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H – 2951

Reg. No. : .....

Name : .....

**Eighth Semester B.Tech. Degree Examination, November 2019**

**13.806.6 : SATELLITE COMMUNICATIONS (T)**

**(2013 Scheme)**

**(Elective – VI)**

Time : 3 Hours

Max. Marks : 100

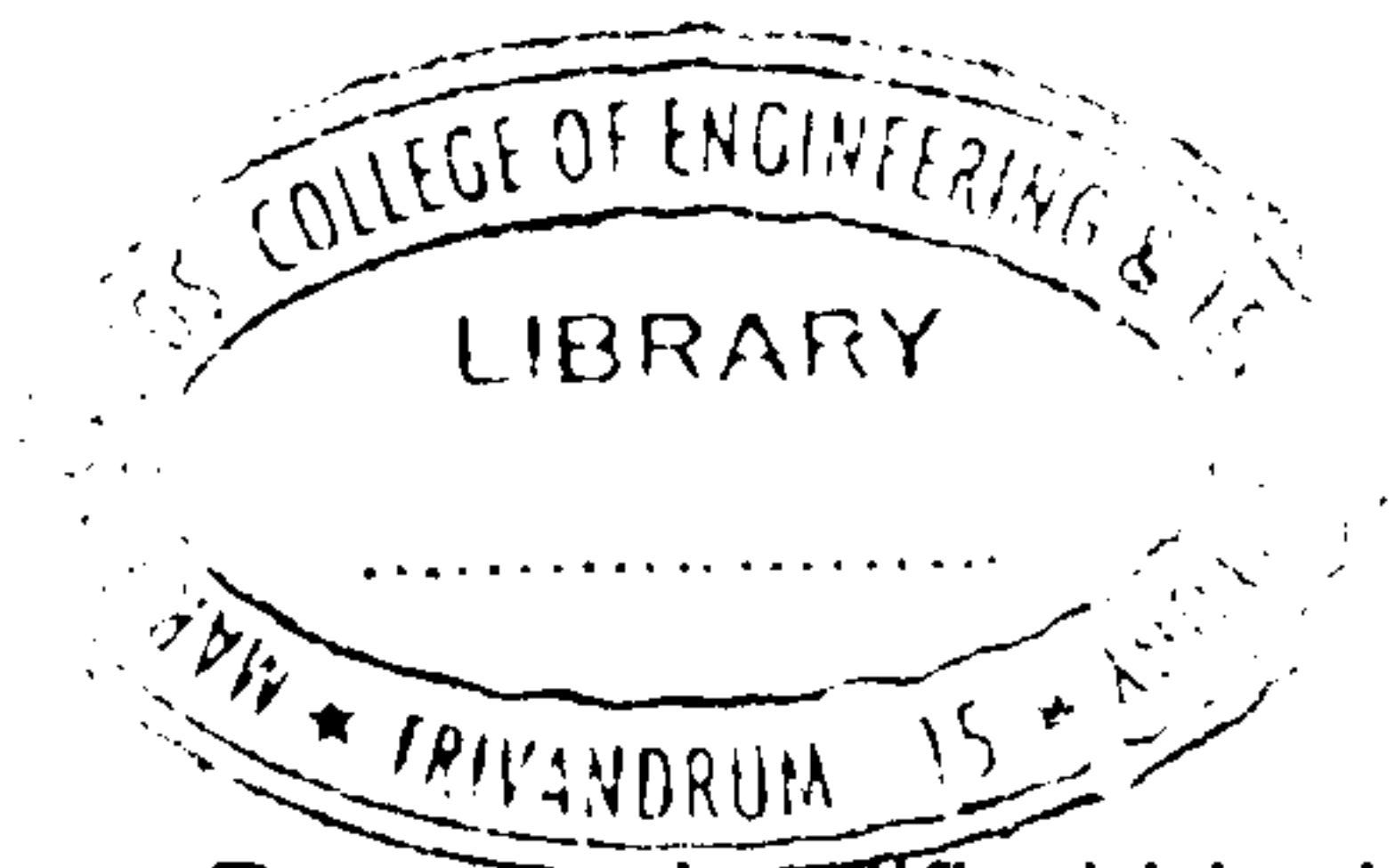
PART – A

Answer **all** questions. Each question carries **2** marks.

1. Define and explain subsatellite point.
2. What are the factors which decide selection of launch vehicles?
3. Explain attitude control of a satellite.
4. List the steps used in the design of a satellite communication link.
5. Why pre-emphasis and de-emphasis are needed in FM transmission?
6. Draw the block diagram of a band-pass transmission system for digital data and explain the functions of the blocks.
7. How is synchronization achieved in TDMA systems?
8. Draw the block diagram of a typical VSAT earth station, and briefly explain it.

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9. Draw a simplified block diagram of a DBS-TV uplink earth station and explain it.
10. A 12 GHz direct broadcast satellite link was found to experience 4 dB of rain attenuation at an elevation angle of  $45^\circ$  for 0.01% of the time in an average year. What would be the rain attenuation measured at the same time percentage for the same site if the elevation angle were  $10^\circ$ ?

**(10 × 2 = 20 Marks)**

**PART – B**

Answer **any one** question from **each** Module. Each question carries **20** marks.

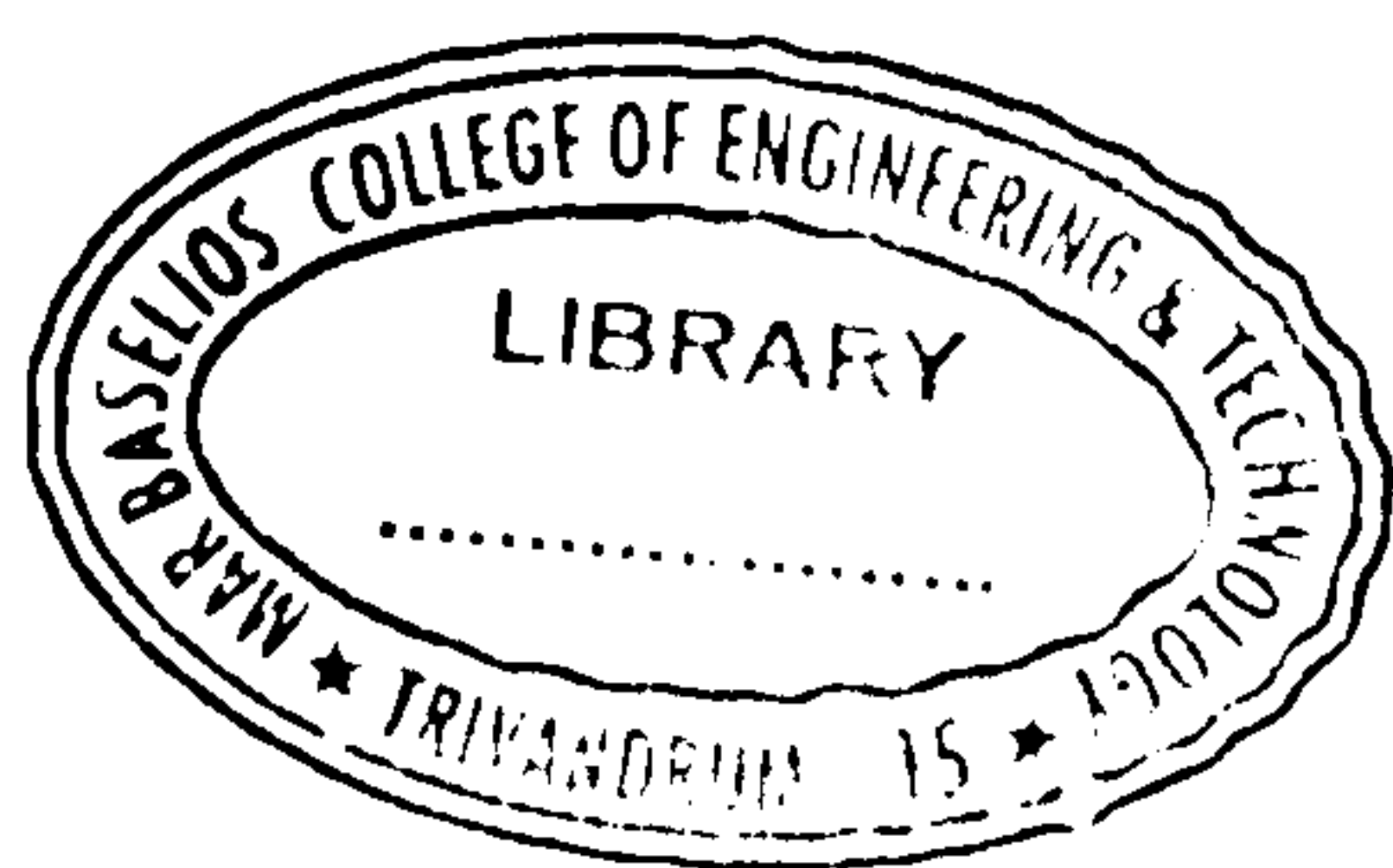
**Module – I**

11. (a) Derive expressions for,
- (i) elevation and
  - (ii) azimuth angle for a satellite in geostationary orbit. **(2 × 5 = 10 marks)**
- (b) What are the effects of non-spherical earth on a satellite? **5**
- (c) What are the Keplerian orbital elements? Explain them. **5**

OR

12. (a) The orbit of an earth-orbiting satellite has an eccentricity of 0.15 and a semi major axis of 9000 km. Determine (i) its periodic time (ii) the apogee height (iii) the perigee height. Assume the mean radius of the earth to be 6371 km. **(3 × 4 = 12 marks)**
- (b) Outline the principle of Sun-synchronous orbits and Molniya orbits. What are the uses of Molniya orbits? **8**





## Module – II

13. (a) Draw the reliability model of a communication satellite and show that the reliability  $R$  is given by,

$$R = 1 - (1 - e^{-\lambda t})^i$$

where  $1/\lambda$  is the mean time between failures. 10

- (b) What is attitude control? Why is it needed? What are the techniques used for attitude control? 10

OR

14. (a) The earth to satellite path affects radio waves in several ways. Explain the role of propagation effects on the design of a satellite communication link. 10

- (b) Explain attenuation for transmission caused by rain. Derive an expression for rain attenuation in decibels. 6

- (c) What is the effect of rain on antenna noise? 4

## Module – III

15. (a) Draw the frame structure of a TDMA system and explain the details. 10

- (b) Explain and write expressions for,

(i) Transponder utilization in TDMA systems

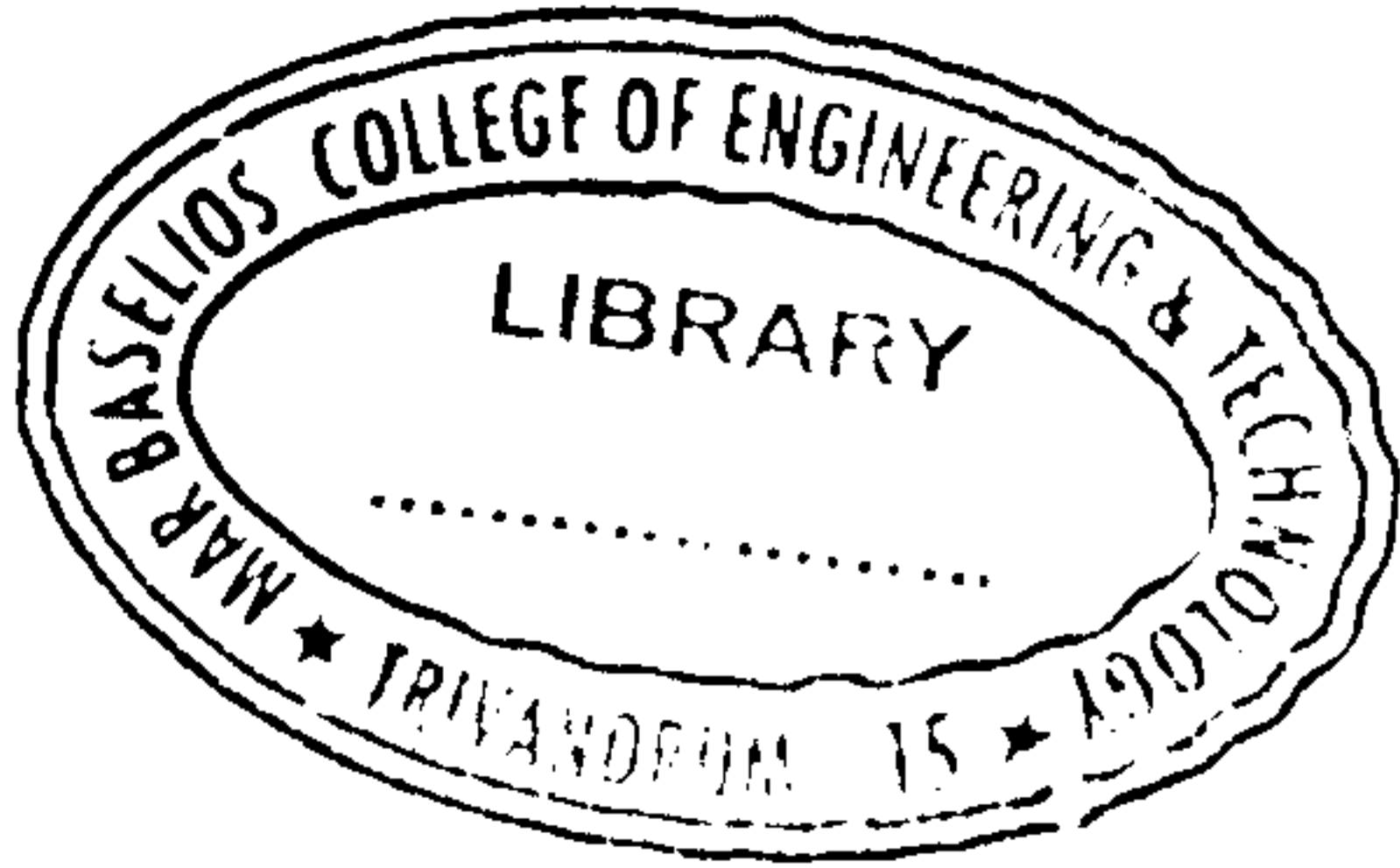
(ii) Frame efficiency of TDMA. (2 × 5 = 10 marks)

OR

16. (a) What is the principle of DS-SS-SSA? Explain with necessary theory. 10

- (b) Describe with help of diagrams, the code acquisition and tracking in DS-SS-SSA systems. 10





### Module – IV

17. (a) Explain the general configuration of an earth station with the help of a block diagram. List and explain the RF subsystems required for the earth station. **12**
- (b) Compare the performance of the various types of tracking systems used in earth stations. **8**

OR

18. (a) Explain the principle of GPS, clearly explaining how positioning is done and how timing error in the receiver is removed. **10**
- (b) What are the different types of antennas used in satellite communication? **10**
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