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Roll No.....

**EC - 7201**

**B.E. VII Semester**

Examination, December 2012

**Satellite Communication**  
(Elective)

*Time : Three Hours*

*Maximum Marks : 100*

*Minimum Pass Marks :35*

**Note :** 1. Answer all the questions.

2. Assume suitable data if any missing.

3. Answer must be to the point.

4. Use of Smith Chart is permitted.

- 1) a) The semi major axis and the semi minor axis of an elliptical satellite orbit are 20000 Km and 160000 Km respectively. Determine the apogee and the perigee distances. (8)
- b) Briefly explain Kepler's second law of planetary motion with necessary illustrations. (6)
- c) List the various frequency bands being used in satellite communications. (6)

OR

- a) Find the velocity of a satellite at the perigee and apogee of its elliptical orbit in terms of the semi major axis  $a$  and the eccentricity  $e$ . (12)
- b) Consider two geostationary satellites at longitudes  $75^\circ E$  and  $75^\circ W$ . Can these two satellites see each other? (4)

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- c) Draw the geometry of a geostationary link showing elevation, azimuth and range. (4)
- 2) a) Calculate the gain (in decibels) and 3-dB beamwidth (in degrees) for a parabolic antenna with the following diameters at 10 GHz (a) 3 ft and (b) 10ft. Determine the far field zone for both cases. (7)
- b) What are look angles and derive the expression for azimuth and elevation? (13)

OR

A parabolic dish antenna has a diameter of 1 m operating at 10GHz. The antenna efficiency is assumed to be 55% (a) calculate the antenna gain in dB (b) What is the 3-dB beam width in degrees? (c) What is the maximum power density in watts per square meter at a distance of 100m away from the antenna? The antenna transmits 10W. (d) What is the power density at  $1.05^\circ$  away from the peak? (20)

- 3) a) Explain, why the low noise amplifier in a satellite receiving system is placed at the antenna end of the feeder cable. (7)
- b) What is meant by tracking and pointing? Explain its significance. (7)
- c) What do you understand by Monitoring and Control? (6)

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- a) What is meant by input back off of a transponder? (4)
- b) Explain how power is generated in satellite. (9)
- c) Distinguish between passive and active attitude control. (7)

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4) The details of a C-band GEO satellite are given below: (20)

- i) Transponder saturated output power = 20 W
- ii) Output back off = 2 dB
- iii) Antenna gain on axis = 20 dB
- iv) Receiving earth station antenna gain at 4 GHz = 49.7 dB
- v) Receiving system noise temperature = 75K

Calculate:

- i) Diameter of the antenna at 4 GHz
- ii) Saturated output power of the transponder in dBW
- iii) Power transmitted by the transponder in dBW
- iv) On axis EIRP of the transponder and antenna in dBW
- v) G/T ratio for the earth station.
- vi) Path loss at 4GHz over the maximum path length for a GEO satellite link.

OR

- a) Determine the value of over all carrier to Noise ratio at the earth station in a satellite link if a signal is transmitted to a satellite transponder with carrier to noise ratio of 30dB and transponder transmit it with a ratio of 40dB.

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- b) Starting from fundamentals derive the equation for the minimum value of EIRP in dBW, which the earth station must provide to produce a given flux density at the satellite for clear sky conditions. (9)

- 5) a) With the help of block diagram describe the operation of VSAT system. (10)

- b) Explain and discuss the block diagram of a DBS system. (10)

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OR

- a) Explain various application areas of VSAT (10)

- b) Write short note on: (10)

- i) VSAT star network  
ii) VSAT mesh network

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