Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ELECTRONICS & TELECOMMUNICATION ENGINEERING

Name of the Course: Final Year B. Tech (Sem.– I & II)

(Syllabus to be implemented from w.e.f. July 2021)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Electronics & Telecommunication Engineering

Programme Educational Objectives and Outcomes

A. Program Educational Objectives

1. To make students competent for professional career in Electronics & allied fields.
2. To build strong fundamental knowledge amongst student to pursue higher education and continue professional development in Electronics & other fields
3. To imbibe professional ethics, develop team spirit and effective communication skills to be successful leaders and managers with a holistic approach.
4. To nurture students to be sensitive to ethical, societal & environmental issues while conducting their professional work.

B. Program Outcomes

Electronics and Telecommunication Engineering Graduate will be able to –

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of t h e engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

C. Program Specific Outcomes

1. Graduates will be able to attain a **solid foundation** in Electronics and Communication Engineering with an ability to function in multidisciplinary environment.
2. Graduates will be able to use **techniques and skills** to design, analyze, synthesize, and simulate Electronics and Communication Engineering components and systems.
3. Graduate will be capable of **developing programs** in Assembly, High level and HDL languages using contemporary tools for software development.

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Science & Technology

Choice Based Credit System (CBCS) Curriculum of

Final Year B. Tech Electronic & Telecommunication Engineering ***W.E.F. 2021-22***

Semester I

Course Code	***Theory Course Name***	***Hrs./week***			***Credit***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET411	Machine Learning	4	---	--	4	30	70	--	100
ET412	Data Communication	4	---	--	4	30	70	--	100
ET413	Internet of Things	4		--	4	30	70	--	100
ET414	Database Management System	3	1	--	4	30	70	25	125
ET415A & ET415B	Elective-II * Image & Video Processing * Wireless Sensor Network	3	1	--	4	30	70	25	125
Sub Total		**18**	**2**	**--**	**20**	**150**	**350**	**50**	**550**
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET411	Machine Learning	--	--	2	1	--	25	--	25	50
ET412	Data Communication	--	--	2	1	--	--	25	25	50
ET413	Internet of Things	--	--	2	1	--	25	--	25	50
ET416	Project Phase I	--	--	4	2	--	--	25	50	75
ET417	Vocational Training	--	--	--	1	--	--	--	25	25
Sub Total		**--**	**--**	**10**	**6**	**--**	**100**		**150**	**250**
Grand Total		**18**	**2**	**10**	**26**	**150**	**450**		**200**	**800**

Abbreviations: L: Lectures, P: Practical, T: Tutorial, ISE: In Semester Exam., ESE: End Semester Exam, ICA: Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Science & Technology

Choice Based Credit System (CBCS) Curriculum of

Final Year B. Tech Electronic & Telecommunication Engineering ***W.E.F. 2021-22***

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credit***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET421	Microwave Engineering	4	--	--	4	30	70	--	100
ET422	CMOS VLSI Design	4	--	--	4	30	70	--	100
ET423A & ET423B	Elective- III * Industrial IOT *Artificial Intelligence and Applications	3	1	--	4	30	70	25	125
ET424A & ET424B	Elective-IV * Network Security * Data Analytics	3	1	--	4	30	70	25	125
Sub Total		14	2	--	16	120	280	50	450
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET421	Microwave Engineering	--	--	2	1	--	--	50	25	75
ET422	CMOS VLSI Design	--	--	2	1	--	50	--	25	75
ET425	Project Phase II	--	--	8	4	--	100	--	100	200
Sub Total		--	--	12	6	--	200		150	350
Grand Total		**14**	**2**	**12**	**22**	**120**	**480**		**200**	**800**

Abbreviations: L: Lectures, P: Practical, T: Tutorial, ISE: In Semester Exam., ESE: End Semester Exam, ICA: Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)

Note –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining student exceeds 7, then a new batch shall be formed.
2. Project group for Final Year B.Tech - Semester I and Semester II shall not be of more than three students.
3. Minimum strength of the students for Elective is 15.
4. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction, attendance for theory and lab sessions as applicable.
5. Project phase-I shall cover Literature survey, Problem statement Identification, and Synopsis submission of proposed work. Student shall submit hard copy of synopsis only after delivering seminar.
6. Project phase-II shall cover Simulation work, Software programming, and Hardware implementation. A hard copy of the final report shall be submitted to the department after successfully completion of project.
7. As per the guidelines of New Education Policy (NEP), the student of final year B.Tech. in Electronics and Telecommunication Engineering (Sem-II) can opt for any one "Employability Enhancement / Skill Development Course" from the list provided by PAH Solapur University, Solapur. This course will be 8 to 12 week duration and it can be taken in self learning mode or by physically attending at the affiliated institute wherever this course is offered. Though this course is not mandatory to any of the student, but the student attending this course will get the certificate from the university after successfully completion of this course. If any of the students could not complete this course within stipulated time then also he/she will be able to receive the regular B. Tech. Degree Certificate.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech. (Electronics& Telecommunication Engineering)

Semester-I

ET411: Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lectures– 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Practical – 2 Hours/week, 1 Credit	**ISE – 30 Marks**
POE – 25 Marks	**ICA – 25 Marks**

This course introduces Machine Learning applications perspective. The course also introduces practical design aspects of Machine Learning Models.

Course Prerequisite:

Student shall have knowledge of programming language like python / R, also fundamentals of probability and Statistics.

Course Objectives:

1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

Course Outcomes:

At the end of this course students will be able to

1. Describe fundamental aspects of Machine Learning.
2. Distinguish between various characteristics of ML
3. Explore classification and regression algorithms
4. Design neural network for classification
5. Design and implement different Machine Learning models.
6. Apply Machine learning techniques that enable to solve real world problems.

Section - I

Unit 1- Introduction to Machine Learning (09)

Basics of Statistics, Introduction of Machine learning, Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Features: Feature types, Feature Construction and Transformation, Feature Selection.

Unit 2- Flavours of Machine Learning (07)

Definition of learning systems, **Types:** Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples, Introduction to Deep Learning, Deep learning vs Machine Learning.

Unit 3- Classification and Regression (08)

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation- Assessing class probability Estimates, Multiclass Classification.

Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.

Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

Section - II

Unit 4- Neural Networks (08)

Introduction, Neural Network Elements, Basic Perceptron, Feed Forward Network, Back Propagation Algorithm, Introduction to Artificial Neural Network.

Unit 5- Machine Learning Models (10)

Linear Models: Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification.

Logic Based and Algebraic Models: Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification,

Rule Based Models: Rule learning for subgroup discovery, Association rule mining,

Tree Based Models: Decision Trees

Probabilistic Models: Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood

Unit 6- Applications of Machine Learning (06)

Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.

Internal Continuous Assessment:

ICA consists of minimum 8 practical based upon above curriculum.

Text books:

1. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.

Reference Books:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar " Foundations of Machine Learning", MIT Press,2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Charu C.Aggarwal,"Data Classification Algorithms and Applications", CRCPress,2014.
6. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press, 2014.
7. Machine Learning Mastery With Python 2016 by Jason Brownlee.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B. Tech (Electronics and Telecommunication Engineering)

Semester-I

ET412: Data Communication

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hrs/Week, 4 Credits	**ISE: 30 Marks**
Practical: 2 Hr/Week, 1 Credit	**ESE: 70 Marks**
OE: 25 Marks	**ICA: 25 Marks**

Course Objectives:

1. To explain need of Data Communications System and network components.
2. To aware students about the layers of the OSI model and TCP/IP with function(s) of each layer.
3. To develop building skills of subnetting and understand routing mechanisms.
4. To introduce students with the different types of network topologies and standards.
5. To acquaint students with the basic protocols of computer networks and how they can be used to assist in network design and implementation.

Course Outcomes:

After completion of this course, student will be able to

1. Explain Data Communications System and its components.
2. Develop building skills of subnetting and understand routing mechanisms.
3. Enumerate the layers of the OSI model and TCP/IP and explain the function(s) of each layer.
4. Identify the different types of network topologies and protocols.
5. Acquaintance with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Section – I

Unit 1- Data Communication and Network (08)

Introduction to Data Communication, Network- Need, Types (LAN, MAN, WAN), Topologies, Layer communication, OSI model, TCPIP Suite, OSI Versus TCP/IP, Network Devices at each layer (RS232, MODEM, Repeaters, Switches, bridges, routers, gateway).

Unit 2- Data Link Layer **(12)**

Framing, Circuit Switching and Packet Switching, Error detection and error correction, Block parity code ,CRC code, Hamming code , Flow control methods- Stop and wait protocol, sliding window protocol, Piggybacking, MAC: Collision oriented and collision based protocols, ALOHA, CSMA, CSMA/CD, CSMA/CA, HDLC, STP Protocol.

Unit 3- Wireless LAN Standards **(04)**

IEEE Standards, IEEE802.3, IEEE802.4, IEEE802.5, USB-OTG, Bluetooth 5.1, 5.2.

Section-II

Unit 4- Network Layer **(08)**

Virtual circuit & datagram approach, Routing- Principle of optimality, shortest path routing, flow based routing, distance vector routing, link state routing routing protocols – shortest path, distance vector routing,link state, ICMP, ARP,RARP.

Unit 5- Transport Layer **(08)**

TCP & IP header format, encapsulation, IPv4 addressing ,IPv6 addressing subnetting& masking, user datagram protocol (UDP) – transmission control protocol (TCP) - three way handshake – congestion & its control,TCP practical applications.

Unit 6- Application Protocols: **(08)**

FTP, DNS, TELNET, HTTP, SMTP, E-mail, DHCP, Case study, Cisco DNA-Center Controller, IBM Virtual Router Appliance (VRA).

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum eight experiments based on the above curriculum. Sample list is provided below.

1. Network Ethernet LAN driver installation and working.
2. Network topologies using CISCO packet tracer.
3. RS 232 based lab sessions-
    a. Character transfer using half duplex and Full duplex mode of operation.
    b. File transfer using serial port.
4. Flow control and error control mechanism using CISCO packet tracer.
5. Implementation of Scrambler and descrambler.
6. IP subnetting and masking in Intranet using CISCO Packet tracer.

7. All network protocol tree model setup in command prompt.
8. Internet application protocol-FTP and DNS.
9. Network analyzer (Protocol analyzer)-wire shark.

Text books:

1. Data communication- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
2. TCP/IP protocol suit- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
3. Computer networks- Andrew S. Tanenbaum.

Reference Books:

1. Internetworking TCP/IP Principal, Protocol and Architecture -Douglas Comer- Wesley
2. TCP/IP Illustrated, The Protocols – W. Richard Slevens, G.Gabrani –PE pub.
3. Data and computer communication – William Stallings. - PE pub.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-II

ET413: Internet of Things

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE - 70 Marks**
Practical – 2 Hour/week, 1 Credit	**ISE - 30 Marks**
POE – 25 Marks	**ICA - 25 Marks**

The Internet of Things (IoT) refers to the system in which different devices equipped with sensors and signal processing are connected through a network to communicate with each other and/or with central servers. This course provides a thorough introduction to the different components of an IoT System. The course also introduces cloud platforms of IoT and different communication protocols. Introduction to Cortex M Series ARM architecture is also a part of this course.

Course Prerequisite:

Student shall have knowledge of microcontroller and interfacing techniques and working of different peripherals.

Student shall have adept knowledge of assembly and C language programming,

Course Objectives:

1. To make student aware of different components of an IoT System
2. To make student learn the architecture of Cortex M3 series ARMmicrocontroller/Raspberry Pi
3. To make student learn interfacing of different peripherals with microcontroller.
4. To make student learn different communication technologies and application protocolsused in IoT.
5. To introduce to student different cloud platforms of IoT.

Course Outcomes:

1. Student can elaborate different components of an IoT System.
2. Student can describe the architecture Cortex M3 series ARM microcontroller/ RaspberryPi.
3. Student can write interfacing program for different applications with ARMmicrocontroller.
4. Student can describe different communication technologies and application protocolsused in IoT.
5. Student can elaborate different cloud platforms of IoT.

Section - I

Unit 1 - Introduction to Internet of Things **(06)**

Introduction to IoT, different components of an IoT system: embedded systems, sensors, communication systems, cloud, applications of IoT in various domains.

Unit 2 – Embedded Systems for IoT **(06)**

Introduction to embedded systems, different components of an embedded system, and basics of microcontroller based embedded systems; basics of Linux based embedded systems, various embedded platforms used in IoT, understanding the various IDEs used for embedded development.

Unit 3 – Development of IoT solution. **(12)**

ARM Cortex- M3 Architecture, registers, memory map, instruction set: data accessing, processing, arithmetic, program flow control etc., Assembly/C programs for interfacing I/O devices like LED's, Switch's, LCD etc.

Introduction to Raspberry Pi, Features, Setting up the hardware and software, python programs for interfacing of raspberry pi.

Section II

Unit 4 – Communication technologies for IoT **(08)**

Basics of the communication technologies like Bluetooth Low Energy (BLE), Zigbee, Wifi, RFID, their architecture, characteristics, limitation, power consumption parameters and applications

Unit 5 – Internet connectivity principles and Application protocols for IoT **(08)**

Internet connectivity, Communication, overview of Protocols: IPv4, IPv6, 6LoWPAN, Basics of application protocols like MQTT and CoAP, their features, framework, message formats, implementations and applications

Unit 6 – Cloud platforms for IoT **(08)**

Cloud architecture for IoT, concepts of application programming interface (API), survey of various IoT cloud platforms, understanding the costing structure of cloud for IoT services, performance metrics for cloud platforms in IoT.

Case study: Smart Cities, Home Automation, Weather Monitoring System.

- **Internal continuous Assessment (ICA)**

ICA shall be based on minimum 8 Experiments from the list mentioned below to be performed using LPC1768 / Raspberry Pi / Simulation software.

1. Installation and initial set up of Hardware.
2. Study of S/W (Operating system)
3. Study of Python IDE for programming in python.
4. Interfacing general purpose I/O devices like LED's, switches
5. Interfacing motors (DC/Stepper/Servo)
6. Reading sensor values and plotting them on the PC / LCD
7. Interfacing of Camera for capturing and storing the image.
8. Data transfer using MQTT & CoAP.
9. Interfacing sensor and sending data to the cloud using Wifi
10. Data Acquisition System
11. Project based on IoT.

- **Text Books**

1. Internet of Things by Raj Kamal
2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu
3. Internet of Things for Architects by Perry Lea
4. Analytics for the Internet of Things (IoT) by Andrew Minteer

- **Reference Books**

1. Internet –of-Things (IoT) System: Architectures, Algorithms, Methodologies by DimitriosSerpanos, Marilyn Wolf
2. MQTT Essentials- A Lightweight IoT Protocol by Gaston C. Hillar
3. Mastering Internet of Things: Design and create your own IoT applications usingRaspberry Pi 3 by Peter Waher.
4. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed byPerry Xiao
5. Raspberry Pi CookBook- Software and Hardware Problems and Solutions by Simon Monk(O'Reilly Media, Inc.,)

- **Recommended Online Free Courseware**

1. Udemy.com
2. Introduction to ARM mbed: playlist on Youtube

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Final Year B.Tech. (Electronics and Telecommunication Engineering)

Semester-I

ET414: Database Management System

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 Credits	**ISE: 30 Marks**
Tutorial: 1Hr/Week, 1 Credit	**ESE:70 Marks**
	ICA: 25 Marks

This course introduces a Data Base Management System, which is the system software for easy, efficient and reliable data processing and management. It covers ER Model, Relational Model, Structured Query Language, Relational Database Design and Concurrency Control techniques.

Course Objectives:

1. To understand the basics of database, structure, design and applications.
2. To design of the database using data modeling concepts such as entity relationship diagrams.
3. To understand and use Structured Query Language to search, update and manage a database.
4. To apply normalization techniques to normalize the database.
5. To familiarize the students with the fundamentals of database transaction processing, techniques for concurrency control and recovery methods.
6. To introduce the concept of Bigdata and NoSQL.

Course Outcomes:

At the end of this course, the student will be able to

1. Design ER models to represent simple database application scenarios.
2. Construct relational tables from ER model, populate relational databases and formulate SQL queries on data.
3. Analyze & improve the database design by applying normalization.
4. Describe database storage structures and access techniques.
5. Elaborate the concept of transaction processing, concurrency control, recovery techniques, Bigdata and NoSQL.

Section– I

Unit 1: Introduction and E-R model **(04)**

Database- System Applications, Purpose of Database Systems, View of data, Database Languages, Database Architectures, Database users and administrators, history of databases system. Overview of design process, E-R Model, Constraints, E-R diagrams, E-R design issues, Weak Entity Sets, Extended E-R features, Reduction to relational schema.

Unit 2: Relational Model **(06)**

Relational Model: Basic structure of relational databases, Database schema, keys, Schema diagrams, Relational Query languages, Relational algebra-Fundamental, Additional and Extended Relational Algebra Operations.

Unit 3: Introduction to SQL **(06)**

Overview, SQL data definition, SQL data types, Integrity constraints, Basic structure of SQL Queries, Types of SQL Commands: DDL, DML, DCL and TCL statements, Basic SQL clauses [select, from, where, group by, having, order by etc.].

Unit 4: Intermediate SQL **(05)**

Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases. Join operations, Views, Integrity constraints, Authorization.

Section-II

Unit 5: Normalization **(05)**

Features of good Relational Designs, Atomic Domains, First Normal Form, Keys and Functional dependencies, Second Normal Form, Boyce-Codd Normal Form, Third Normal Form, Functional dependency theory.

Unit 6: Indexing and Hashing **(05)**

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Static Hashing, Dynamic Hashing, Comparison of Indexing and Hashing, Index definition in SQL.

Unit 7: Transactions and Concurrency Control **(07)**

Transaction concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Testing of Serializability. Concurrency Control - Lock based protocol: Locks, Granting of Locks, Two-Phase Locking Protocol. Time Stamp-based protocols, Deadlock handling.

Unit 8: Recovery System and Introduction to Bigdata and NoSQL **(04)**

Failure Classification, Storage Types, Log-Based Recovery, Shadow paging. Bigdata - What is Bigdata?, Characteristics of Bigdata, NoSQL- What is NoSQL?, Key-Value stores, Document databases.

Internal Continuous Assessment (ICA):

ICA shall consist of minimum 8 assignments based on the syllabus contents. The assignments are not limited to the one mentioned below.

1. For any real life application, draw an E-R diagram and create a data dictionary for the same.
2. Write queries in SQL using DDL and DML commands.
3. Write queries in SQL to demonstrate integrity constraints.

4. Write nested sub queries in SQL using Joins and Set operations.
5. Write queries in SQL to create Views and demonstrate Authorization.
6. Identify set of functional dependencies, find canonical cover and closure of functional dependency.
7. Convert the created database into 1NF, 2NF, 3NF and BCNF

Text books:

1. "Database System Concepts" by Abraham Silberschatz, Henry F. Korth, S. Sudarshan (McGraw Hill International Edition) sixth edition.
2. "Database System Concepts" by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.

Reference Books:

1. Fundamentals of Database systems by Ramez ElMasri, S. B. Navathe (Pearson Education) 5th edition.
2. Database Management Systems by Ramkrishnan Gehreke (Tata McGraw Hill), 3rd edition.
3. Principles of Database Systems by J. D. Ullman (Galgotia Publications)
4. Advanced Database Management System by Rini Chakrabarti, Shilbhadra Dasgupta (Dreamtech Press Publication).

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Final Year B.Tech (Electronics& Telecommunication Engineering)

Semester-I

ET 415A: Elective II - Image & Video Processing

Teaching Scheme:	Examination Scheme:
Lectures – 3 Hours/week, 3 Credits	ESE – 70 Marks
Tutorial – 1 Hours/week, 1 Credit	ISE – 30 Marks
	ICA – 25 Marks

This course covers fundamental notions in image and video processing, as well as covers most popular techniques used, such as edge detection, motion estimation, segmentation, and case studies.

Course Prerequisite:

Student shall have knowledge of Digital Signal Processing

Course Objectives:

1. To describe and performs basic operations on image and video.
2. To design and apply filter on images in spatial and frequency domain.
3. To analyze and implement algorithm for image and video processing application using modern tools.
4. To select and apply appropriate technique for preprocessing, segmentation and feature extraction of images and videos in real time applications.

Course Outcomes:

After successfully completing the course student will able to

1. Describe and performs basic operations on image and video.
2. Design and apply filter on images in spatial and frequency domain.
3. Analyze and implement algorithm for image and video processing application using modern tools.
4. Select and apply appropriate technique for preprocessing, segmentation and feature extraction of images and videos in real time applications.

Section I

Unit 1: Image fundamentals (06)

Image acquisition, sampling and quantization, image resolution, basic relationship between pixels, color images, RGB, HSI and other models

Discrete Fourier Transform, Discrete Cosine Transform, KL Transform

Unit 2: Image Enhancement (08)

Spatial Domain: Point Processing: Digital Negative, contrast stretching, thresholding, gray level slicing, bit plane slicing, log transform and power law transform.

Neighborhood Processing: Averaging filters, order statistics filters, high pass filters and high boost filters.

Frequency Domain: DFT for filtering, Ideal, Gaussian and Butterworth filters for smoothening and sharpening, and Homomorphic filters.

Histogram Modeling: Histogram equalization and histogram specification**.**

Unit 3: Image segmentation and Morphology: (07)

Point, line and edge detection, edge linking using Hough transform and graph theoretic approach, thresholding, and region based segmentation. Dilation, erosion, opening, closing, hit or miss transform, thinning and thickening, and boundary extraction on binary images

Section II

Unit 4: Image Restoration (05)

Degradation model, noise models, estimation of degradation function by modeling, restoration using Weiner filters and Inverse filters.

Unit 5: Video Formation, Perception and Representation: (07)

Digital Video Sampling: Video Frame classifications, I, P and B frames, Notation, ITU-RBT 601Digital Video formats, Digital video quality measure.

Video Capture and display: Principle of color video camera, video camera, digital video.

Sampling of video Signals: Required sampling rates, sampling in two dimensions and three dimensions, progressive versus interlaced scans.

Unit 6: Two Dimensional Motion Estimation (9)

Optical Flow: 2-D motion Vs optical flow, optical flow equations, motion representation, motion estimation criteria, optimization method.

Pixel based motion estimation: Regularization using motion smoothing constraints, using multipoint neighborhood.

Block Matching Algorithms: Exhaustive block matching algorithms, phase correlation method, Binary feature matching.

Multi resolution Motion Estimation: General formulation, Hierarchical blocks matching Algorithms.

- **Internal Continuous Assessment (ICA):**

  ICA consists of minimum eight tutorials based upon above curriculum.

- **Text Books:**

1. Gonzales and Woods--Digital Image Processing, Pearson Education, India, Third Edition
2. Murat Tekalp--Digital Video Processing, Pearson, 2010.
3. A.I.Bovik--Handbook on Image and Video Processing", Academic Press.

- **Reference Books:**

1. Anil K. Jain, ―Fundamentals of Image Processing, Prentice Hall of India, First Edition, 1989.
2. John W. Woods, ―Multidimensional Signal, Image and Video Processing, Academic Press 2012
3. J.R. Ohm , ―Multimedia Communication Technology", Springer Publication.

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B.Tech. (Electronics and Telecommunication Engineering)

Semester - I

ET415B: Elective-II - Wireless Sensor Networks

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 Hrs/Week, 3 Credits	**ISE: 30 Marks**
Tutorial: 1 Hr/Week, 1 Credit	**ESE: 70 Marks**
	ICA: 25Marks

This course provides knowledge of the networks formed by spatially dispersed and dedicated sensors that monitor and record the physical conditions of the environment and forward the collected data to a central location. It comprises exploration of various aspects of wireless sensor networks.

Course Objectives:

1. To understand the basics of Wireless Sensor Networks with its architecture, Infrastructure, associatedprotocols and IEEE standards.
2. To study applications of WSN in various fields

Course Outcomes:

At the end of this course, the student will be able to

1. Know Wireless Sensor scenario with its challenges, architecture and protocols.
2. Apply their knowledge for the implementation of the Wireless Sensor Network in various applications.

Section– I

Unit 1: Introduction to Wireless Sensor Network (04)

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks,applications of WSN and Mobile adhoc networks and wireless sensor networks.

Unit 2: Architectures of WSN (09)

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Unit 3: Infrastructure Establishment **(08)**

Topology Control, Clustering, Time Synchronization, Localization and positioning, Sensor Tasking and Control

Section-II

Unit 4 - Protocols and Standards **(05)**

MAC protocol- Low duty cycle and wake up concepts, Connection based protocols, Schedule based protocols and The IEEE 802.15.4 MAC protocol.

Unit 5 - QoS and Energy Management **(08)**

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Unit 6 - Applications Of WSN: **(08)**

WSN Applications - Home Control – Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

Internal Continuous Assessment (ICA):

It should consists of 6-8 assignments on topics given above.

Text Books:

1. Protocols and Architectures for Wireless Sensor Networks -Holger Karl & Andreas Willig -John Wiley, 2005.
2. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education – 2008

Reference Books:

1. Wireless Sensor Networks- Technology, Protocols, and Applications - Kazem Sohraby, Daniel Minoli, & Taieb Znati - John Wiley, 2007.
2. Wireless Sensor Network Designs - Anna Hac - John Wiley, 2003.
3. Ian F. Akyildiz and Mehmet Can Vuran, Wireless Sensor Networks, A John Wiley and Sons, Ltd,Publication, 2010.
4. Wireless Sensor Networks – A Networking Perspective, Jun Zheng, Abbas Jamalipour, Wiley-IEEE
5. Fundamentals of Wireless Sensor Networks- Theory and Practice, Waltenegus Dargie, Chrstian Poellabauer, Wiley
6. Networking Wireless Sensors, Bhaskar Krishnamachari, Cambridge University Press

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Semester-II

ET 421: Microwave Engineering

Teaching Scheme:	**Examination Scheme:**
Lectures – 4 Hours/week	**ESE – 70 Marks**
Practical – 2 Hours/week	**ISE – 30 Marks**
OE– 50 Marks	**ICA – 25 Marks**

This course introduces importance of microwave engineering as emerging technology to be used for communication applications. It constitutes generation, transmission, and measurement of various parameters dealing with microwave frequency. The performance analysis is carried out using Microwave network analysis.

Course Prerequisite:

Student shall have knowledge of Electromagnetic Field Theory

Course Objectives:

1. To make students aware about Microwave communication and its importance,
2. To learn about different ways of microwave generation and transmission using active and passive components.
3. To do analysis of microwave components performance using network analysis techniques
4. To acquaint students about measurement of various microwave parameters.

Course Outcomes:

After successfully completing the course student will able to

1. Understand the importance of microwave Engineering
2. Formulate the wave equation in wave guide for analysis.
3. Understand the working principles of all the microwave tubes and solid state devices
4. Identify the use of microwave components and devices in microwave applications.
5. Carry out the microwave network analysis
6. Choose a suitable microwave measurement instruments and carry out the required measurements

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Section I

Unit 1–Microwave Waveguides (06)

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands, Microwave Hazards, Applications of Microwave.

Introduction to Waveguide: Comparison between Transmission Line and Waveguide, Solution of wave equations in rectangular coordinates, Waveguide parameters, TE modes, TM modes, Power transmission and losses

Unit 2–Microwave Components (08)

Multi port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers.

Ferrites components: Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

Strip lines: Structural details and applications of Strip lines, Micro strip line, Parallel Strip line, Coplanar Strip line, Shielded Strip Line

Unit 3– Microwave Network Analysis (10)

The Transmission (ABCD) matrix: Introduction to Impedance and Admittance matrix, Relation to impedance matrix, Equivalent circuits for two port networks

Scattering Matrix: Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler

Section II

Unit 4- Microwave Tubes (10)

Limitations of conventional tubes, O and M type classification of microwave tubes, concept of reentrant cavity, velocity modulation.

O-type tubes: Two cavity Klystron: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, and efficiency.

M-type tubes: Magnetron: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications.

Slow wave devices: Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

(Excluding mathematical derivations of Klystron, Magnetron and TWT, But numerical will included)

Unit 5-Microwave Solid State Devices (08)

Structural details, Principle of operation, specifications, and applications of Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode, Microwave bipolar transistor, FET, MESFET.

Unit 6- Microwave Measurements **(06)**

Measurement of power, frequency, attenuation, phase shift, VSWR, Impedance, Dielectric constant and Insertion loss.

- **Internal Continuous Assessment (ICA):**

ICA consists of minimum eight practical shall be performed using Klystron and Gunn diode based microwave bench based upon above curriculum.

- **Text Books:**

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd edition, Pearson
2. David M. Pozar, "Microwave Engineering", Fourth edition, Wiley publications.
3. M. Kulkarni, "Microwave and Radar engineering", 3rd edition, Umesh Publications

- **Reference Books:**

1. Foundations for Microwave Engineering by Robert Collin, Wiley publications
2. Microwave Engineering (Passive Circuit) by Peter Rizzi, Pearon Eucation
3. M L Sisodia& G S Raghuvanshi, "Basic Microwave Techniques and Laboratory Manual", New Age International (P) Limited, Publishers

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Semester-II

ET422: CMOS VLSI Design

Teaching Scheme:	**Examination Scheme:**
Lectures– 4 Hours/week, 4 Credits	**ESE – 70 Marks**
Practical – 2 Hours/week, 1 Credit	**ISE – 30 Marks**
POE - 50 Marks	**ICA – 25 Marks**

This course introduces how to design, simulate and test logic circuits using different CMOS Logic Design. It also describes the design of sequential logic circuits and timing issues present in the implementation of the logic circuits applications.

Course Prerequisite:

Student shall have knowledge of Digital Devices, combinational and sequential logic circuit design and simulation.

Course Objectives:

1. To make student learn EDA Tools for CMOS Logic Design and simulation.
2. To enable student to design CMOS Logic baseddesign modules for combinational logic circuits.
3. To enable student to design CMOS Logic based design modules for sequential logic circuits.
4. To acquaint students to timing issues, arithmetic and memory module design and testing.

Course Outcomes:

At the end of course, students will be able to

1. Describe MOS transistor theory and mathematical equations for behavior of E-MOSFET
2. Design combinational logic circuits using E-MOSFETs.
3. Design sequential logic circuits using E-MOSFETs.
4. Analyze timing issues in digital circuits

Section – I

Unit 1- MOS Transistor Theory: (08)

Physical structure of MOS transistor, accumulation, depletion & inversion modes, MOS device design equations, second order effects, Technology scaling, Static and dynamic behavior of CMOS inverter, power and energy delay, impact of technology scaling on inverter.

Unit 2- Circuit Design Processes: (06)

MOS Layers, Stick Diagrams, Design Rules and Layouts – Lambda based design and other rules.

Unit 3- Combinational Logic Design in CMOS: (10)

Static CMOS design- complementary CMOS,Implementation of Boolean Expressions using CMOS Logic, Ratioed logic and pass transistorlogic; dynamic CMOS design- dynamic logic basic principle, speed and power dissipation, issues in dynamic design, cascading dynamic gates, comparison of static and dynamic designs in CMOS

Section - II

Unit 4- Sequential Logic Designs in CMOS: (08)

Static latches and registers- the bistability principle, multiplexer based latches, Master-slave edge triggered register, low voltage static latches, static SR flip flops, dynamic latches and registers- dynamic transmission-gate edge triggered registers,C2MOS- A clock- skew insensitive approach, true single-phase clocked register(TSPCR)

Unit 5- Timing Issues in Digital Circuits: (08)

Timing classification: synchronous interconnect, mesochronous interconnect, plesiochronous interconnect, asynchronous interconnect, synchronous design- clock skew, jitter, clock distribution, latch based clocking, synchronizers and arbiters, using PLL for clock synchronization

Unit 6- Designing Arithmetic and Memory Building Blocks: (08)

Designing fast adders, designing fast multipliers, designing other arithmetic building blocks, designing ROMs, DRAMs & SRAMs

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Internal Continuous Assessment:

- Term work shall consist of minimum eight experiments based on above syllabus using any EDA software tool

Suggested List of Practical:

Design and Implementation of Following using CMOS / Ratioed Logic / Dynamic CMOS Logic.

1. Logic Gates
2. Universal Logic Gates
3. Boolean Expression
4. Half adder and full adder
5. Half subtractor and full subtractor
6. Multiplexer and DeMultiplexer
7. Latches
8. Flip flops

Text Books:

1. Digital Integrated Circuits, Rabey, Chandrakasan, Nikolic, Pearson Education
2. CMOS VLSI design, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson Education

Reference Books:

1. CMOS digital integrated circuits, Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, TATA McGRAW Hill
2. Principles of CMOS VLSI Design, Neil Weste, Kamran Eshraghian, Addison Wesley/Pearson Education
3. Wayne Wolf, “Modern VLSI Design ", 2nd Edition, Prentice Hall,1998
4. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.

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Semester-II

ET423A: Elective III- Industrial Internet Of Things

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hours/week, 3 Credits	**ESE: 70 Marks**
Tutorials: 1 Hour/week, 1 Credits	**ISE: 30 Marks**
	ICA: 25 Marks

This course is a practical guide that lets one discover the technologies and the use cases for the industrial IoT considering the implementation of industrial processes, specialized control devices, and protocols, it covers the process of identification and connection of different industrial data sources gathered from different sensor sand the ability to be able to connect these sensors with cloud platforms such as AWS, GCP and open source IoT platforms.

Course Objectives:

1. To make student aware of the difference between IoT and IIoT.
2. To make student learn the architecture of Industrial IoT and key practices.
3. To make student learn different WAN communication technologies and protocols and associated security aspects.
4. To introduce students with different industrial cloud platforms of IoT and assist in building practical applications.

Course outcomes:

At the end of this course students will be able to**,**

1. Comprehend different components and technical requirements of an IIoT System.
2. Design reference IIoT architecture based solution for the development of IIoT application.
3. Select appropriate communication technology and/or protocol for a given application.
4. Analyze the security issues associated with identity access component of an IIoT system.
5. Implement cloud industrial IoT solutions for a given application.

Section I

Unit 1: Introduction to the Industrial IoT [6]

What is IIoT, Key IIoT Technologies Catalysts and Precursors of the IIoT, Innovation and the IIoT, Key Opportunities and Benefits, The Digital and Human Workforce, Technical requirements, IoT background, History and definition, IoT enabling factors, IoT use cases IoT key technologies, IoT and IIoT similarities and differences, IoT analytics and AI, Industrial Internet Use-Cases– Healthcare and Smart Office

Unit 2:IIoT Reference Architecture [7]

The IIC Industrial Internet Reference Architecture, Industrial Internet Architecture Framework (IIAF), Architectural Topology, The Three-Tier Topology, Connectivity, Key System Characteristics, Data Management. Designing Industrial Internet Systems- The Concept of the IIoT, The Proximity Network, WSN Edge Node, Legacy Industrial Protocols, Modern Communication Protocols, Wireless Communication Technologies, Proximity Network Communication Protocols, Gateways.

Unit 3: IIoT WAN Technologies and Protocols [8]

IIoT Device Low-Power WAN Optimized Technologies for M2M :SigFox, LoRaWAN, Low Power Wi-Fi, LTE Category-M, Weightless Securing the Industrial Internet - Security in Manufacturing: PLCs and DCS, Securing the OT, Network Level: Potential Security Issues, System Level: Potential Security Issues, Identity Access Management

Section II

Unit 4: Cloud Industrial IoT Solution with AWS [7]

The AWS architecture, AWS IoT, Registering for AWS IoT core, Storing data, AWS analytics , Quick Sight

Unit 5: Cloud Industrial IoT Solution with Google Cloud [6]

Google Cloud IoT Core, Google Cloud Bigtable, Google Cloud analytics

Unit 6: Practical Industrial IoT Solution using Open Stack [8]

Understanding the architecture, understanding the Open Stack ecosystem: core projects (identity, compute, storage, imaging, dashboard, networking), introduction to application development, deploying the application (only definitions of bare metal, virtual machines, and containers, orchestration and configuration management, monitoring and metering, elasticity, updating and patching)

Internal Continuous Assessment (ICA):

ICA shall consist of minimum eight assignments based on above curriculum.

Text Books:

1. Alasdair Gilchrist,"Industry 4.0: The Industrial Internet of Things" by, ISBN: 978-1-4842- 2046-7, APRESS.
2. Veneri, Giacomo; Capasso, Antonio. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0 . Packt Publishing.
3. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach".

4. OpenStack Cloud Application Development Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson

Reference Books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013

Additional Resources:

- AWS IoT Core Documentation: https://docs.aws.amazon.com
- Quickstart | Cloud IoT Core Documentation | Google Cloud https://cloud.google.com
- OpenStack Docs: https://docs.openstack.org/install-guide/overview.html
- Azure IoT documentation | Microsoft Docs https://docs.microsoft.com
- Docker Community Edition: https://store.docker.com
- JDK 1.8: http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html
- Git: https://git-scm.com/downloads
- Node.js 8+: https://nodejs.org
- Python 3.7: https://www.python.org/downloads/
- Anaconda 5.3: https://www.anaconda.com/download/

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Semester-II

ET423B: Elective III - Artificial Intelligence and Applications

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 Credits	**ESE:70 Marks**
Tutorial: 1Hr/Week, 1 Credit	**ISE:30 Marks**
	ICA: 25 Marks

This course presents an overview of the principles and practices of AI to address such complex real-world problems. The course is designed to develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of AI and applications of Artificial Intelligence. The course prepares students to take a variety of focused, advanced courses in various subfields of AI.

Course Prerequisite:

Student shall have some exposure to algorithms and programming.

Course Objectives:

1. To introduce the basic concepts and theory of Artificial Intelligence and its applications.
2. To develop problem solving approach using different search techniques.
3. To learn Natural Language Processing.
4. To understand kinematics and applications of Robotics.
5. To introduce basic concepts and applications of Deep Learning.

Course Outcomes:

At the end of this course, the student will be able to

1. Understand and able to use problem solving approach using Artificial Intelligence.
2. Understand the need of NLP and Probabilistic language models.
3. Understand basics of Robotics and apply AI in Robotics.
4. Differentiate between Machine Learning and Deep learning as well as apply deep learning for various applications.

Section– I

Unit 1– Overview **(06)**

Foundations, scope, problems and approaches of AI
Intelligent agents: Reactive, deliberative, goal-driven, utility-driven and learning agents

Unit 2- Problem-solving through Search **(07)**

Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, and stochastic search methods.

Game Playing: minimax, alpha-beta pruning.

Unit 3- Knowledge Representation and Reasoning (08)

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time and space first order logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

Section-II

Unit 4- Natural Language Understanding (06)

Why NL, Formal grammar for a fragment of English, Syntactic analysis, Augmented grammars, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding, Grammar induction, Probabilistic language processing, Probabilistic language models

Unit 5- Introduction to Robotics (08)

Fundamentals of Robotics, A Brief History of Robotics: Industrial manipulators, Robotic Paradigms: From Tele operation To Autonomy, Making machine intelligent, Use of Robots, Space robotics with AI approach.

Unit 6– Introduction to Deep Learning (07)

Introduction to deep learning, Deep learning Vs. Machine learning, Introduction to deep learning networks and CNN, Applications of Deep learning in computer vision

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Internal Continuous Assessment (ICA):
ICA should consist of minimum 10 assignments using any programming language with openly available tools, frameworks and resources based on the following topics.

- Intelligent agents
- Problem solving through search
- First order logic

In addition to above students shall undertake a case study on **"Applications of AI: The Present and Future"**

Text books:

1. Artificial Intelligence: A Modern Approach,Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall.
2. A First Course in Artificial Intelligence, Deepak Khemani, McGraw Hill Education (India).
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.
4. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep Learning (Adaptive Computation and Machine Learning series)." (2016): 800.

Reference Books:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill.
2. Ravichandiran, Sudharsan. Hands-on deep learning algorithms with python: master deep learning algorithms with extensive math by implementing them using tensor flow. Packt Publishing Ltd, 2019.
3. Murphy, Robin R. Introduction to AI robotics. MIT press, second edition,

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Semester-II

ET 424A : Elective IV- Network Security

Teaching Scheme:	**Examination Scheme:**
Lectures – 3 Hours/week, 3 Credits	**ESE – 70 Marks**
Tutorial – 1 Hours/week, 1 Credit	**ISE – 30 Marks**
	ICA – 25 Marks

This course addresses security issues for TCP/IP based and NT networks. Access Control and Communications Security issued will be covered as well as Internet and intranet security. The course also surveys cryptographic and other tools used to provide security and reviews how these tools are utilized in protocols and applications.

Course Prerequisite:

Student shall have knowledge of communication principles and protocols of Computer Network

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Course Objectives:

1. To introduce fundamentals of Network Security Model and Cryptography.
2. To acquire knowledge of standard Cryptography Algorithms.
3. To get familiarized with various network security protocols to protect against threat.
4. To showcase IP Security Architecture at Network and Transport Layer for identifying the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
5. To get familiarized with various tools and methods used in cyber crime and law acts.

Course Outcomes:

After successfully completing the course student will able to

1. Describe classical encryption techniques and cyber laws within the context of cyber security.
2. Identify working principles of secret key and public key cryptography.
3. Demonstrate Network and Transport layer communication standards/protocols for web security.
4. Apply network security principles, authentication mechanism for secure data transmission.
5. Select appropriate security services to prevent, detect and/or recover from a security attack.

Section - I

Unit 1 – Security Fundamentals **(05)**

Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.
Classical Encryption Techniques: Symmetric Cipher Model, Cryptography.
Substitution Techniques: Caesar Cipher, Mono alphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Rotor Machines, Steganography.

Unit 2 – Block Ciphers and the Data Encryption Standard **(06)**

Traditional Block Cipher Structure: Stream Ciphers and Block Ciphers, Motivation for the Feistel Cipher Structure, Feistel Cipher.
Data Encryption Standard: DES Encryption, DES Decryption, The Strength of DES.
Public-Key Cryptography and RSA: Principles of Public Key Cryptosystem, RSA: Description of the Algorithm, Computational Aspects, Security of RSA.

Unit 3 – Key Management and Distribution **(04)**

Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure.

Unit 4 – Network and Internet Security **(06)**

Network Access Control and Cloud Security: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control Cloud Computing, Cloud Security Risks and Counter measures, Data Protection in the Cloud, Cloud Security as a Service. Intrusion Detection Systems along with Firewalls.
Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security HTTPS, Secure Shell (SSH).

Section - II

Unit 5 - Wireless Network Security **(04)**

Wireless Security 559, Mobile Device Security, IEEE 802. Wireless LAN Overview, Wireless LAN Security, Electronic **Mail & IP Security:** Pretty Good Privacy, S/MIME,

Unit 6 - IP Security **(04)**

IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

Unit 7 - Introduction to Cybercrime **(07)**

Introduction: Cybercrime definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.
Cyber Offenses: How Criminals Plan Them, How Criminals Plan the Attacks, Social Engineering, Cyber stalking.
Botnets: The Fuel for Cybercrime, Attack vector, Cloud computing.

Unit 8 - Tools and Methods Used in Cybercrime **(06)**

Introduction: Proxy Servers and Anonymizers, Phishing Password Cracking Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft(ID Theft).

- **Internal Continuous Assessment (ICA):**

  ICA consists of minimum eight assignment/tutorial based upon above curriculum.

- **Text Books:**

1. Willaim Stallings, "Computer Security: Principles and Practices", Pearson Ed. ISBN :978-81-317-3351-6.
2. Cryptography and Network Security, Atul Kahate, TataMcGrawhill.
3. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, ISBN-978-81-315-1349-1.
4. Nina Godbole, "Cyber Security-Understanding Cyber crimes Computer Forensics and Legal Perspectives".

- **Reference Books:**

1. Nina Godbole, "Information Systems Security", Wiley India Pvt Ltd.
2. "Modern Cryptography, Theory & Practice", Pearson Education by Wenbo Mao.
3. Cryptography and Network Security; McGraw Hill; Behrouz A Forouzan.

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Semester-II

ET424 B: Elective IV- Data Analytics

Teaching Scheme:	**Examination Scheme:**
Lectures – 3 Hours/week, 3 Credits	**ESE – 70 Marks**
Tutorial – 1 Hour/week, 1 Credit	**ISE – 30 Marks**
	ICA – 25 Marks

This course provides foundation level training that enables immediate and effective participation in big data and other analytics projects. It includes an introduction to big data and big data analytics. The course provides grounding in basic analytic methods and an introduction to big data analytics technology and tools.

Course Prerequisite:

Student shall have knowledge of Database Management Systems

Course Objectives:

1. To provide an overview of an exciting growing field of big data analytics.
2. To apply algorithmic strategies while solving problems
3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.

Course Outcomes:

After successfully completing the course student will able to

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Use the right method to solve real problem.
3 Selecting appropriate data visualizations to clearly communicate analytic insights.
4. Use the tools and techniques to apply different algorithms and methodologies.

Section - I

Unit 1- Introduction to Data Analytics: (06)

What Can We Do With Data? Big Data and Data Science, Big Data Architectures, Small Data, What is Data? A Short Taxonomy of Data Analytics, Examples of Data Use, A Project on Data Analytics.

Unit 2 – Descriptive Statistics and Analysis: (08)

Scale Types, Descriptive Univariate Analysis, Univariate Frequencies, Univariate Data Visualization, Univariate Statistics, Common Univariate Probability Distributions, Descriptive Bivariate Analysis, Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics.

Unit 3 - Data Quality and Preprocessing: (07)

Data Quality, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction.

Section – II

Unit 4- Basic Data Analytics methods using R (07)

Introduction to R: GUI of R, Getting data into & out of R, Data types in R, Basic operations, Basic statistics, Generic functions, Data visualization using R, Data exploration & presentation, Statistics for model building & evaluation

Unit 5- Introduction to Big Data Analytics (07)

Definition of Big Data, Big data characteristics & considerations, Data repositories- analyst perspective, Business drivers for analytics, Typical analytical architecture, Business Intelligence Vs Data science, Drivers of Big data analytics, Role of data scientist in Big data ecosystem, Applications of Big data analytics.

Unit 6 - Big Data Visualization (07)

Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Analytical techniques used in Big data visualization.

Internal Continuous Assessment (ICA):

ICA shall consist of minimum 6 assignments based on the syllabus contents.

Text Books:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
2. A General Introduction to Data Analytics, by Joao Moreira, Andre Carvalho, Tomas Horvath, Wiley Publication.
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
4. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6

References:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication, ISBN: 978-1-118-16430-3
3. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866.