Detailed Syllabus

Course Code	17M15EC114	Semester 9th	Semester 9th Session 2022- 2023 Month from: June 2023 – July 2023
Course Name	ECE DESIGN AND SIMULATION LAB -2		
Credits	1	Contact Hours	
Faculty (Names)	Coordinator(s)	Dr Rahul Kaushik	
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understand and Analyze the path loss exponent for wireless communication.	Analyzing Level (IV)
CO2	Design an efficient communication system having adequate signal strength for base station	Applying Level (Level III)
CO3	Analyze the frequency reuse and handover probability for a given wireless communication system.	Applying Level (Level III)
CO4	Simulate the various performance metrics of the wireless communication system.	Analyzing Level (IV)

Module No.	Title of the Module	List of Experiments	CO
1	Introduction to Modelling of Wireless Channel	1. To understand the path loss prediction formula and Calculation of received signal strength as a function of distance of separation, antenna height and carrier frequency. **To understand the impact of :-** a) Transmitter Power, b) Path loss exponent, c) Carrier frequency, d) Receiver antenna height, e) Transmitter antenna height.	CO1
		2. Calculation of path loss exponent and variance of shadow fading.	CO1

2	Wireless Communication System Optimization	3. To find the 3dB beam-width of a base station antenna. (a) To study the horizontal beam pattern of tl Base Station antenna and calculate tl beamwidth for horizontal beam pattern (b) To study the vertical beam pattern of tl Base Station antenna and calculate tl beamwidth for vertical beam pattern	CO2
		4. To calculate the probability that the received signal level crosses a certain sensitivity level.	CO2
		5. To understand the concept of co-channel interference and hence Signal to Interference and Noise Ratio**.** **A.Downlink:** To calculate & plot SINR vs. distance at the Mobile Station for adaptation of the following parameters, (a) Shadowing effect, (b) Vertical Beam Pattern, **B.Uplink:** To calculate & plot SINR vs. distance at the base stations for different distance of two mobile stations from the base stations and different separation between them for adaptation of the following parameters, (a) Shadowing effect, (b) Vertical Beam Pattern,	CO2
		6. Understanding the impact of many different parameters influence the downlink C/I ratio. (a) Cell radios, (b) Tx power of B.S, (c) Frequency reuse, (d) Sectoring, (e) Shadowing effect, (f) B.S. height, (g) Path loss exponent, (h) Vertical beam tilt	CO2
3	Capacity Improvement Techniques	7. To understand the cellular frequency reuse concept fulfilling the following objectives: (a) Finding the co-channel cells for a particular cell. (b) Finding the cell clusters within certain geographic area**.**	CO3

		8. To study the effect of handover threshold and margin on SINR and call drop probability and handover probability	CO3

4	Analysis of various performance metrics of the wireless communication systems.	9. To study the outage probability, LCR & ADF in SISO for Selection Combining and MRC.	CO4
		10. To study the effect of delay spread on frequency selectivity.	CO4

Project Based Learning: ECE DESIGN AND SIMULATION LAB -2 is a lab course designed for integrated students. The course provides a thorough knowledge about various aspects of wireless communications system (WCS). This includes understanding and analysing the impact of various performance parameters on a designed WCS. Thus, students are provided a wide scope to do their projects in different modules of the course. The projects can be taken towards designing an efficient WCS. This includes optimization of various parameters like receiving and transmitting antenna height, transmitting power, estimating handoff probability to avoid call drop and to study outage probability, LCR & ADF in SISO for Selection Combining and MRC.

Evaluation Criteria

Components	Maximum Marks
Mid Viva	20
End Viva	20
TA	60
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.
(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1	T. Rappaport, “Wireless Communication” prentice-hall, 2002.
2.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.
3	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
4.	D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber Optic Communications, Pearson Education, 2005.
5.	Journal articles i.e. IEEE, Springer, IOPscience, Elsevier and Video lectures from nanohub, NPTEL, MIT video lectures
6.	http://fcmcvlab.iitkgp.ac.in/http://vlabs.iitkgp.ernet.in/fcmc/#

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC411	**Semester** Summer **(specify Odd/Even)**	**Semester** IX **Session** 2022-2023 **Month from** (June)
Course Name	Introduction to IOT		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Verma (62)
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-7.1	**Outline the basic concepts of IOT with networking and protocol considerations in IOT scenario.**	Understand (C2)
C434-7.2	**Identify various IOT hardware platforms and their utilization with various sensors and actuators.**	Apply (C3)
C434-7.3	**Experiment the basic concepts of python programming and make use of them in image processing, data analytics and machine learning applications.**	Apply (C3)
C434-7.4	**Examine various case studies and cloud platforms in an IOT scenario for monitoring, control and analysis.**	Analyze (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	IOT Basics and its Importance	Introduction to IOT (People Connecting to Things, Things Connecting to Things, Definition of IOT, History of IOT), IOT Components (Sensors & Actuators, Things, Communications, Networks, The Internet, Protocol Stack), Evolution of Connected Devices, IOT Applications, IOT Companies, Baseline Technologies (Machine to Machine (M2M) Communication, Cyber Physical Systems (CPS), Web of Things (WOT)), Address Crunch in IOT, IOT Terminologies (IOT Node, LAN, MAN & WAN, IOT Gateway & Proxy), IOT Network Configuration (Gateway Prefix Allotment, Impact of Mobility on Addressing, Concept of Tunneling, Multi-homing), IPv4 Versus IPv6.	6
2.	Basics of IOT Networking	Introduction to IOT Networking, Networking Standards and Technologies (Network Access & Physical Layer, Internet Layer, Transport Layer, The application layer), IOT Networking Protocols, Network Access and Physical layer IoT Network Technologies ((LPWAN (Low Power Wide Area Network), Cellular, Bluetooth Low Energy (BLE), RFID, NFC, Zigbee, Wifi, Ethernet), Internet layer IoT network technologies (IPv6, 6LoWPAN, and RPL),	6

		Application layer IoT network technologies (HTTP, HTTPS, MQTT, AMQP, and XMPP), IoT networking considerations and challenges, IoT Platforms Capabilities.	
3.	IoT supported Hardware platforms (Arduino) & data visualization using cloud.	Introduction to Arduino (Different Arduino boards, Arduino Uno board description and its pin configuration, Arduino IDE and program uploading, different functions related to GPIOs and special functions (PWM and Serial communication), Interfacing with Arduino using processing language (LED, Switch, Seven Segment, LCD, DC Motor, Relay, IR, LDR and DHT11 sensor), Interrupts, use of simulator and compiler, basics of HTML, Arduino supported IOT modules (Ethernet &Wifi Shield) and their configuration, Monitoring of sensor data on cloud and Web based controlling of actuators.	12
4.	Introduction to Python, Data Analytics, Machine Learning and Case Studies.	Introduction to python, python IDE, Data types, various programming constructs (loops, if, else etc.), operators, functions, modules, data handling (pandas), file operations, Image operations (PIL-pillow), data plotting in python (Matplotlib), basics of machine learning in python (Scikit) and related case studies.	10
5.	IoT supported Hardware platforms (Raspberry pi) & its Applications	Introduction to Raspberry pi (Raspberry pi different model comparison, Pin Configuration, Raspberry Pi operating system choices, Set up your Raspberry pi, Raspbian OS, Remote Access using SSH, Remote Access using TightVNC), Interfacing with Raspberry pi using python and use of open source libraries (LED, Switch, LCD, DC Motor, Relay, IR, LDR and DHT11 sensor), IOT Applications (Water management system, Weather monitoring station on cloud, Smart Agriculture System, Smart Energy meter, Pollution Monitoring system, Smart Dustbin management system.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Attendance & Quiz)
Total	**100**

Project Based Learning Component: This course teaches IoT using a building block approach, which allows one to visualize the requirement of an IoT framework and then to design it efficiently. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. The course will teach IoT based system design using IoT boards, namely Arduino, ESP8266, and Raspberry Pi. The course will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols. It will also teach effective embedded programming techniques in python with application to image processing and Machine Learning. It will have a significant practical component, which will be achieved by providing real time demonstrations of various case studies based on IoT.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2.	"Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti (Universities Press)

Detailed Syllabus

Course Code	20B12EC415	**Semester** Summer **(specify Odd/Even)**		**Semester IX** **Session** 2022 -2023 **Month from** January to June	
Course Name	Network Security				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	P C Gupta			
	Teacher(s) (Alphabetically)	P C Gupta			

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-4.1	At the completion of the course, students will be able to understand the security requirements of networked information systems and general principles of cryptography.	Understanding (C2)
C434-4.2	At the completion of the course, students will be able to apply above concepts for understanding security mechanisms used for network access, message confidentiality, message authentication non-repudiation.	Applying (C3)
C434-4.3	At the completion of the course, students will be able to apply the above security mechanisms to understand of standard security protocols used in the IP network.	Applying (C3)
C434-4.4	At the completion of the course, students will be able to analyze a) network vulnerabilities to adversarial attacks/intrusions, and b) security solutions for preventing such attacks/intrusions.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Security concepts and terminology	General security concepts, need for security & security mechanisms	2
2.	Symmetric-key & Asymmetric-key Cryptosystems	(a) Classical encryption methods (b) Mathematical foundations I – Modular arithmetic (c) Block ciphers, DES, 3 DES, AES (d) Modes of operation of block ciphers (e) Stream ciphers, RC4 (f) Mathematical foundations II – Finite fields (g) Asymmetric-key cryptography, RSA, ElGamal (h) Elliptic curve cryptography	14
3.	Message Authentication & Digital Signatures	(a) Content integrity verification, hash functions, SHA (b) Message Authentication Code (MAC), (c) HMAC, CMAC (d) Digital signature, RSA and ElGamal, applications of digital signatures	3
4.	Key Distribution	(a) Symmetric-key distribution, Diffie-Hellman key exchange, (b) Key Distribution Centre (KDC) (e) Public Key distribution, Digital certificates, X.509, Certification Authority (CA), Public Key Infrastructure	2

5.	Entity Authentication & Security for Remote Access	(a) Fixed and one-time passwords, authentication based on challenge-response. (b) Kerberos (c) PPP, PAP, CHAP, EAP protocols, RADIUS	3
6.	Security at the Transport and Network Layers	(a) Security at the IP layer, VPN, IPsec, AH, ESP protocols (b) Security at the Transport layer, TLS protocol	6
7.	Security in Wireless Networks	(a) Architecture of wireless LAN (b) WEP, RSN protocols	2
8.	Network Vulnerabilities & Malware	(a) IP attacks, TCP attacks, DOD & DDOS attacks (b) Firewalls – packet filtering, stateful inspection, proxy, circuit level (c) Intrusion Detection Systems (IDS) (d) Malware	7
9.	Security at the Application Layer	(a) Secure Electronic Transaction (SET) (b) Email security, SMIME, PGP	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA (Assignment, Quiz, Participation)	25
Total	**100**

Recommended Reading material: (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	Gupta, Prakash C., *Cryptography and Network Security*, PHI, 2014
2.	Stallings W., *Cryptography & Network Security*, 6th Ed., Pearson, 2014
3.	Forouzan, BA., *Cryptography & Network Security*, 3rd Ed., McGraw-Hill, 2015

Course Description

Course Code	**18M11GE111**	**Semester** Summer	**Semester** IX **Session** 2022-23 Summer **Month from** June 2023 -July 2023
Course Name	Research Methodology & Intellectual Property Rights		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**	Prof. B.P. Chamola, Dr. Yogesh Gupta	
	Teacher(s) (Alphabetically)	Prof. B.P. Chamola, Dr. Yogesh Gupta	

COURSE OUTCOMES:		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C101.1	explain the basic concepts and types of research	Understanding Level (C2)
C101.2	define a research problem, its formulation, methodologies and analyze research related information	Analyzing Level (C4)
C101.3	explain research ethics, understand IPR, patents and their filing related to their innovative works.	Understanding Level (C2)
C101.4	explain and analyze the statistical data and apply the relevant test of hypothesis in their research problems	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Research	What is research? Types of research. What is not research? How to read a Journal paper?	3
2.	Report writing	How to write report? Use of Mendeley in report writing. How to write a research paper? Problem identification and solving.	4
3.	Ethics, IPR and Research methodologies	Research ethics, patents, intellectual property rights, plagiarism regulation 2018. Steps in research process and common methodologies to attempt solution to research paper.	8
4.	Basics of statistics and probability distributions	Basic statistical concepts. Handling of raw data, Some common probability distributions.	7

5.	Test of hypothesis and regression analysis	Hypothesis testing. Parametric and non-parametric data, Introduction to regression analysis.	8
		Total number of Lectures (Course delivery method: open ended discussion, guided self-study, lectures)	**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
Assignments	30 (Quiz, Assignments)
Total	**100**

Project based learning: Students divided in small groups will be assigned topics related to patents, intellectual property rights, plagiarism, and statistics. Students can write a report/review paper and find its similarity through plagiarism software available online. Students may collect data and test the relevant hypothesis.They may study some data set and do its regression analysis. The main purpose is to expose students to a wider arena of applicable knowledge of the subject

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Stuart Melville and Wayne Goddard, Research Methodology: An Introduction for Science & Engineering Students, Kenwyn, South Africa: Juta & Co. Ltd., 1996.

Kothari, C.R., Research Methodology: Methods and Techniques, New Age International, New Delhi, 2009.

Kumar, Ranjit, Research Methodology: A Step by Step Guide for Beginners, 2nd Edition, Sage Publications Ltd., 2005.

Ramappa, T., Intellectual Property Rights Under WTO, S. Chand, New Delhi, 2008.

Wayne Goddard and Stuart Melville, Research Methodology: An Introduction, Kenwyn, South Africa: Juta & Co, 2001.