BINDURA UNIVERSITY OF SCIENCE EDICATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF ENGINEERINGAND PHYSICS

Bachelor of Science Honours Degree in Electronic Engineering

EEN5205 - Communication Systems

JUN 2023

Time Allowed: 3 Hours **Total Marks:100**

Special Requirements: Scientific Calculator, rule, pen, pencil

INSTRUCTIONS

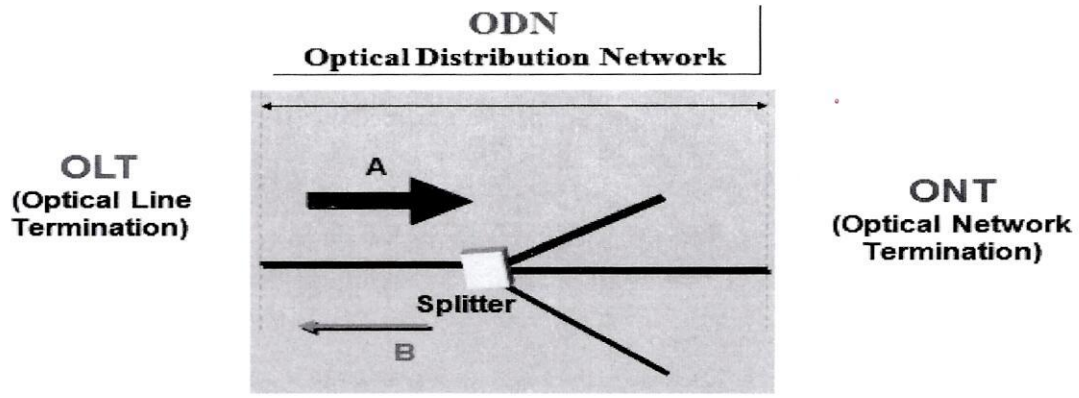
1. Answer any **FIVE (5) questions**
2. The question paper **contains SEVEN (7)** questions
2. Each question carries 20 marks

1(a)With the aid of a suitable diagram explain the ADSL splitter functionality. Include the frequency spectrum of respective signals on your diagram at the input and output of each device. [10]

(b)(i) Illustrate the frequency spectrum of a twisted pair line carrying voice and data.[5]

(ii) Explain the relationship between the bandwidth of each signal and the speed of data in each channel. [5]

2(a)Figure below shows a GPON network operation. Use figure below to answer (i), (ii), (iii) and iv below.



(i) State transmission mode used in direction A and B. [2]

(ii) State wavelengths used in direction A and B. [2]

(iii) In which direction do we implement Dynamic Bandwidth Assignment and why.[2]

(iv) Direction A and B have important names. Give the respective name of each.[2]

(b) With the aid of well labelled diagrams explain the following Type B fibre back-up GPON protection modes. [4]

(c) In GPON explain what you understand by ranging. Explain is significance. [2]

(d)With the aid of a well labelled diagram explain GPON operation principle in the upstream direction. [6]

3(a) Compare, contrast step-index, and graded index optic fibres. [5]

(b)When the mean optical power launched into an 8 km length of fiber is 120 μW, the mean optical power at the fiber output is 3 μW. *Determine:*

(i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices; [2]

(ii) the signal attenuation per kilometre for the fibre. [2]

(iii) the overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1 dB; [2]

(iv) the numerical input/output power ratio in (c). [2]

(c) Draw suitable diagrams to illustrate the following conditions in an optical fiber:

Angle of incidence is greater than the critical angle of incidence [4]

(d) As it is essential that the light should remain confined within the fiber core and no part of light should escape from it towards cladding. Then why is cladding necessary in a practical optical fiber? [3]

4(a) Distinguish between low-, medium-, and geostationary earth orbits, and explain the advantages and disadvantages of each for communication. [7]

(b) Why do all geostationary satellites orbit the earth at the same distance and above the equator? [3]

(c) Find the velocity and the orbital period of a satellite in a circular orbit

(i) 500 km above the earth's surface [2]

(ii) 36,000 km above the earth's surface [2]

(d) At 10 GHz, a ground station transmits 128W to a satellite at a distance of 2000 km. The ground antenna gain is 36 dB with a pointing error loss of 0.5 dB. The satellite antenna gain is 38 dB with a pointing error loss of 0.5 dB. The atmospheric loss in space is assumed to be 2 dB and the polarization loss is 1 dB. Calculate the received input power level and output SNR. The satellite receiver has a noise figure of 6 dB at room temperature. A bandwidth of 5MHz is required for a `channel, and a margin (loss) of 5 dB is used in the calculation. [3+3]

5(a) State four features of microwaves. [4]

(b) Explain the following advantages of microwaves

(i) Increased bandwidth. [2]

(ii) Improved directivity of antenna. [2]

(iii) Reduced fading effect and higher reliability. [2]

(iv) Low attenuation. [2]

(v) Lower power requirements

(c) Briefly explain four applications of microwaves. [8]

6(a) A telephone line normally has a bandwidth of 3000 Hz (300 to 3300 Hz) assigned for data communications. The signal-to-noise ratio is usually 3162. For this channel calculate the capacity. [3]

(b) With the aid diagrams briefly explain the following line coding techniques.

(i)Unipolar Non-Return-to-Zero (NRZ) [3]

(ii)Polar Non-Return-to-Zero (NRZ) [3]

(iii)Return to Zero(RZ) [3]

(c) State five characteristics of line coding techniques. [5]

(d) Write the ASCII code for the word 'HELLO' using even parity by filling in the parity bit at eighth bit position in figure below. [3]

	8	7	6	5	4	3	2	1	Bit positions*
H	1	0	0	1	0	0	0		
E	1	0	0	0	1	0	1		
L	1	0	0	1	1	0	0		
L	1	0	0	1	1	0	0		
O	1	0	0	1	1	1	1		

* The parity bit is at eighth bit position.

7(a) With the aid of block diagrams where possible, explain the following TV applications.

(i) Closed Circuit Television (CCTV) **[4]**

(ii)Satellite TV **[4]**

(b) The scanning in camera and scanning in the picture tube should be *synchronised*. What does that mean. **[2]**

(c) What is the effect of not having synchronization between the scanning in the camera and scanning in the TV receiver. **[2]**

(d) Explain why FM is preferred for sound transmission in TV channels and why AM is preferred for video transmission. **[3]**

(e) With the aid of a suitable diagram, explain Vestigial Sideband Transmission (VSB)**[5]**

The End