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Question	Paper	Code	AECB28
QUESTION	I aper	Coue.	$AEOD_{20}$

Max Marks: 70

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Hall Ticket No

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - DECEMBER 2022 **Regulation: R18**

SATELLITE AND MICROWAVE ENGINEERING

(ELECTRONICS AND COMMINICATION ENGINEERING)

Time: 3 Hours

Answer FIVE Questions choosing ONE question from each module All Questions Carry Equal Marks All parts of the question must be answered in one place only

MODULE – I

- 1. (a) Elucidate the working operation of transponder with the help of block diagram for both single and double conversion. [BL: Understand] CO: 1|Marks: 7]
 - (b) A low earth orbit satellite orbits at an altitude of 250km above the earth's surface, the mean earth's radius is approximately 6378.14km, calculate the period of the satellite orbit when the altitude is 250km and the orbit is circular. Solve the velocity of the satellite along its orbit.

[BL: Apply] CO: 1|Marks: 7]

- 2. (a) Explain the process of eclipse of GEO satellite with necessary diagrams. List the applications of GEO satellite. [BL: Understand] CO: 1|Marks: 7]
 - (b) Determine the limits of visibility for an earth station situated at mean sea level at latitude 48.42° north and longitude 89.26° west. Assume a minimum angle of elevation of 5° .

[BL: Apply] CO: 1|Marks: 7]

MODULE - II

3. (a) With a neat block diagram, discuss the general configuration of a digital earth station and list the important factors to be considered for earth station design.

[BL: Understand] CO: 2|Marks: 7]

(b) A BPSK TDMA system is to transmit 1000 digital voice channels, each with 4 bits per sample at a 64 kbps rate. The system must accommodate 1000 data bits/slot at a frame efficiency of 90%. i) What is the number of slots in a frame. ii) what is the length of TDMA frame. iii) how many preamble bits can be used. iv) what is the required satellite bandwidth.

[BL: Apply] CO: 2|Marks: 7]

- 4. (a) Classify different types of multiple access schemes. Explain briefly about pre assigned TDMA and demand assigned TDMA. [BL: Understand] CO: 2|Marks: 7]
 - (b) If GSM uses a frame structure where each frame consists of 8 time slots and each time slot contains 156.25 bits and data is transmitted at 270.833 kbps in the channel. Find: i) The time duration of a bit ii) Time duration of a slot iii) Time duration of a frame iv) How long must a user occupying a single time slot must wait between two simultaneous transmissions.

[BL: Apply] CO: 2|Marks: 7]

$\mathbf{MODULE}-\mathbf{III}$

- 5. (a) Obtain the expression for various field components present inside a rectangular waveguide for TMmn mode of propagation. [BL: Understand| CO: 3|Marks: 7]
 - (b) Dominant TE mode is propagated through a waveguide of breadth 10cm at a frequency of 2.5GHz.
 Find: i) Cutoff wavelength ii) Phase velocity iii) Group velocity iv) Guide wavelength v) Wave guide impedance vi) Phase constant.
 [BL: Apply] CO: 3|Marks: 7]
- 6. (a) Summarize the expressions of wave impedance (ZZ) for TM and TE waves in a rectangular waveguide. [BL: Understand| CO: 4|Marks: 7]
 - (b) A three port circulator has an insertion loss of 1dB, isolation of 30dB and VSWR = 1.5.
 Determine the S-matrix.
 [BL: Apply] CO: 4|Marks: 7]

$\mathbf{MODULE}-\mathbf{IV}$

- 7. (a) Draw the schematic diagram of two cavity klystron amplifier by indicating different blocks. [BL: Understand] CO: 5|Marks: 7]
 - (b) A two cavity klystron amplifier has the following parameters Beam Voltage $V_0 = 900$ V Beam Current $I_0 = 30$ mA Frequency f = 8 GHz Gap spacing in either cavity d = 1 mm Spacing between centers at cavity L = 4 cm Effective shunt impedance $R_{sh} = 40$ k Ω . Determine: i) The electron velocity ii) The DC electron transit time iii) The input voltage for maximum output voltage iv) The voltage gain in decibels. [BL: Apply] CO: 5|Marks: 7]
- 8. (a) Outline the process of bunching in a helix travelling wave tube amplifier with necessary diagrams. [BL: Understand] CO: 5|Marks: 7]
 - (b) A reflex klystron is operated at 9GHz with a dc beam voltage of 600V for 1(3/4) mode, repeller space length of 1 mm, and dc beam current of 10 mA. The beam coupling coefficient is assumed to be 1. Calculate the repeller voltage, electronic efficiency and the output power.

[BL: Apply| CO: 5|Marks: 7]

$\mathbf{MODULE}-\mathbf{V}$

- 9. (a) Illustrate the various blocks in a microwave bench with neat diagrams. List the applications of microwaves. [BL: Understand] CO: 6[Marks: 7]
 - (b) An n-type GaAs Gunn diode has electron velocity $V_d = 3 \ge 10^5$ m/s negative electron mobility $|\text{un}| = 0.16 \ m^2$ /Vs relative dielectric constant $\epsilon_r = 12.9$. Determine the criterion for classifying the modes of operation. [BL: Apply] CO: 6|Marks: 7]
- 10. (a) What are the limitations of LSA modes of gunn diodes? Discuss the basic operation and V-I characteristics of varactor diodes. [BL: Understand] CO: 6[Marks: 7]
 - (b) A slotted line is used to measure VSWR of the load at 8 GHz by double minima method. If the distance between the positions of twice minimum power is 0.5 cm. Find the value of VSWR on the line and magnitude of the voltage reflection coefficient.
 (BL: Apply| CO: 6|Marks: 7]

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