Project Title

A Project Report submitted to the

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By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

JAHANGIRNAGAR UNIVERSITY

DECEMBER 2015

Abstract

Write your abstract here…………

Declaration

The research work entitled “**PROJECT TITLE**” has been carried out in the Department of Computer Science and Engineering, Jahangirnagar University is original and conforms the regulations of this University.

I understand the University’s policy on plagiarism and declare that no part of this project has been copied from other sources or been previously submitted elsewhere for the award of any degree or diploma.

 (Candidate)

**Counter Signed by**

 (Supervisor)

Acknowledgement

Write your acknowledgement here…….

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# **List of Symbols**

|  |  |
| --- | --- |
| ***Symbol*** | ***Description*** |
| $$H$$ | Random MIMO Channel Matrix |
| $$E \{.\}$$ | Expectation |
| $$(.)^{+}$$ | Hermitian Transposition  |
| $$E\left[ trace\left(H^{+}H\right)\right]$$ | Expectation of the trace of complex channel matrix (H+H) |
| $$E\left[trace\left\{\left(H^{+}H\right)^{2}\right\}\right]$$ | Expectation of the trace of complex channel matrix (H+H)2 |
| $$E\left[x^{k}\right]$$ | kth Moment of the MIMO Channel |
| $$\frac{E\_{b}}{N\_{0 min}}$$ | Minimum Normalized Transmit Energy per Information Bit |
| $$\frac{E\_{b}}{ N\_{0}}$$ | Normalized Transmit Energy per Information Bit |
| $$S\_{0}$$ | Wideband Slope |
| $$R\_{c}$$ | Code Rate in bits/s/Hz |
| $$C\left(\frac{E\_{b}}{N\_{o}}\right)$$ | Shannon’s capacity function with respect to Eb/N0 |
| $$ μ$$ | Mean of Gaussian random variable |
| $$ σ$$ | Standard deviation |
| $$ λ$$ | Scale Parameter |
|  **m** | Shape Parameter |
| $$ Γ\left(x\right)$$ | Gamma function |
| $$ γ\_{av}$$ | Ratio of shape and spread parameter |
|  **k** | Constant |

# **List of Algorithms**

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Chapter 1

Introduction

Write intro here [1]. Write intro here.

* 1. **Testing**
		1. **Testing**

Each figure must be referred in literature like ‘fig. 1.1.’. All figures and graph must be in gray scale except some special cases.



**Fig. 1.1** Performance of wireless channel under awgn environment taking service time as a parameter

The figure must be numbered like above with title. The figure should be referred in literature like, ‘the profile of throughput and security level is shown in fig.1.1’. All figures and graph must be in gray scale except some special cases.

TABLE 1.1

Units for Magnetic Properties

|  |  |  |
| --- | --- | --- |
| Symbol | Quantity | Conversion from Gaussian andCGS EMU to SI a |
| Φ | magnetic flux | 1 Mx → 10−8 Wb = 10−8 V·s |
| *B* | magnetic flux density,magnetic induction | 1 G → 10−4 T = 10−4 Wb/m2 |
| *H* | magnetic field strength | 1 Oe → 103/(4π) A/m |
| μr | relative permeability | μ → μr |
| *w, W* | energy density | 1 erg/cm3 → 10−1 J/m3 |
| *N, D* | demagnetizing factor | 1 → 1/(4π) |

Table must have both number and title and must be mentioned in literature. All tables, graphs and figures must be centered.

10 points

12 points

The following Equations:

  (1.1)

All mathematical variables must be in italic, vectors and matrix in bold phase in the literature. Equations must be left aligned but their numbers must touch the right end of the lines. All characters in literature must be in Times New Romans 12 points font and subscripts/superscripts in 10 pints font.

Chapter 2

Literature Review

Write review here [1]. Write review here.

* 1. **Testing**
		1. **Testing**

References

1. W. K. Chen. *Linear Networks and Systems*. Belmont, CA: Wadsworth, 1993, pp. 123-35.
2. J. E. Bourne. “Synthetic structure of industrial plastics,” in *Plastics*, 2nd ed., vol. 3. J.Peters, Ed. New York: McGraw-Hill, 1964, pp.15-67.
3. G. Pevere. “Infrared Nation.” *The International Journal of Infrared Design*, vol. 33, pp. 56 - 99, Jan. 1979.
4. D. B. Payne and H. G. Gunhold. “Digital sundials and broadband technology,” in *Proc. IOOC-ECOC*, 1986, pp. 557-998.
5. B. Brandli and M. Dick. “Engineering names and concepts,” presented at the 2nd Int.Conf. Engineering Education, Frankfurt, Germany, 1999.
6. M. Duncan. “Engineering Concepts on Ice. Available online: www.iceengg.edu/staff.html, Accessed on Oct. 25, 2000.
7. S. Mack. “Desperate Optimism.” M.A. thesis, University of Calgary, Canada, 2000.