CSE(BC) Semester: VII Sem	Code Subject BC–701 Deep Learning	L T P C 3 0 0 3
Prerequisite: Discrete mathematics, Basic probability theory, and Data Structures		
Course Objective -The objective of this course is to introduce students to deep learning algorithms and their applications to solve real problem**s.**		
CO1	Describe the feed-forward and deep networks.	
CO2	Design single and multi-layer feed-forward deep networks and tune various hyper parameters.	
CO3	Implement deep neural networks to solve a problem.	
CO4	Analyze the performance of deep networks.	
CO5	Apply Deep learning to typical problems in their field of research.	
Unit-I	History of Deep Learning, Deep Learning Success Stories, review of Neuron model, activation functions, Perceptron Learning, Multilayer Perceptrons (MLPs), Feed forward Neural Networks, Back propagation, weight initialization methods, Batch Normalization, Representation Learning, GPU implementation, Decomposition – PCA and SVD.	6 Hrs.
Unit-II	Deep Feed forward Neural Networks, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, Adam, RMSProp, Auto encoder, Regularization in auto-encoders, Denoising auto-encoders, Sparse auto encoders, Contractive auto-encoders, Variational auto-encoder, Auto-encoders relationship with PCA, Dataset augmentation..	7 Hrs.
Unit-III	Introduction to Convolutional Neural Networks (CNN) and its architectures, CCN terminologies: ReLU activation function, Stride, padding, pooling, convolutions operations, Convolutional kernels, types of layers: Convolutional, pooling, fully connected, Visualizing CNN, CNN examples: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, RCNN, etc. Deep Dream, Deep Art Regularization: Dropout, drop Connect, unit pruning, stochastic pooling, artificial data, injecting noise in input, early stopping, Limit Number of parameters, Weight decay, etc.	8 Hrs.
Unit-IV	Introduction to Deep Recurrent Neural Networks and their architectures, Back propagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, Gated Recurrent Units (GRUs), Long Short Term Memory (LSTM), Solving the vanishing gradient problem with LSTMs, Encoding and decoding in RNN network, Attention Mechanism, Attention over images, Hierarchical Attention, Directed Graphical Models.	7 Hrs.
Unit -V	Introduction to Deep Generative Models, Restricted Boltzmann Machines (RBMs), Gibbs Sampling for training RBMs, Deep belief networks, Markov Networks, Markov Chains, Autoregressive Models: NADE, MADE, Pixel RNN, Generative Adversarial Networks (GANs), Applications of Deep Learning in Object detection, speech/ image recognition, video analysis, NLP.	7 Hrs.
Text Books		
1. Andreas Muller, " Introduction to Machine Learning with Python: A Guide for Data Scientists”, First edition, O' Reilly Edition, 2016.		

CSE(BC) Semester: VII Sem	Code BC–701	Subject Deep Learning	L T P C 3 0 0 3

Reference Books

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville; Deep Learning, MIT Press, 2017.
2. Chris Bishop; Pattern Recognition and Machine Learning, Springer publication, 2006.
3. Aurelien Geon, “Hands-On Machine Learning with Scikit-Learn and Tensorflow: Concepts, Tools, and Techniques to Build Intelligent Systems”, First Edition, O’Reilly publication, 2017.
4. Francois Chollet, “Deep Learning with Python,” First Edition, Manning Publications, 2018.

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 1	PO_{11}	PO_{12}	PSO 1	PSO 2
CO-1	2	2							1			2	2	2
CO-2	2	2		1								1	1	2
CO-3	2	3		1	2							2	2	3
CO-4	2	3		1	2							2	2	3
CO-5	1	1						2				1	2	

CSE(BC) Semester: VII Sem	Code Subject BC –702(A) Distributed Ledger Technology	L T P C 3 0 0 3
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure		
CO1	1. Understand the cryptographic basis for cryptocurrency.	
CO2	2. Choose a blockchain implementation based on real time scenario.	
CO3	3. Categorize the various types of blockchains.	
CO4	4. Examine the techniques for anonymity preservation.	
CO5	5. Identify and understand the use cases of distributed ledger technology. 6. Evaluate alternative Blockchains and their applicability.	
Unit-I	Introduction to Blockchain, Crypto currencies and Distributed Ledgers: Block chain, Distributed Ledgers - Cryptographic basics for cryptocurrency Hashing, signature schemes, encryption schemes and elliptic curve cryptography - CAP theorem Permissioned Ledger, Tokenized blockchains, Token less blockchains, Side chains.	6 Hrs.
Unit-II	Essentials of Cryptocurrencies :Distributed identity: Digital identification ; Decentralized network - Distributed ledger: Permissioning framework, Blockchain data structure - Double spending; Network consensus -Sybil attacks, Block rewards and miners, Difficulty under competition, Forks and consensus chain, The 51% attack, Confirmations and finality - The limits of proof-of-work - Alternatives to Proof of Work.	7 Hrs.
Unit-III	Blockchain Implementations : Bitcoin: Bitcoin and Merkle Root - Eventual Consistency & Bitcoin - Bitcoin and Secure Hashing - Bitcoin block-size - Bitcoin Mining- Bitcoin Scripting. Blockchain Collaborative Implementations:- ERC 20 and the token explosion.	8 Hrs.
Unit-IV	Pseudo-anonymity vs. anonymity - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash - Zk-SNARKS for anonymity preservation. Financial Services: Accounting and audit, Global payments, Programmable money - Citizen Identification, Voting - Healthcare: Electronic health records system - Supply chain management - Trade finance - Tokenization of real assets	7 Hrs.
Unit -V	Distributed Ledger Technology in alternative Blockchains Alternative Blockchains: Kadena, Rootstock, Drivechain, Quorum Transaction manager: Crypto Enclave, Quorum Chain - Network manager. Tezos, Storj, Maid safe, BigChainDB. The impact of distributed ledger technology, limitations of existing distributed ledger platforms, possible enhancements to existing platforms, and possibilities of having new applications, Future use cases of distributed ledger technology	7 Hrs.
Text Books:		

1.Treccani, A., Lipton, A. (2021). Blockchain And Distributed Ledgers: Mathematics, Technology, And Economics - First Edition, Singapore: World Scientific Publishing Company.
2.Wattenhofer, R. (2019), Blockchain Science: Distributed Ledger Technology - Third Edition, United States: Independently Published.

Reference Books:

1.Goldfeder, S., Bonneau, J., Miller, A., Felten, E., Narayanan, A. (2016). Bitcoin and Cryptocurrency Technologies - First Edition, Princeton University Press.
2.Bashir, I. (2020). Mastering Blockchain: A Deep Dive Into Distributed Ledgers, Consensus Protocols, Smart Contracts, DApps, Cryptocurrencies, Ethereum, and More Third Edition, United Kingdom: Packt Publishing.

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 1	PO_{11}	PO_{12}	PSO 1	PSO 2
CO-1	2	2							1			2	2	2
CO-2	2	2		1								1	1	2
CO-3	2	3		1	2							2	2	3
CO-4	2	3		1	2							2	2	3
CO-5	1	1						2				1	2	

CSE(BC) Semester: VII	Code Subject BC – 702(B) Bio-Informatics	L T P C 3 0 0 3
Prerequisite: Concepts in chemistry, Databases & Information retrieval**.**		
Course objectives: To provide the knowledge of information storage, management, retrieval and analysis procedures and techniques which are useful and applicable in the field of bio sciences.		
CO1	Understand the fundamental theoretical concepts in pervasive computing	Level 3: Apply
CO2	Conclude the enabling technologies that drive the pervasive and ubiquitous computing	Level 3: Apply
CO3	Analyze and compare the performance of different data dissemination techniques	Level 6: Create
CO4	Formulate the design aspects, that are essential to create the model of pervasive computing	Level 6: Create
CO5	Develop solutions for problems related to pervasive and ubiquitous computing system through investigation	Level 3: Apply
Unit – I	Introduction to bioinformatics, objectives of bioinformatics, Basic chemistry of nucleic acids, structure of DNA and RNA, Genes, structure of bacterial chromosome, cloning methodology, Data maintenance and Integrity Tasks.	6 Hrs.
Unit – II	Bioinformatics Databases and Image Processing: Types of databases, Nucleotide sequence databases, Protein sequence databases, Protein structure databases, Normalization, Data cleaning and transformation, Protein folding, protein function, protein purification and characterization, Introduction to Java clients, CORBA, Using MYSQL, Feature Extraction.	7 Hrs.
Unit – III	Sequence Alignment and database searching: Introduction to sequence analysis, Models for sequence analysis, Methods of optimal alignment, Tools for sequence alignment, Dynamics Programming, Heuristic Methods, Multiple sequence Alignment.	8 Hrs.
Unit – IV	Gene Finding and Expression: Cracking the Genome, Biological decoder ring, finding genes through mathematics and learning, Genes prediction tools, Gene Mapping, Application of Mapping, Modes of Gene Expression data, Mining the Gene Expression Data.	7 Hrs.
Unit – V	Proteomics and Problem solving in Bioinformatics: Proteome analysis, tools for proteome analysis, Genetic networks, Network properties and analysis, complete pathway simulation: E-cell, Genomic analysis for DNA and Protein sequences, Strategies and options for similarity search , flowcharts for protein structure prediction	7 Hrs.
Text Books:		

1. Gopal and Jones, “BIOINFORMATICS with fundamentals of Genomics and Proteomics”, TMH Pub.
2. Rastogi, “Bioinformatics – Concepts, skills and Applications”, CBS Pub.

Reference Books:

1. Bergeron, “Bioinformatics computing”, PHI.
2. Claverie , “Bioinformatics”, Wiley pub

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
CO2	**2**	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**2**	**0**
CO3	**0**	**2**	**0**	**3**	**3**	**2**	**0**	**0**	**1**	**0**	**0**	**0**
CO4	**2**	**0**	**2**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**
CO5	**0**	**3**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**3**

CSE(BC) Semester:VII Sem	Code BC-702(C)	Subject Optimization Technique	LTP 3 0 0	C 3
Prerequisite: Fundamentals of Computing and Programming				
CO1	Understanding the Concept of optimization and classification of optimization problems.			
CO2	Formulation simplex methods variable with upper bounds			
CO3	Study the Queuing Model, poison and exponential distributions			
CO4	Understand the maximization and minimization of convex functions			
CO5	To study equality constraints, inequality constraints			
Unit - I	INTRODUCTION Concept of optimization – classification of optimization – problems.			8
Unit - II	LINEAR PROGRAMMING: Examples of linear programming problems – formulation simplex methods variable with upper bounds – principle- duality -dual simplex method - sensitivity analysis – revised simplex procedure – solution of the transportation problem – assignment – network minimization – shortest route problem – maximal two problem – L.P. representation of networks.			10
Unit - III	QUEUING THEORY Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures-random and series queues.			9
Unit - IV	UNCONSTRAINED OPTIMIZATION: Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convergence – unibariate search – steepest and desent methods- metcher reeves method -conjugate gradient method.			9
Unit - V	CONSTRAINED OPTIMIZATION Necessary and sufficient condition – equality constraints, inequality constraints -kuhu – tucker conditions – gradient projection method – penalty function methods – cutting plane methods of sibel directions.			9
Text Books:				
1. Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979.				
Reference Books:				

1. David G.Luerbeggan, “Introduction to Linear and Non Linear Programming”, Addison Wesley Publishing Co.1973.

2. Hadley G. “Nonlinear and – dynamic programming” Addison Wesley Publishing Co. 1964.

3. Cordan C.C. Beveridge and Robert S. Schedther, “Optimization, Theory and Practice” McGraw Hill Co.1970.

4. HarndyA.Tahh. “operations Research, An Introduction”, Macmillan Publishers Co.NewYork,1982.

5. Beightferand S. others, “Foundations of Optimization Pill”, New Delhi, 1979.

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3										2	3	1
CO2	3	2	3		1							2	3	1
CO3	2	3		2	1							2	3	1
CO4	2	3	2		1							2	2	1
CO5	2	3	2	2	2							1	3	1

CSE(BC) Semester: VII	Code Subject BC – 703(A) Android Programming	L T P C 3 0 0 3
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure		
CO1	Understand Android architecture and project lifecycle	Level 2: Understand
CO2	Develop responsive user interfaces using Android UI components	Level 6: Create
CO3	Handle data storage with SharedPreferences, SQLite, and Room	Level 2: Understand
CO4	Build apps with services, broadcasts, and background processing	Level 6: Create
CO5	Connect apps to online services and deploy Android applications	Level 6: Create
Unit – I	**Introduction to Android & Development Environment**:History and evolution of Android OS **Android architecture**: Linux kernel, Libraries, Android Runtime (ART), Application Framework, Android SDK and Android Studio installation, Creating and running a simple app, Project structure (manifest, Gradle, src, res), Activity lifecycle, Intents, and event handling, Permissions and app components (Activities, Services, Broadcast Receivers, Content Providers)	8 Hrs.
Unit – II	**User Interface Design & Layouts**:Views and ViewGroups: TextView, EditText, Button, ImageView, RecyclerView. **Layouts**: LinearLayout, RelativeLayout, ConstraintLayout, FrameLayout,Handling user input and UI events. **Menus**: Options Menu, Context Menu, Popup Menu, Dialogs and Toast messages, Styles and Themes, Accessibility and Localization.	8 Hrs.
Unit – III	**Data Storage and Persistence**:SharedPreferences, Internal and External Storage. **SQLite Database**: Creating, updating, querying, Room Persistence Library (with LiveData and ViewModel), JSON parsing and file operations, Content Providers.	8 Hrs.
Unit – IV	**Advanced Components & Background Tasks:**Fragments and Fragment lifecycle, Navigation components and Jetpack architecture. **Notifications**: Standard and custom. **Services**: StartedService and IntentService, Broadcast Receivers, AsyncTask, Handlers, and WorkManager, Sensors and multimedia APIs (Camera, Audio).	8 Hrs.
Unit - V	**Connectivity, Publishing & Modern Features:**Networking with Retrofit/Volley, RESTful API integration and JSON handling. **Firebase Integration**: Realtime Database, Authentication, Cloud Messaging, App signing, versioning, and publishing to Google Play Store, Jetpack Compose (intro only), Best practices for performance and security, Testing and debugging tools (Logcat, Profiler, Unit/UI Testing)	8 Hrs.

List of Experiments

1. Setting up Android Studio, Creating First App (Hello Android)
2. Designing UI using Layouts (Linear, Relative, Constraint)
3. Event handling using Buttons, EditText, and Listeners
4. Activity Lifecycle and Intent Navigation
5. Implementing RecyclerView with Adapter
6. Using SharedPreferences and Internal Storage
7. SQLite database CRUD operations
8. Room Persistence Library integration
9. Fragment lifecycle and communication
10. Notifications and background services
11. Using Retrofit to fetch API data
12. Firebase integration – Realtime DB or Authentication
13. Testing and debugging with Logcat and Profiler
14. App packaging, signing, and publishing (demo)

Text Books

- "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips, Chris Stewart, and Kristin Marsicano – A hands-on guide for modern Android development.
- "Professional Android" by Reto Meier and Ian Lake – Covers advanced topics and industry-level practices.

Reference Books

- "Android Development with Kotlin" by Marcin Moskala and Igor Wojda – Great for those using Kotlin for Android.
- "Head First Android Development" by Dawn Griffiths and David Griffiths – A beginner-friendly, visual guide.
- "Kotlin Programming: The Big Nerd Ranch Guide" – Useful for understanding Kotlin's integration with Android.
- Official Android Developer Documentation – https://developer.android.com – Most up-to-date and authoritative resource.

CO\POMapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3										2	3	1
CO2	3	2	3		1							2	3	1
CO3	2	3		2	1							2	3	1
CO4	2	3	2		1							2	2	1
CO5	2	3	2	2	2							1	3	1

CSE(BC0 Semester: VII	Code BC – 703(B)	Subject NLP	L T P C 3 0 0 3
Prerequisite: A solid foundation in mathematics, programming (especially Python), and basic machine learning concepts is essential			
CO1	Define approaches to syntax and semantics in NLP.		Level 3: Apply
CO2	Realize approaches to discourse, generation, dialogue, and summarization within NLP.		Level 3: Apply
CO3	Illustrate current methods for statistical approaches to machine translation.		Level 6: Create
CO4	Realize machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, and clustering.		Level 6: Create
CO5	Use unsupervised methods, log-linear and discriminative models, and the EM Algorithm as applied within NLP.		Level 3: Apply
Unit - I	INTRODUCTION -Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues - Applications -The role of machine learning - Probability Basics –Information theory – Collocations -N-gram Language Models - Estimating parameters and smoothing - Evaluating language models.		7 Hrs.
Unit - II	MORPHOLOGY AND PART OF SPEECH TAGGING-Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers - Part of speech Tagging - Rule-Based Part of Speech Tagging - Markov Models - Hidden Markov Models –Transformation-based Models - Maximum Entropy Models. Conditional Random Fields		9 Hrs.
Unit - III	SYNTAX PARSING- Syntax Parsing - Grammar formalisms and treebanks - Parsing with Context Free Grammars -Features and Unification -Statistical parsing and probabilistic CFGs (PCFGs)-Lexicalized PCFGs.		8 Hrs.
Unit - IV	SEMANTIC ANALYSIS-Representing Meaning – Semantic Analysis - Lexical semantics –Word-sense disambiguation -Supervised – Dictionary-based and Unsupervised Approaches - Compositional semantics Semantic Role Labeling and Semantic Parsing – Discourse Analysis.		7 Hrs
Unit - V	APPLICATIONS-Named entity recognition and relation extraction- IE using sequence labeling- Machine Translation(MT) - Basic issues in Statistical translation- word alignment- phrase-based translation.		7 Hrs
Text Books			
1. Daniel Jurafsky and James H. Martin, Speech and Language Processing (2nd Edition), Prentice Hall;			

CSE(BC0 Semester: VII	Code BC – 703(B)	Subject NLP	L T P C 3 0 0 3

Reference Books

1 edition, 2008. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MIT Press, 1999

2. Steven Bird, Ewan Klein, and Edward Loper. Natural Language Processing with Python, O'Reilly Media; 1 edition, 2009

CO \ PO Mapping	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3										2	3	1
CO2	3	2	3		1							2	3	1
CO3	2	3		2	1							2	3	1
CO4	2	3	2		1							2	2	1
CO5	2	3	2	2	2							1	3	1

CSE(BC) Semester: VII	Code Subject BC – 703(C) Block chain and IoT	L T P C 3 0 0 3
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure		
CO1	Demonstrate the working of IoT and Blockchain	Level 3: Apply
CO2	Identify Consensus mechanism for Blockchain Application	Level 3: Apply
CO3	Discover the security challenges in IoT	Level 6: Create
CO4	Analyze the need of BaaS for Organizations	Level 6: Create
CO5	Apply the Blockchain usecases for IoT sector	Level 3: Apply
Unit – I	INTRODUCTION TO IoT & BLOCKCHAIN: Introduction to Internet of Things (IoT)- Concepts and definitions of IoT-History of IoT –IoT vs Conventional Network-IoT Architecture- Introduction to Blockchain-Generations of Blockchain- Structure of Blockchain- Opportunities and challenges in IoT and Blockchain.	6 Hrs.
Unit – II	CONSENSUS ALGORITHMS : Building Blocks of Block chain-Database-Block-Hash-Minor-Transaction-Smart Contracts-Consensus Mechanisms-PoW-PoS-Characteristics of Block chain-Types of Block chain-Permissioned Block chain Permissionless Block chain-Consortium Block chain.	7 Hrs.
Unit – III	IOT SECURITY : IoT Layer Challenges – Sensing layer– Challenges in end nodes –Threat based on Network layer Service layer based threats-Application Interface layer –Cross layer Challenges-Challenge to implementation of IoT in Blockchain-IoT Device Integration challenges.	8 Hrs.
Unit – IV	BLOCKCHAIN AS A SERVICE (BAAS): Defining of Blockchain as a Service - IoT Cloud server security challenges– Cloud computing with BaaS-Hybrid Cloud server with BaaS for Remote Monitoring-Case study: Industries adopting BaaS for security.	7 Hrs.
Unit – V	BLOCKCHAIN USECASES IN IOT SECTOR: Autonomous Decentralized peer to peer telemetry-Blockchain Enabled Security for Smart cities-Blockchain Enabled Smart Home Architecture-Blockchain based self-managed VANETs-Security and privacy of data.	7 Hrs.
Text Books		

1. Brojo Kishore Mishra , Sanjay Kumar Kuanar “Handbook of IoT and Blockchain: Methods, Solutions, and Recent Advancements (Internet of Everything (IoE)) “, CRC Press; 1st edition , November 2020.
2. Shiho Kim ,Ganesh, Chandra Deka, Peng Zhang, ”Role of Blockchain Technology in IoT Applications”, Volume 115 in the Advances in Computers series ,first edition ,Academic Press 2019
3. Harshita Patel , Ghanshyam Singh Thakur,”Blockchain Applications in IoT Security” 1st Edition by IGI Global; 1st edition 2020
4. David Etter,” IoT Security: Practical Guide Book”, CreateSpace Independent Publishing Platform, 2016.

Reference Books:

John Soldatos, ” Building Blocks for IoT Analytics”, River Publishers,2016

E BOOKS:

1. https://www.researchgate.net/publication/337649428_Handbook_of_IoT_and_Blockchain_ _Methods_Solutions_and_Recent_Advancements.

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3			1								2	1
CO2	3	3			1					2			2	
CO3	3	3	3			1							2	
CO4	3	3			1								2	
CO5	3	3	3		3							3	2	

CSE(BC) Semester: VII	Code Subject BC – 704(A) Wireless Network	L T P C 3 0 0 3
Prerequisite: Basics of Network networking.		
CO1	Identify the basic concept of wireless networks.	Level 3: Apply
CO2	Analyze traffic theories, mobile radio propagation, channel coding, and cellular concepts.	Level 3: Apply
CO3	Compareand contrast multiple divisiontechniques andmobileCommunicationsystems.	Level 6: Create
CO4	Apply wireless ID technologies, in particular RFID work.	Level 6: Create
CO5	Explain and differentiate between technologies like 2.5G and 3G.	Level 3: Apply
Unit - I	**Introduction of Wireless Networks:** Different Generations of Wireless Networks. Characteristics of the Wireless Medium: Radio Propagation Mechanisms, Path Loss Modeling and Signal Coverage, Effect of Multipath and Doppler, Channel Measurement and Modeling Techniques.	6 Hrs.
Unit - II	**Network Planning:** Introduction, Wireless Network Topologies, Cellular Topology, Cell Fundamentals Signal to Interferences Radio Calculations, Network Planning for CDMA Systems. Wireless Network Operations**:** Mobility Management, Radio Resources and Power Management.	7 Hrs.
Unit - III	**Multiple Division Techniques:** FDMA, TDMA, CDMA, OFDM, SDMA. Comparison of Multiple Division Techniques, Modulation Techniques – AM, FM, FSK, PSK, QPSK, QAM, 16QAM Mobile Data Networks: Introduction, Data Oriented CDPD Network, GPRS, EDGE and High Data Rates, SMS in GSM, Mobile Application Protocols.	8 Hrs.
Unit - IV	**Introduction to Wireless LAN:** Evolution of WLAN, Wireless Home Networking, Technologies for Home Area Network (HAN), Overview of IEEE 802.11, Reference Architecture, PHY and MAC Layer, Wireless ATM, HIPERLAN.	7 Hrs.
Unit - V	**Standards:** IEEE 802.15 WPAN, HomeRF, Bluetooth, Interference between Bluetooth and 802.11, Adhoc Networks, Introduction to 2.5 G and 3 G Networks**.**	7 Hrs.
Text Books		

1. Kaveh Pahlavan, Prashant Krishnamurthy, “principles of Wireless Networks”, PHI.
2. Qing- An Zeng, Dharma Prakash Agrawal, “Introduction to Wireless and Mobile Systems”, CENGAGE Learning.

Reference Books

1. Sumit Kasera, Nishit Narang, A P Priyanka, “2.5 G Mobile Networks: GPRS and EDGE”, TMH
2. Dr. Kamilo Feher, “Wireless Digital Communications”, PHI.Jochen Schiller, “Mobile Communications”, PEARSON.

Sites to be added

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO_{11}	PO_{12}	PSO 1	PSO 2
CO-1	**3**	**1**				**2**		**1**					**2**	**1**
CO-2	**3**	**3**		**2**	**3**		**3**				1		**2**	
CO-3	**3**	**2**	**2**									**3**		**3**
CO-4	**2**		**1**	**2**	**1**		**2**				2		**2**	**1**
CO-5	**2**	**3**											**2**	

CSE(BC) Semester: VII	Code Subject BC – 704(B) Data Engineering & Analytics	L T P C 3 0 0 3
Prerequisite:	Discrete mathematics, Basic probability theory and Data Structure	
CO1	Understand big data analytics as the next wave for businesses looking for competitive advantage	Level 2: Understand
CO2	Access and Process Data on Distributed File System	Level 3: Apply
CO3	Explore tools and practices for working with big data.	Level 3: Apply
CO4	Develop Big Data Solutions using Hadoop Eco System.	Level 3: Apply
CO5	Apply Machine Learning Techniques using R.	Level 4: Analyze
Unit - I	Introduction to Big Data And Hadoop: Dawn of the Big Data Era, Definition and Features of Big Data, Big Data Value, The Development of Big Data, Challenges of Big Data, Big Data Analytics, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights and Big Sheets.	6 Hrs.
Unit - II	HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	7 Hrs.
Unit - III	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	8 Hrs.
Unit - IV	Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction	7 Hrs.

Unit - V	Data Analytics with R: Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	7 Hrs.

Text Books:

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Books:

2. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
3. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
4. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R
5. Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press,2012.
7. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with AdvancedAnalytics", John Wiley & sons, 2012.

COs	**Programme Outcomes (POs)**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	**2**		**2**	**2**										
CO2	**1**		**2**	**2**	**1**								**2**	**2**
CO3	**2**	**2**	**2**	**2**	**2**								**2**	**2**
CO4		**1**	**2**	**2**	**1**								**2**	**2**
CO5	**2**	**2**	**2**	**2**	**1**						1		**2**	**2**

CSE(BC) Semester: VII	Code Subject BC – 704(C) Pervasive and Ubiquitous Computing	L T P C 3 0 0 3
Prerequisite: **Operating System**		
CO1	Understand the fundamental theoretical concepts in pervasive computing	Level 3: Apply
CO2	Concludetheenablingtechnologiesthatdrivethepervasiveandubiquitouscomputing	Level 3: Apply
CO3	Analyzeandcomparetheperformanceofdifferentdatadisseminationtechniques	Level 6: Create
CO4	Formulatethedesignaspects,thatareessentialtocreatethemodelofpervasivecomputing	Level 6: Create
CO5	Developsolutionsforproblemsrelatedtopervasiveandubiquitouscomputingsystemthroughinvestigation	Level 3: Apply
Unit – I	**Introduction:** Pervasive Computing: Principles-Characteristics-interaction transparency-context aware-automated experience capture - Vision and challenges of pervasive computing - Pervasive computing infrastructure - Architecture for pervasive computing-Pervasive devices-embedded controls-smart sensors and actuators-Context communication and access services.	6 Hrs.
Unit – II	**Technologies:** Device Technology for Pervasive Computing: Hardware - Human-machine interfaces - Biometrics - Operating Systems-Java for pervasive devices-Voice Technology: Basics of Speech Recognition-Voice standards-Speech Applications - Speech and Pervasive Computing - Security - Personal Digital Assistants.	7 Hrs.
Unit – III	**Sensor Networks and RFID:** Introduction to Sensor networks: Sensor Node Architecture - Sensor Network Architecture - Types of sensor networks - Platforms for Wireless sensor networks - Applications of Wireless Sensor networks - Introduction to RFID -transponder and reader architecture -Types of tags and readers -Frequencies of operation – Application of RFID Technologies.	8 Hrs.
Unit – IV	**Introduction to Ubiquitous Computing:** An introduction - overview - challenges to research topics in ubiquitous computing including sensors - ambient displays - tangibles - middleware - mobility - allocation and context awareness - Architecture for ubiquitous computing: new devices and communications - software architectures - Wireless standards & protocols for ubiquitous networks-Near field communication(NFC)-Bluetooth classic-Bluetooth Low Energy(BLE)–WiFi Direct.	7 Hrs.

Unit – V	**Ubiquitous Computing Applications :** Ubiquitous applications: the appropriate design - Weiser's vision of ubiquitous computing - mixed reality and sensibledesign-Wearablecomputing-GlassandAugmentedReality-Eye-Tracking-DigitalPenandPaperMobile social networking & crowd sensing Event based social network.	7 Hrs.

Text Books:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec, Klaus Rindtorff, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Sixth Edition, Pearson Education, New Delhi, 2009.
2. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Pub., Taylor and Francis Group, New York, 2007.
3. JohnKrumm,"UbiquitousComputingFundamentals",CRCPress,2010.

Reference Books:

1. Genco,S.Sorce,"PervasiveSystemsandUbiquitousComputing",WITPress,2012.
2. GuruduthS.Banavar,NormanH.Cohen,ChandraNarayanaswami,"PervasiveComputing:AnApplication- Based Approach", Wiley Interscience, 2012.
3. FrankAdelstein,SKSGupta,GGRichard,LSchwiebert,"FundamentalsofMobileandPervasive Computing", Tata McGraw Hill, New Delhi, 2005.
4. StefenPoslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions", Second Edition, Wiley, 2010.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
CO2	**2**	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**2**	**0**
CO3	**0**	**2**	**0**	**3**	**3**	**2**	**0**	**0**	**1**	**0**	**0**	**0**
CO4	**2**	**0**	**2**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**
CO5	**0**	**3**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**3**

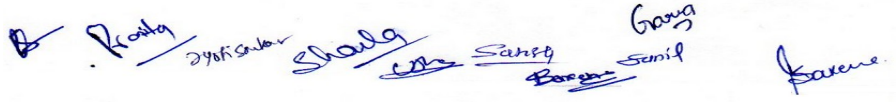
CSE(BC) Semester: VII	Code Subject BC – 705 Major Project Prelim	L T P C 3 0 0 3
CO1	To apply engineering management principles and effectivelycommunicate about well-defined engineering activities.	Level 3: Apply
CO2	To apply the knowledge/ skills/ modern engineering tools learnt in previous semesters, tosolve real life industrial / engineering / professional problems.	Level 3: Apply
CO3	To modify/ improve the existing engineering / professional systems by applying appropriate and modern technology/ tools	Level 4: Analyze
CO4	To develop systems / components / methods / processes / resourcestocater to the needs of the nearby small scale / medium industry/ startup	Level 6: Create
CO5	To analyze innovation inproposed solution for prevailing engineering / professionalissues / problems / concerns	Level 6: Evaluate

This course aims to provide more weightage to project work in a team.
The object of this major project work &its dissertation is to enable the student to extend further theinvestigative study taken up during minor project, either fully theoretical/practical or involving boththeoretical and practical work, under the guidance of a supervisor from the department. This is expected to provide goodtraining for the students in R&D work and technical leadership.
Participation in any technical event/ competition to fabricate and demonstrate an innovativemachine or product or prototype could be encouraged under this course.
The assignment to normallyinclude:

3. In depth study of the topic assigned in the light of the report prepared under minor project.
4. Review and finalization of the approach to the problem relating to the assigned topic.
5. Preparing an action plan for conducting the investigation, including teamwork.
6. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
7. Final development of product/process, testing, results, conclusions and future directions.
2. Preparing a paper for Conference presentation/Publication in Journals, if possible.
3. Preparing a Dissertation in the standard format for being evaluated by the Department.
4. Final seminar presentation before a departmental committee.

Report format and writing style	The following should be the order of contents for the report/ dissertation and should be strictly maintained- I. Cover Page II. Candidate's Declaration III. Institute Certificate IV. Acknowledgement V. Abstract VI. Notation, Naming Convention and Abbreviations VII. Table of Contents VIII. List of Figures IX. List of Tables X. Chapters: include but not limited to introduction, motivation, objectives, activity schedule chart, role of each group member, literature work, identified research gaps, research statements, problem statement, proposed methodology, technology used, algorithms, use case/ class diagram/ block diagram/ etc., result snapshots, pseudo code, innovation, feedback from stockholders, etc. XI. Conclusion and Future Work XII. Report on suggestions provided by Mentor and Its Incorporation XIII. Your Publications: Proof of published Research Papers/ Patent/ Book Chapters/ Technical Articles/ Posters/ Project Exhibition/ Technical Competitions/ Internship Certificate etc. XIV. References: Follow standard format to write the references including IEEE, APA, MLA, Chicago, etc. **General Instructions for writing reports-** The report should be written in Times New Roman font style,justify text alignment, 1.5 line spacing and black font color with A4 size page margin 2.5, 1.5, 15. 1.5 (Left, Right, Top, Bottom). • Chapter heading with 16 pts font size, all caps, bold. • Main Heading with 16 pts font size, bold. • Sub Heading with 14 pts font size, bold. • Second Sub Heading with 12 pts font size, bold, Italic. • Paragraphs should be written with 12 pts. font style, normal text.	
Evaluation Phases	Evaluation is based on the work done, quality of report, performance in viva-voce,presentation etc. The major project will have two mid semester presentations and one end semester presentation that will be monitored by the Project Evaluation Committee.	

Project Evaluation Committee	A project evaluation committee is constituted that includes Head of the Department, Project Coordinator, Mentor, & External Expert to evaluate the project based on evaluation matrix.	
Distribution of Marks	Term Work/ Lab Work/ Sessional evaluation of 50 marks will be carried out in 40%and 60% ratio by the mentor and project evaluation committee-I. Mentor analyzed the project and awarded the marks during Mid Sem-I and Mid Sem-II. Project evaluation committee-I will assess the project during end-semester examination. Project evaluation committee-II will assess the project during schedule of practical viva examination for 100 marks.	
Rubrics and Points for Project Evaluation	**Mid Sem. I Evaluation (10 Marks)** • Analysis of Clarity &Significance ofProblemStatement (PS) and Identification of Gap • Analysis of Requirement Engineering • Analysis of SelectedTechnological Stack, Project Cost, Time, Resource Management, etc. • Analysis of Project Feasibilities and ApplicationImpact on Society • Analysis of Planning, Designing& Risk Management **Mid Sem. II Evaluation (10 Marks)** • Analysis on Incorporation of Suggestions • Analysis of Use case/ Block Diagram/ etc. of Proposed Model • Analysis of Innovation and Creativity inSolution • Analysis of Coding, Security Issues& Other Concerns • Analysis of Content's Quality in Synopsis **Internal Evaluation (30 Marks)** • Analysis of Implementation Level • Analysis of Deployment Status • Analysis of Demonstration & Presentation • Analysis of Uniqueness and Innovation • Analysis of Publication Status **External Evaluation (100 Marks)** • Analysis of Comparation with ExistingSolutions and Benchmarks • Analysis of Maintenance of Implemented Solution • Analysis of Project Report Work • Clear division of work, use of collaboration tools • Other Pointsby Director/ Dean/HoD/ Coordinator/ Mentor	
Reference Books	• S. M. LaValle, "Planning algorithms", Cambridge University Press, 2006. • Project Management – David I Cleland – Mcgraw Hill International Edition. • Project Management – Gopalkrishnan – Mcmillan India Ltd.	



CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	1	1	2	2	1	2
CO2	2	3	3	2	2	1	1	1	2	1	1	2
CO3	2	2	3	2	3	1	1	1	3	2	1	2
CO4	3	3	3	3	2	1	1	1	2	2	1	3
CO5	1	1	1	1	1	1	1	2	3	3	1	2

CSE(BC) Semester: VII	Code Subject BC – 706 Internship-III (Completed in Third Year)	L T P C 3 0 0 3
CO1	Design, implement, and evaluate computing systems or components in realistic constraints.	Level 3: Apply
CO2	Communicate effectively and work collaboratively in a professional environment.	Level 2: Understand
CO3	Exhibit professional ethics and understand the societal impact of technology.	Level 4: Analyze
CO4	Develop adaptability, problem-solving skills, and lifelong learning mindset.	Level 6: Create
CO5	Reflect on the internship experience for personal and professional development.	Level 3: Analyze
This course aims to bridge the gap between academic learning and industry practices by providing students with real-world exposure to professional work environments. It enables students to apply their theoretical knowledge of computer science and engineering to practical tasks, develop technical and soft skills, and understand organizational culture and expectations.		
Objectives	**Practical Application**:To provide hands-on experience in solving real-world engineering problems using the concepts learned in the classroom. **Industry Exposure**:To expose students to the structure, functioning, and workflow of IT and software development organizations. **Skill Development**:To enhance students' technical, analytical, communication, and teamwork skills in a professional context. **Professionalism**:To inculcate ethical practices, time management, and responsibility in a workplace environment. **Career Readiness**:To prepare students for future employment or entrepreneurial ventures by equipping them with industry-relevant experience. **Problem Solving and Innovation**:To encourage critical thinking and innovative problem-solving approaches in technology projects.	

Evaluation Process	The internship of the students completed in third year will be evaluated in the following two stages: • Industry Evaluation about Students • Evaluation through seminar presentation/viva-voce at the Institute **Industry Evaluationabout Students** The industry will evaluate the students during internship period and put the remark on certificate. An evaluation will be carried out based on this remark or other important points mentioned by industry. **Evaluation through seminar presentation/viva-voce at the Institute** The student will give a seminar based on his training report, before an expert committee constituted by the department. The evaluation will be based on the following criteria: a. Impact/ Level of company b. Type of Internship(paid, unpaid, with stipend, etc.) c. Quality of content presented d. Effectiveness of presentation& solution e. Proper planning & designing solutions f. Depth of knowledge and communication skills g. Project management and role of team members h. Tool used during internship i. Attendance records, daily diary, departmental reports shall also be analyzed along with the Internship Report. Seminar presentations will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.	
Record to be submit	Students need to submit the copy of- j. Internship Certificate k. Internship Report l. Internship Presentation	
Report/ Presentation Guidelines	Few suggested points for PPT Presentation but not limited to- • Title of Internship Work • Objective of the Internship • Details of Internship company/organization/institution • Introduction of the Area of Work • Work done during Internship • Learning Outputs • Conclusion • Future Scope • Internship Completion Certificate/ Proof	

Reference Books	• "The Internship Bible" – Mark Oldman & Samer Hamadeh • "Technical Communication: Principles and Practice" – Meenakshi Raman & Sangeeta Sharma	

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**3**	**2**	**3**						**2**	**1**
CO2									**3**	**3**	**2**	
CO3						**2**	**1**	**3**				
CO4	**1**	**2**	**2**	**2**	**2**				**2**	**2**	**2**	**3**
CO5	**1**								**2**		**2**	**3**