*** Print the 'Application form, Check list of documents, Study Plan and Personal Statement, and Letter of Disclosure Agreement' written on the admission application website.**
Submit the printed documents along with other documents(Transcripts, Diploma (certificate) of degree, English Score and so on).

UNIST

Ulsan National Institute of Science and Technology

(2022 Fall UNIST Graduate Admission)

Application Number

□ Scholarship — Scholarship(Government or UNIST) (●)
Other Scholarship(Company, Institute, Yourself, etc.) ( )

□ Intended Degree — Master ( ) Master-Doctor ( ) Doctor (●)

□ Applying Unit(Major) — Electrical Engineering

□ Applicant Name

□ Nationality

□ Date of Bitrh — 03/01/1992 (dd/mm/yyyy)

□ Address

□ Gender — Male

□ Phone Number

□ Cell Phone

□ Fax Number

□ E-Mail

□ College / University Attended

○ Undergraduate

Pakistan(Faisalabad), Government College University Faisalabad, https://gcuf.edu.pk/ Electrical Engineering 2009/09/05~2013/11/08 GPA/Scale: 2.55/4.0 Ranking: 10

○ Graduate

Pakistan(Karachi,Lahore,Faisalabad), National University of computer and emerging sciences Electrical Engineering 2014/08/25~2017/06/13 GPA/Scale: 3.42/4.0 Ranking: 3

□ Advisor information of Masters Program

Name

Enrolled Major

Enrolled University — University of Computer & Emerging Sciences

Contact number

Email Address

□ English Proficiency English Test Scores

TOEFL(PBT,CBT,IBT)

IELTS — 6.5(Test Date 2021/08/12)

TOEIC

TEPS

G-TELP

TOEIC S/W

OPIC

Exemption ( )

Expected Admission : 2022-08-29
(Applicants must enroll with in the designated period)

I agree to provide my personal information and academic information(UNIST & Domitory) ■ Agree □ Not Agree

□ I Apply for enterance to this graduate school with some documents

□ Signature [redacted] Date 30/03/2022 (dd/mm/yyyy)

*** Organize them in the order of the 'Check List of documents', and then scan them as a single PDF file, and submit(upload) the PDF file on the admission application website.**
(Please scan clearly and neatly for better identification during evaluation - Only PDF file with a file size of 8MB or less can be uploaded)

Check List of Documents

Please submit the documents in the following order.

No.	List of Documents	Attachment	
		Yes	No
1	Application form (Print out after completing online application)	✓	
2	Check list of documents (Form 1) (Print out after completing online application)	✓	
3	Transcripts of Bachelor's degree	✓	
4	Transcripts of Master's degree	✓	
5	Diploma (certificate) of Bachelor's degree	✓	
6	Diploma (certificate) of Master's degree	✓	
7	Study Plan and Personal Statement (Form 2) (Print out after completing online application)	✓	
8	English Test Report	✓	
9	Letter of Disclosure Agreement (Form 3) (Print out after completing online application)	✓	
10	Recommendation Letter from Others(Company, Institute, etc.) (Form 4) (* Only for student funded by Others(Company, Institute, etc.)) * No need to submit for those who pay for education expenses(tuition) by yourself		✓
11	Certificate of Employment (* Only for student funded by Others(Company, Institute, etc.)) * Submit only those who can issue a certificate		✓
12	Additional documents	✓	

* Please, submit transcripts with a GPA that can be verified at the time of application submission.
* Submit the certificate with notarization or Apostille (Consular confirmation).

Government College University
Faisalabad, Pakistan

TRANSCRIPT

BSc Electrical Engineering in Telecommunication Session 2009- 2013

Name: [redacted] Reg. No: 2009-GCUF-2084-522

Father Name: [redacted] Roll No: 1823

Course Code	Title of The Course	Credit Hours	Total Marks	Obtained Marks	%Age Obtained	Letter Grade	G.P.	Remarks
1st Semester								
CS-111	COMPUTER FUNDAMENTALS	3(2-1)	60.00	34.75	58	C	6.00	
EE-101	CIRCUIT ANALYSIS	43-1)	80.00	62.00	78	B+	13.2	
EE-112	WORKSHOP PRACTICE	2(2-0)	40.00	23.50	59	C	4.00	
GS-105	APPLIED CALCULUS	3(3-0)	60.00	42.00	70	B	9.00	
HS-106	ISLAMIC STUDIES	2(2-0)	40.00	29.00	73	B	6.00	
HS-104	COMMUNICATION SKILLS	3(3-0)	60.00	46.00	77	B+	9.90	
	Semester Total:	**17**	**340.00**	**237.25**	**68.89**		**48.10 GPA ->**	**2.83**
2nd Semester								
EE-121	COMPUTER AIDED DRAWING	1(0-1)	20.00	10.00	50	C-	1.70	
EE-125	MECHANICS OF MATERIALS	3(3-0)	60.00	37.00	62	C+	6.90	
EE-126	BASIC ELECTRONICS	4(3-1)	80.00	43.00	54	C-	6.80	
HUM-127	PAKISTAN STUDIES	2(2-0)	40.00	32.50	81	A	7.40	
MTH-123	LINEAR ALGEBRA	3(3-0)	60.00	39.00	65	B-	8.10	
MGE-124	ENGINEERING MANAGEMENT	3(3-0)	60.00	47.00	78	B+	9.90	
PHY-122	APPLIED PHYSICS	4(3-1)	80.00	60.00	75	B+	13.2	
	Semester Total:	**20**	**400.00**	**268.50**	**66.43**		**54.00 GPA ->**	**2.70**
3rd Semester								
CSE-234	OBJECT ORIENTED PROGRAMMING	4(3-1)	80.00	44.00	55	C	8.00	
EE-236	ANALOG ELECTRONICS	4(3-1	80.00	45.90	57	C	8.00	
EE-233	ELECTRICAL MACHINES	4(3-1)	80.00	54.00	68	B-	10.8	
MTH-235	DIFFERNTIAL EQUATIONS	3(3-0)	60.00	31.00	52	C-	5.10	
MTH-231	NUMERICAL ANALYSIS	3(3-0)	60.00	45.50	76	B+	9.90	
HUM-232	ENGINEERING ETHICS	3(3-0)	60.00	44.50	74	B	9.00	
	Semester Total:	**21**	**420.00**	**264.90**	**63.59**		**50.80 GPA ->**	**2.42**
4th Semester								
EE-242	DIGITAL LOGIC & DESGIN	4(3-1)	80.00	47.00	59	C	8.00	
EE-243	NETWORK ANALYSIS	4(3-1)	80.00	48.65	61	C+	9.20	
EE-244	SIGNAL & SYSTEM	3(3-0)	60.00	45.00	75	B+	9.90	
MTH-245	COMPLEX VARIABLE & TRANSFORMS	3(3-0)	60.00	32.00	53	C-	5.10	
MGE-241	ENGINEERING ECONOMICS	3(3-0)	60.00	41.00	68	B-	8.10	
	Semester Total:	**17**	**340.00**	**213.65**	**63.24**		**40.30 GPA ->**	**2.37**
5th Semester								
EE-351	ELECTROMAGNETIC FIELD THEORY	3(3-0)	60.00	39.00	65	B-	8.10	
EE352	DIGITAL ELECTRONICS	4(3-1)	80.00	54.50	68	B-	10.8	
EE354	COMMUNICATION SYSTEM	4(3-1)	80.00	57.50	72	B	12.0	
EE355	COMPUTER COMMUNICATION & NETWORK	4(3-1)	80.00	54.50	68	B-	10.8	
MTH353	PROBABILITY &STATISTIC FOR ENGINEERS	3(3+0)	60.00	37.00	62	C+	6.90	
	Semester Total:	**18**	**360.00**	**242.50**	**66.96**		**48.60 GPA ->**	**2.70**
6th Semester								
EE-361	DIGITAL COMMUNICATION	4(3-1)	80.00	46.00	58	C	8.00	
EE-362	LINEAR CONTROL SYSTEMS	4(3-1)	80.00	51.00	64	C+	9.20	

Prepared By:

Checked By:

(Errors and omissions excepted)

Government College University
Faisalabad, Pakistan

TRANSCRIPT

BSc Electrical Engineering in Telecommunication Session 2009- 2013

Name: [redacted]ER **Reg. No:** 2009-GCUF-2084-522

Father Name: [redacted] **Roll No:** 1823

EE-365.	MICROPROCESSOR BASES SYSTEMS	4(3-1)	80.00	49.00	61	C+	9.20	
EE-363.	POWER ELETRONICS	4(3-1)	80.00	57.00	71	B	12.0	
EE-364.	DIGITAL SIGNAL PROCESSING	4(3-1)	80.00	50.00	63	C+	9.20	Repeated
	Semester Total:	**20**	**400.00**	**253.00**	**63.25**		**47.60**	**GPA -> 2.38**

7th Semester

EE-471.	INTRODUCTION TO POWER ENGINEERING	3(3-0)	60.00	35.50	59	C	6.00	
EE-474.	WIRELESS AND MOBILE COMMUNICATION	3(3-0)	60.00	31.15	52	C-	5.10	
EE-472.	ANTENA AND WAVE PROPAGATION THEORY	4(3-1)	80.00	57.00	71	B	12.0	
	Semester Total:	**10**	**200.00**	**123.65**	**60.78**		**23.10**	**GPA -> 2.31**

8th Semester

EE-473	TRANSMISSION AND SWITCHING	4(3-1)	80.00	41.00	51	C-	6.80	
EE-475	ELECTRICAL ENGINEERING PROJ.	6(0-6)	120.00	102.00	85	A	22.2	
EE-483	SATELLITE COMMUNICATION	4(3-1)	80.00	45.00	56	C	8.00	
EE-482	RF AND MICROWAVE ENGINEERING	4(3-1)	80.00	52.00	65	B-	10.8	
EE481	OPTICAL FIBER COMMUNICATION	4(3-1)	80.00	50.00	63	C+	9.20	
	Semester Total:	**22**	**440.00**	**290.00**	**64.00**		**57.00**	**GPA -> 2.59**
	Grand Total:	**145.00**	**2900.00**	**1,893.45**	**65.29**		**369.50**	

Cumulative Grade Point(CGPA) required 2.00, Earned-> 2.55

(Errors and Omissions excepted)

Certified that the candidate has successfully completed his/her degree requirements.

- This transcript is valid when signed by the Additional Controller of Examinations along with official seal.

Prepared By:

Checked By:

Dy. Controller:

Result Declaration Date: 8-11-13

Date Of Issue: 26-11-13.

Serial No.: 66 04.

Additional Controller of Examinations,
G C University, Faisalabad

NATIONAL UNIVERSITY
of Computer & Emerging Sciences
www.nu.edu.pk

Student Name: [redacted] Roll No: 14L-5114
Date of Birth: [redacted]92 Univ. Reg. No: 14L-5114 Degree: MS(EE)

Fall 2014

Code	Course Title	Crd	Pnt	Grd	Rmk
EE506	Advanced Digital Signal Processing	3	2.67	B-	
EE545	Advanced Probability Theory	3		W	
SS310	Research Methodology	1	3.00	B	

Credits Attempted: 4 GPA: 2.75
Credits Earned: 4 CGPA: 2.75

Spring 2015

Code	Course Title	Crd	Pnt	Grd	Rmk
EE516	Power Electronics & Applications	3	3.00	B	
EE524	Speech Processing	3		W	
EE528	Linear Systems	3	2.67	B-	

Credits Attempted: 10 GPA: 2.84
Credits Earned: 10 CGPA: 2.80

Fall 2015

Code	Course Title	Crd	Pnt	Grd	Rmk
EE523	Analog and Discrete Electronics	3	3.33	B+	
EE545	Advanced Probability Theory	3	3.67	A-	

Credits Attempted: 16 GPA: 3.50
Credits Earned: 16 CGPA: 3.06

Spring 2016

Code	Course Title	Crd	Pnt	Grd	Rmk
EE509	Signal Detection & Estimation	3	3.67	A-	
EE521	Optical Communications	3	3.67	A-	
EE591	MS Thesis - I	3	4.00	A	

Credits Attempted: 25 GPA: 3.78
Credits Earned: 25 CGPA: 3.32

Fall 2016

Code	Course Title	Crd	Pnt	Grd	Rmk
EE504	Advanced Wireless Communications	3	3.67	A-	
EE592	MS Thesis - II	3	4.00	A	

Credits Attempted: 31 GPA: 3.84
Credits Earned: 31 CGPA: 3.42

CGPA Required: 2.50 Credits Required 31 Credits Transferred 0
CGPA Earned: 3.42 Credits Earned: 31
Degree Status Completed Credits Completed: 31

August 14, 2017

NATIONAL UNIVERSITY
of Computer & Emerging Sciences
Islamabad

Controller Examinations

TO BE THE TRUE COPY

ATTESTED

FARZANA LATIF CH.
Advocate High Court
Notary Public Chamber # 86-A
District Courts, Sahiwal

NOTARY PUBLIC
No:.....
Date: 27 JAN 2018
District Courts, Sahiwal

* If you cannot submit a graduation certificate(degree certificate) because you are currently enrolled, please submit a certificate of expected graduation or a certificate of enrollment.
* Submit the certificate with notarization or Apostille (Consular confirmation).

بِسۡمِ اللّٰہِ الرَّحۡمٰنِ الرَّحِیۡمِ

Government College University

Faisalabad, Pakistan

On the recommendations of the Faculty,
by virtue of the authority vested in it,
the University confers upon

[redacted]

the degree of

BSc
Electrical Engineering in Telecommunication
Session 2009-2013

with all the rights, honours and privileges pertaining thereof,

He/She Obtained Cummulative Grade Point Average of 2.55 / 4.00

Controller of Examinations

Vice Chancellor

Chancellor

Serial # 033179

Date November 08, 2013

Reg. # 2009-GCUF-2084-522

*** If you cannot submit a graduation certificate(degree certificate) because you are currently enrolled, please submit a certificate of expected graduation or a certificate of enrollment.**
*** Submit the certificate with notarization or Apostille (Consular confirmation).**

بسم الله الرحمن الرحيم

National University of Computer & Emerging Sciences

This is to certify that

[redacted]

has been admitted to the degree of

Master of Science (Electrical Engineering)

With all the honours, privileges, and responsibilities pertaining thereto.

Awarded in the city of Islamabad on the Thirteenth day of June in the year 2017.

Rector

Chancellor

14L-5114

17-1387

UNIST

Study Plan and Personal Statement

□ 1. Name □ 2. Application Number

□ 3. Scholarship Scholarship(Government or UNIST) (●)
Other Scholarship(Company, Institute, Yourself, etc.) ( )

□ 4. Degree Proposed Master ( ) Master-Doctor ( ) Doctor (●)

□ 5. Application Unit Electrical Engineering (Details:)

□ 6. Colleges/Universities Attended

	University	Major	Dates Attended	GPA/Scale
Bachelor	Government College University Faisalabad	Electrical Engineering	2009/09/05	2.55/4.0
Master	National University of computer and emerging sciences	Electrical Engineering	2014/08/25	3.42/4.0
Doctor				

□ 7. Research Achievements

No.	Author	Title	Journal	Date Issued
1				
2				
3				

□ 8. Preferred study field in detail

I want to apply for Electrical Engineering specializing in Telecommunications. My proposed research topic is ~~WWW~~"Fading due to scintillation and pointing error on an optical wireless multiple input multiple output channel~~WWWWWWW~~" and the role of machine learning algorithms in the domain of free space optical wireless multiple input multiple output communication.

□ 9. Study Plan

Although Optical wireless communication (OWC) has attractive advantages over radio frequency (RF) communication, but the main drawback of OWC is the loss of optical energy due to gas molecule, vapor, pollutants, dust, fog and other particles present in the atmosphere which create irradiance fluctuations in the received signal. Therefore, OWC communication is severely impacted by scintillation due to atmospheric turbulence and pointing errors due to misalignment. These fading effects can be reduced by using multiple input multiple output optical wireless channel.

Therefore, I shall be looking To derive the closed-form expression for the probability of outage of an optical wireless(OW) Multiple in put multiple output (MIMO) channel with fading due to scintillation caused by turbulent conditions of atmosphere and pointing error owing to misalignment due to structure sways. The closed form results for the probability of outage of an OW MIMO channel has never been derived by using the joint distribution of scintillation and pointing error. Therefore, this research will be a design guide to model an OW MIMO channel in terms of probability of outage.

Moreover, I shall compute the probability of outage of a MIMO optical wireless channel both by using Mupad and Monte Carlo simulations and by setting different values of large scale turbulent cells alpha, small scale turbulent cells beta and pointing error parameter xi. Furthermore, I am also quite enthusiastic to determine closed form expressions for Ergodic capacity of a proposed MIMO channel and to apply Machine learning algorithms like (Linear Regression and Decision Trees)in the domain of free space optical wireless communication (OWC). There are numerous implementation issues in the OWC systems, such as signal dependent properties of OWC channels from non-trivial challenges both in modulation and demodulation of optical signals. However, such issues can be best resolved by using deep learning algorithms. Furthermore, a very little research has been done to model OWC systems by using machine learning techniques. Therefore, I am deeply interested in using Machine Learning techniques in the domain of optical wire-
less communication.

□ 10. Personal Statement

I have a passion for electrical engineering and working with professionals to improve their quality of life through support and communication. One of my main goals is to develop my knowledge of ₩"Optical Wireless Communication₩" and promote employee wellness programs. Within the next 10 years, I hope to move into a position as a professional researcher in a well reputed research institution where I can implement innovative research ideas. I am reliable, enthusiastic, and possess a 'can do attitude'. I have an inclination to learn and grow under diversified experience, which I feel is my strong point. This is also evident from my qualifications and projects tackled at the graduate level. On the other hand, my career vision is to be able to become a professional researcher at an international level. However, I am certain that if I did not finish off my professional degrees I could never have the chance to attain my career goals. I have decided that I will achieve a career as a doctoral international researcher since my passion has always been helping others and trying to enhance their quality of knowledge. Therefore, I think that hunting such a career will give me the opportunity to help increase the community₩'s research quality and learn about the quality research requirements. Moreover, I have the ability to absorb the incoming hardships in a most professional manner. I can accumulate new ideas and I have the ability to solve complex mathematical problems in a very efficient way which is certainly the most basic requirement of a well-known researcher. After becoming a certified doctoral engineer, I want to continue my Doctoral research from an advanced institution like university of science and technology in Korea. It will definitely help me a lot to acquire the extensive knowledge regarding my core research direction ₩"Free Space Optical Wireless Communication₩". Furthermore, I want to donate back to

underserved students in Pakistan that grapple every day to survive in the domain of optical wireless communication and who do not have ample access to advance instruments in this particular domain.

After the completion of my doctoral research, I shall like to serve in Korea as a post-doctoral research fellow. I have a clear picture of where I will be in the next 10 years, and I know this degree is going to help me get there. Moreover, I shall perform my services as Assistant Professor after coming back to my homeland. I have a have a strong belief that this Doctoral Program will provide me a great chance to get in touch with modern optical wireless systems which will allow me to globalize the Telecommunication industry at my homeland. Korea and Pakistan have very friendly relationships at an international level. Therefore, my family fully supports my choice for Korea being my choice for Korea being my preference for Doctoral studies. Concluding it, with high hopes I believe this application will receive your favorable consideration.

*** When applying for admission, you must submit the designated official English score.**

*** If you are a native speaker of English, or if you have completed 100% of your degree course in English(submission of proof is required), you may be exempted from submitting an official English score.**

IELTS™

Test Report Form

ACADEMIC

NOTE *Admission to undergraduate and post graduate courses should be based on the ACADEMIC Reading and Writing Modules. GENERAL TRAINING Reading and Writing Modules are* ***not*** *designed to test the full range of language skills required for academic purposes. It is recommended that the candidate's language ability as indicated in this Test Report Form be re-assessed* ***after two years*** *from the date of the test.*

Centre Number	PK011	Date	12/AUG/2021	Candidate Number	005697

Candidate Details

Family Name	[redacted]
First Name	[redacted]
Candidate ID	[redacted]
Date of Birth	
Sex (M/F)	M
Scheme Code	Private Candidate
Country or Region of Origin	
Country of Nationality	[redacted]
First Language	[redacted]

Test Results

Listening	Reading	Writing	Speaking	Overall Band Score	CEFR Level
6.5	6.0	6.0	7.0	6.5	B2

Administrator Comments

Centre stamp

British Council
Lahore PK011
www.britishcouncil.org.pk

Validation stamp

VALIDATION STAMP
IELTS
CAMBRIDGE ESOL/BRITISH COUNCIL/IDP

Administrator's Signature

Date: 24/08/2021

Test Report Form Number: 21PK005697TANM011A

BRITISH COUNCIL idp Cambridge Assessment English

The validity of this IELTS Test Report Form can be verified online by recognising organisations at http://ielts.ucles.org.uk

* As an example of a certificate that the degree course was taught in English, in order to be exempted from submitting an official English score, the following certificate must be officially issued and submitted by the school.

Central Queensland
UNIVERSITY

17 MARCH 2008

Student Reference No:

Unit 8/16-17 Alexandra Pde
Rockdale
NSW 2216 Australia

(SAMPLE)

To Whom It May Concern - Notification of Completion

This letter is to advise that on March 07, 2008, , born the completed the requirements for the award of Master of Accounting from Central Queensland University with an award conferral date of

The Master of Accounting is a Postgraduate award studied over 2 Years (104 weeks) of full time study.

was enrolled as a full-time International Full Fee paying student at the Sydney campus of Central Queensland University. All courses studied under this program were conducted in English.

commenced study in the Master of Accounting program on

Yours sincerely

Manager
Student Administration

UNIST

Letter of Disclosure Agreement

To whom it may concern
This letter is to confirm that I attended NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES LAHORE, PAKISTAN

I have applied to **UNIST, Republic of Korea, for the 2022 academic year** and have agreed to allow **UNIST** to officially request my academic records from previously attended schools. In this regard, I would like to request your full assistance when UNIST contacts you regarding verification of enrollment and transcripts.

School Name	National University of Computer and Emerging Sciences Lahore, Pakistan
Student Name	
Major	Electrical Engineering
Date of Birth	1992/01/03
Date of Admission	2014/08/25
Date of Graduation	2017/06/13

□ Date : 31/03/2022 (dd/mm/yyyy)

□ Name :

* 'Additional documents' is to selectively submit documents that are judged to prove your excellence in research or learning, such as Thesis data, Research reports, Awards(Prizes), Recomendation letters, and Patents, as additional documents.

Department of
Electrical Engineering

NATIONAL
UNIVERSITY
of Computer & Emerging Sciences

Reference Letter for

Dear Sir/ Madam,

I am writing to recommend admission in your esteemed institution. I have known Farrukh for 3 years, and I have taught him the subjects of "Advance Wireless Communication" and "Optical Communications". I was also the committee member for his research thesis.

It should go without saying that he is a remarkable talent, he would be a good catch for any department and I urge you to consider his candidacy seriously.

has always taken his role seriously and is passionate about his results. Beyond his passion on driving performance, Farrukh is a good researcher and fights hard for his beliefs. He's at his best in a group environment and is consciously proactive at getting full involvement of all other team members to derive the best results possible.

I have the deepest personal and professional respect for and sincerely belief he will bring his unique energy, optimism, passion, and tireless creativity to institution. He has my highest endorsement. If you have any questions about this recommendation or my endorsement of lease contact me at ok.

Sincerely,

Fessor

Department of
Electrical Engineering

NATIONAL
UNIVERSITY
of Computer & Emerging Sciences

Fax : 92 42 35[illegible] 5232

Reference Letter for M

Dear Sir/ Madam,

It gives me immense pleasure in recommendir _ for the PhD program at your venerated institution. I have known him for three years when he first enrolled in master's program at "National University of Computer and Emerging Sciences". In 2014, I taught him the course of "Advanced Digital Signal Processing". He has shown the motivation, intelligence, preserving nature and analytical aptitude for graduate study.

Farrukh's attendance and his presence of mind has been a key part of his study program. Moreover, he has contributed effectively while working as a part of the team. As a team worker, he balanced competing needs with humor and professionalism.

In my view, Farrukh stands among with my best students. I am sure, he will make an outstanding performance at her PhD studies. I strongly recommend him for admission to a PhD program at your esteemed university. I also strongly recommend him for a position as research assistant. If you would like further information about Farrukh's recommendation, I may be contacted at amjad.hussain@nu.edu.pk.

Sincerely,

[illegible]-017

Dr. Amjad Hussain
Professor and [illegible]
National University of Computer & Emerging Sciences
Pakistan

Research Proposal or Study Plan

M [redacted] and my major is Electrical Engineering. I had completed my post graduate studies in Electrical Engineering specialized in Telecommunications from "National University of Computer and Emerging Sciences", Pakistan in June 2017. I attained a "Cumulative Grade Point Average (CGPA)"of 3.42 out of 4. During my post graduate studies, I was actively involved in numerous curricular and extra-curricular activities. In fact, I was academically efficient and esteemed in the top 10 out of 80 students in my post graduate class. If observed by the perplexing efforts, I remained very proficient and I had passed all entrance tests organized by the academic institutions of my education with high acquisition and secured overall 3rd place during my graduate studies. Since the beginning of my undergraduate studies, Information and Telecommunication has been a subject that fascinated me with its power of applications. The subjects that I have studied include "modern information theory, multimedia analysis and retrieval, broadband multimedia information processing and transmission, optical wireless communication, transmission and switching, digital signal processing, advance probability theory, analog and digital communication, signal estimation and detection, C++ and object oriented programming ".

Moreover, I performed my post graduate dissertation on "Fading due to scintillation and pointing error on an optical wireless multiple input multiple output (MIMO) channel". Although Optical wireless communication (OWC) has attractive advantages over radio frequency (RF) communication, but the main drawback of OWC is the loss of optical energy due to gas molecule, vapor, pollutants, dust, fog and other particles present in the atmosphere which create irradiance fluctuation in the received signal[1][2][3][4]. Therefore, OWC communication is severely impacted by scintillation due to atmospheric turbulence and pointing errors due to misalignment[5]. Scintillation and pointing error cause fading effects in OWC. These fading effects can be reduced by using multiple input multiple output optical wireless channel[6][7][8]. In order to mitigate the effects of scintillation and pointing error, I am looking forward to derive the closed form expressions for the probability of outage and bit error rate (BER) of a 2×1 optical wireless MIMO channel. The closed form results for the probability of outage of an OW MIMO channel has never been derived by using the joint distribution of scintillation and pointing error. Therefore, In my Doctoral research, I shall apply an analytical technique to model an optical wireless MIMO channel both in terms of probability of outage and BER. Probability of outage is the probability of output signal to noise ratio (SNR) falls below a certain threshold level. It occurs when instantaneous error probability exceeds a specified value[10]. While bit error rate is the ratio of the number of error bits divided by total number of transmit bits. BER has no specific units and it is often expressed as a percentage. The proposed MIMO system is shown in the diagram below.

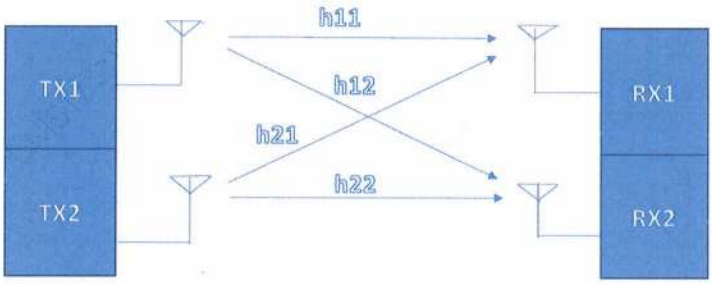

Figure 1: Proposed Optical Wireless MIMO channel

Where TX1, TX2 are the transmitted signals. While, h11, h12, h21, h22 are the corresponding channel gains and RX1, RX2 are the received signals.

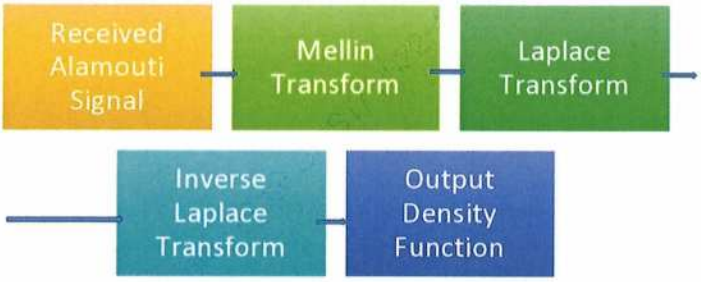

Figure 2: Proposed scheme to model MIMO channel

The received modified Alamouti signal in terms of on-off keying (OOK) Modulation schemes is given by [10][11],

$$\widetilde{y} = (h_{11}^2 + h_{12}^2)x + \widetilde{N} \tag{1}$$

Where h_{11}^2 and h_{12}^2 are the channel responses of a 2×1 MIMO FSO channel. x represents the transmitted signal and $\widetilde{N}$ is the additive white Gaussian Noise (AWGN). h_{11} has the density function $f(h_{11})$. But the received signal contained the square of h_{11} and h_{12}. Therefore, Mellin transform is applied to find $f(h_{11})^2$ and $f(h_{12})^2$. Where $f(h_{11}^2 + h_{12}^2) \sim g(X)$. The Laplace transform for the received density function is computed.

$$\pounds[f(h_{11}^2 + h_{12}^2)] = \pounds f(h_{11}^2)\pounds f(h_{12}^2) = \pounds[g(X)] \tag{2}$$

Then the inverse Laplace transform of $g(X)$ is applied to compute the cumulative density function (CDF) for the probability of outage $F(X \leq X_{TH})$. Where X_{TH} is the normalized Threshold (Ptn) in decibels (dB).

$$F(X \leq X_{TH}) = \pounds^{-1}[\frac{1}{s}\pounds[g(X)]] \tag{3}$$

The joint Probability density function (Pdf) of scintillation and pointing error is given by [9],

$$f_X(x) = \frac{\alpha_i^2\beta_i^2\xi_i^2}{\Gamma(\alpha_i)\Gamma(\beta_i)} G_{1\,3}^{3\,0}\left(_{\xi_i^2-2,\alpha_i-2,\beta_i-2}^{\xi_i^2-1} \middle| \alpha_i\beta_i\sqrt{x}\right) \tag{4}$$

Where $G_{p,q}^{m,n}(.)$ is the Meijer-G function. α represents large scale turbulent cells and β denotes small scale turbulent cells. While, $\Gamma(.)$ is a gamma function and ξ is a pointing error parameter. During my Doctoral studies, I am interested to apply the proposed scheme on joint density function $f_X(x)$ to comupte the Cumulative distribution function (CDF) for the probability of outage of a free space optical wireless MIMO channel.

I shall compute the probability of outage of a MIMO optical wireless channel both by using MuPad and Monte Carlo simulations and by setting different values of large scale turbulent cells α, small scale turbulent cells β and pointing error parameter ξ.

Furthermore, I am also quite enthusiastic to determine closed form expressions for Ergodic capacity of a proposed MIMO channel and to apply Machine learning algorithms like (Linear Regression and Decision Trees)in the domain of free space optical wireless communication (OWC)[12]. There are numerous implementation issues in the OWC systems, such as signal dependent properties of OWC channels from non-trivial challenges both in modulation and demodulation of optical signals. However, such issues can be best resolved by using deep learning algorithms. Furthermore, a very little research has been done to model OWC systems by using machine learning techniques. Therefore, I am deeply interested in using Machine Learning techniques in the domain of optical wireless communication[13][14].

Finally, I am looking forward to apply for the scholarship program in Communication and Media Engineering from Ulsan national institute of science and technology of in Korea and it is evident from my research work and current job position that I have a vast knowledge about the practical applications of Electrical Engineering . This caught my attention towards a "Ulsan national institute of science and technology Scholarship "and created a thirst of knowledge in me to study my chosen program in South Korea. It is my ultimate desire to work in an international field related to Electrical Engineering. Therefore, I shall prefer to gain more deeper practical knowledge in managing most innovative projects. I hope to be able to take part in maximizing the research of my country in the

field of Telecommunication Engineering. Moreover, I shall perform my services as Assistant Professor after coming back to my homeland. I have a strong belief that this Scholarship Program will provide me a great chance to get in touch with modern Telecommunication systems which will allow me to globalize the industry at my homeland.

Last but not the least I am completely committed to continue my research from the well renowned universities in South Korea. Therefore, it is my very humble request to take my application into consideration and grant me a suitable scholarship position under "Ulsan national institute of science and technology scholarship program ".

With Warm Regards,
Muhammad Farukh Tanveer

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