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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

ELECTRONICS AND COMMUNICATION ENGINEERING

VII Semester

EC 5701 MILLIMETER AND OPTICAL WAVE COMMUNICATION

(Regulation2019)

Time:3hrs Max.Marks: 100

CO1	Ability to understand fundamentals & millimeter wave communication
CO2	Ability to design millimeter wave communication systems
CO3	Ability to understand and apply fiber transmission characteristics
CO4	Ability to understand and analyze optical transmitters and receivers
CO5	Ability to understand & apply free space optical systems

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Calculate path loss in dB for a 60 GHz signal propagated over a 1 km range.	2	1	L3
2	What is QAM and comment on its use in millimeter wave communication	2	1	L2
3	Define directivity of an antenna? What is its relation to beamwidth?	2	2	L2
4	What is the use of a beam steering antenna in millimeter wave communication?	2	2	L2
5	Determine the numerical aperture and critical angle of a step index fiber with core refractive index of n1 = 1.5 and the cladding refractive index of n2 = 1.35.	2	3	L3
6	Distinguish Step index fibers and graded index fiber.	2	3	L2
7	List the various sources of noise in an optical receiver	2	4	L1
8	Differentiate between direct and external modulation in optical sources	2	4	L2
9	Define scintillation effect	2	5	L1
10	Compare FSO with Radio Frequency Communication Systems.	2	5	L2

PART- B(5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Elaborate the channel performance at 60 GHz millimeter wave frequencies.	13	1	L3
	OR			
11 (b)	Briefly explain the use of millimeter as wireless backhaul systems and the various advantages it would provide	13	1	L3
12 (a)	Draw and describe the direct conversion millimeter transceiver architecture	13	2	L3
	OR			
12 (b)	Discuss the various antenna topologies used for mmwave	13	2	L3

13 (a)	Elaborate on the bending and scattering losses in optical fibers	**13**	3	L2
	OR			
13 (b)	Write short notes on the following (i) Fiber non-linearities (ii) Structure of an optical fiber and its types	**13**	3	L2
14 (a)	(i) A double heterojunction InGasAsP LED emitting at a peak wavelength of 1310 nm has radiative and nonradiative recombination times of 30 and 100ns respectively. The drive current is 40mA. Compute the internal optical power from the LED. (ii) Explain the construction and use of a double heterojunction structure in light source devices.	**7** **6**	4	L5
	OR			
14 (b)	(i) A silicon avalanche photodiode has a quantum efficiency of 70% at a wavelength of 900 nm. If 0.5 μW of optical power produces a multi-plied photocurrent of 20 μA, find the multiplication factor M. (ii) Compare and contrast the construction and characteristics of PIN and avalanche photo diode.	**7** **6**	4	L5
15 (a)	Describe in detail about the choice of transmitters, lasers, modulators and modulation schemes for FSO	**13**	5	L3
	OR			
15 (b)	Explain the various phases involved in acquisition link establishment between initiating and target parties.	**13**	5	L3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	(i) Consider a 30-km long optical fiber that has an attenuation of 0.7dB/km at 1300nm. Find the optical output power Pout in dBm if 100μw of optical power is launched into the fiber. (ii) Explain the Material dispersion in optical fibers	**15**	3	L5