmitter on the satellite has a frequency of 2.6GHz. Find
(i) The velocity of the satellite in orbit.
(ii) The component of velocity towards an observer at an earth station as the satellite appear over the horizon, for an observer who is the plane of the satellite orbit.
(iii)Hence find the Doppler's shift of the received signal at the earth station. Use the mean earth radius value, r_e , of 6378 Km the satellite also carries a K-band transmitter at 20.0 GHz.
(iv)Find the Doppler shift for this signal when received by the same observer. **(8)**

Q.3 a. Explain what is meant by the term rain rate and how is this related to the specific attenuation. What is meant by effective path length in connection with rain attenuation? **(8)**

b. What are the various propagation concerns for satellite communication systems? Explain the atmospheric losses in detail. **(8)**

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Q.4 a. What are LEO's? Explain the personal communication system using L-band LEO satellite link. **(8)**

b. (i) A satellite at a distance of 40,000 Km from a point on the earth's surface radiates a power of 10 W from an antenna with a gain of 17 db in the direction of the observer .Find the flux density at the receiving point, and the power received by an antenna at this point with an effective area of $10m^2$.
(ii) If the satellite operates at a frequency of 11GHz .The receiving antenna has a gain of 52.3 dB. Find the received power. **(8)**

Q.5 a. Explain as to why time division multiplexing is the only option for digital satellite link. Explain bell T1 PCM format. **(7)**

b. Write a short note on Pulse Code Modulation. **(5)**

c. The average power received in binary polar transmission is 10 mW and the bit period is 100 μ J and optimum filtering is used, determine the bit error rate. **(4)**

Q.6 a. With a block schematic for illustration briefly describes a satellite wideband receiver. **(8)**

b. Describe the east–west and north–south station keeping maneuvers required in satellite station keeping. What are the angular tolerances in station keeping that must be achieved? **(8)**

Q.7 a. Briefly describe a TDMA frame. Illustrate by a simplified diagram, a TDMA frame for four transmitting earth stations and briefly explain. **(8)**

b. Write a note on CDMA and explain the principle of Direct Sequence Spread Spectrum (DSSS). **(8)**

Q.8 a. Distinguish between block and convolutional codes. Explain the Shannon Hartley Law for a digital communication link. **(8)**

b. Why are cyclic codes widely used in satellite transmission? Write a brief note on the following:
(i) Hamming codes.
(ii) BCH codes. **(4×2)**

Q.9 a. What are the various network architecture? Explain them in detail. **(8)**

b. Define saturation flux density. Derive expression for minimum value of EIRP. **(8)**

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