VIISemester(ArtificialIntelligenceandMachineLearning)													
SL.NO	**Courseandcourse Code**		**CourseTitle**	**Teaching Department**	**TeachingHours/Week**				**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/Drawing**	**Self Study**	**Duration in hours**	**SEE Marks**	**CIE Marks**	**Total Marks**	
					L	T	P	S					
1	PEC	21AI71A	GenerativeAI	RD	3	0	0	0	03	50	50	100	3
2	PEC	21AI72A	VirtualReality andAugmented Reality	RD	3	0	0	0	03	50	50	100	3
3	OEC	21AI731	OpenElective–II	RD	3	0	0	0	03	50	50	100	3
4	OEC	21AI741	OpenElective–III	RD	3	0	0	0	03	50	50	100	3
5	Project	21AIP75	ProjectWork	Rd	Twocontacthours/weekforinteractionbetweenthefacultyandstudents.				03	50	50	100	10
6	AEC	21AI76	Ability Enhancement Course(Online4 weeks)		-	-			03	50	50	100	2
			Total		**12**	**0**	**0**	**0**	**400**	**400**		**800**	**24**
ProfessionalElectiveCore-I					**ProfessionalElectiveCore-II**								

1. NaturalLanguageProcessing(21AI71B) 2. Multimedia&InformationRetrieval (21AI71C)		1. QuantumComputing(21AI72B) 2. Image&VideoProcessing(21AI72C)
OpenElective-I		**OpenElective-II**
1. BigDataAnalytics(21AI73OE1)		1. CellularTechnology(21AI74OE1)

	VIIISemester(ArtificialIntelligenceandMachineLearning)											
	Course and CourseCode		CourseTitle	Teaching Department	Teaching Hours/Week				Examination				
Sl. NO					Lecture	Tutorial	Practical/Drawing	Self Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	Seminar	21AI81	Technical Seminar		Onecontacthour/weekfor interaction between the faculty and students.				03	50		50	1
2	Internship	21AI82	Research/Industry Internship		Twocontacthours/weekfor interaction between the faculty and students.				03	50	50	100	15
	Total								**06**	**100**	**50**	**150**	**16**

Sl.No	Semester	21-22 (BATCH)
01	I	20
02	II	20
03	III	20
04	IV	20
05	V	18
06	VI	22
07	VII	24
08	VIII	16
	Total	160

GenerativeAI		
CourseCode:	21AI71A	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite: Thestudentsshouldhavethebasicknowledgeof Machinelearning		

CourseLearningObjective

- To understandthe mathematicalfundamentalsthatisprerequisitesforavarietyof courses like
- Datamining,Networkprotocols,analysisofWebtraffic,Computersecurity, Software
- engineering,Computerarchitecture,operatingsystems,distributedsystems, Bioinformatics,
- Machine learning.
- To develop the understanding of the mathematical and logical basis to many moderntechniquesfortechnologylikemachinelearning,programminglanguage design, and concurrency.
- Tostudyvarioussamplingandclassificationproblems.

Modules	Teaching Hours
ModuleI **Probability and Information Theory:** Why Probability?, Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, The Chain Rule of Conditional Probabilities, Independence and Conditional Independence, Expectation, Variance and Covariance, Common Probability Distributions, Useful Properties of Common Functions, Bayes' Rule, Technical Details of Continuous Variables, Information Theory, Structured Probabilistic Models .	9Hrs.
ModuleII **Generative AI Applications:** Applications in Various Fields : Art and Creativity, Image and Video Generation, Text Generation, Music Composition, Healthcare Finance.Real-world use cases and challenges in deploying generative AI models.	8Hrs.
ModuleIII **Introduction to Large Language Models :** Overview of Generative AI and Large Language Models. Basics of attention mechanisms and Transformer architecture. Pre-training techniques and transfer learning strategies.	8Hrs.
ModuleIV **Python and TensorFlow 2 in Generative AI:** Overview of Python and TensorFlow 2, Preprocessing and cleaning data for Generative AI applications. Visualizing data distributions and patterns in Generative AI datasets. Introduction to TensorFlow's computation graph and eager execution.	9Hrs.

ModuleV	8Hrs.
Applications and Future Directions: Real-world applications of large language models. Challenges and limitations of current approaches. Emerging trends and future directions in Generative AI.	

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestions ineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:

1. Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology". Altaf Rehmani .

2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

3. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal.

Reference:

1. "Generative Adversarial Networks Cookbook: Over 100 recipes to build generative models using Python, TensorFlow, and Keras" by Josh Kalin.

2. “Generative AI in Software Development: Beyond the Limitations of Traditional Coding” Jesse Sprinter, 2024.

Course Outcome

Attheend ofthecoursethestudentwillbeableto:

CO#	**Course Outcome**
CO1	Tounderstandthebasicnotionsofdiscreteandcontinuousprobability.
CO2	Tounderstandthemethodsofstatisticalinference,andtherolethat sampling distributions Playin thosemethods.
CO3	Tobeabletoperformcorrectandmeaningfulstatisticalanalysesofsimpleto moderate complexity.
CO4	Applygenerativemodelstogeneratenewcontentandenhanceexistingdata.
CO5	UtilizegenerativeAItechniquestosolvecomplexproblemsindifferentdomains

NaturalLanguageProcessing		
CourseCode:	21AI71B	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite: Thestudentsshould haveknowledge ofNeuralNetworksandMachine Learning		
CourseLearningObjectives Thiscoursewillenablestudentsto • DefineNaturalLanguage Processing • ExplainWordlevelandsyntacticanalysis • Analyzethenaturallanguagetext • Understand the conceptsofTextmining • Illustrateinformationretrievaltechniques.		
Modules		**Teaching Hours**
ModuleI **Overview and language modeling:** Overview: Origins and challenges ofNLP-LanguageandGrammar-ProcessingIndianLanguages-NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.		8Hrs.
ModuleII **Word level and syntactic analysis:** Word Level Analysis: Regular Expressions-Finite- State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.SyntacticAnalysis:Context-freeGrammar-Constituency-Parsing-ProbabilisticParsing.		8Hrs.
ModuleIII **ExtractingRelationsfromText:FromWordSequencesto Dependency Paths:** Introduction, Subsequence Kernels for Relation Extraction, A Dependency-PathKernelforRelationExtractionandExperimental Evaluation. **MiningDiagnosticTextReportsbyLearningtoAnnotate Knowledge Roles:** Introduction, Domain Knowledge and Knowledge Roles, Frame SemanticsandSemanticRoleLabeling,LearningtoAnnotateCases with Knowledge Roles and Evaluations. **ACaseStudyinNaturalLanguageBasedWebSearch:**InFact SystemOverview,TheGlobalSecurity.orgExperience.		9Hrs.
ModuleIV **Evaluating Self-Explanations in iSTART: WordMatching, Latent Semantic Analysis, and Topic Models:** Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, **TextualSignatures:IdentifyingText-TypesUsingLatentSemantic Analysis toMeasure the Cohesion ofText Structures:** Introduction, Cohesion,Coh-Metrix,Approachesto AnalyzingTexts, Latent		9Hrs.

SemanticAnalysis,Predictions,ResultsofExperiments. **AutomaticDocumentSeparation:ACombinationofProbabilistic Classification and Finite-State Sequence Modeling:** Introduction, RelatedWork,DataPreparation, Document SeparationasaSequence Mapping Problem, Results. **EvolvingExplanatoryNovelPatternsforSemantically-BasedText Mining:** Related Work, A Semantically Guided Model for Effective Text Mining.	
ModuleV **INFORMATIONRETRIEVALANDLEXICALRESOURCES:** Information Retrieval: Design features of Information Retrieval Systems-Classical,Nonclassical,AlternativeModelsofInformation Retrieval – valuation Lexical Resources: World Net- Frame Net- Stemmers-POSTagger- ResearchCorpora.	8Hrs.

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestions ineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:

1. NaturalLanguageProcessingandInformationRetrievalTanveer Siddiqui,U.S.Tiwary, Oxford University Press, 2008
2. NaturalLanguageProcessingandText Mining AnneKaoandStephenR.Poteet Springer-Verlag London Limited 2007

Reference:

1. NaturalLanguageUnderstandingJames Allen2ndedition,Benjamin/Cummingspublishing company, 1995
2. GeraldJ. KowalskiandMark.T.MayburyInformationStorageandRetrievalsystemsKluwer academic Publishers, 2000.

Course Outcome

Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	Applythe naturallanguagetextat wordlevel
CO2	Developsyntacticstructurestosimpleandcomplexapplications.
CO3	Analyzethenaturallanguagetextatwordlevelandsyntactic structures.
CO4	Identifythe conceptsofTextmining.
CO5	Applyinformationretrievaltechniquestodevelopapplications.

Multimedia&informationRetrieval		
Subject Code:	21AI71C	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.

Prerequisite:Thestudentsshouldhavethebasicknowledgeofalgorithms,data structures and database

CourseLearningObjectives

- Usethedifferentinformationretrievaltechniquesinvariousapplicationareas
- ApplyIRprinciplestolocaterelevantinformationcollectionsofdata
- Analyzetheperformanceofretrievalsystemswhendealingwithunmanageddata sources

Modules	Teaching Hours
ModuleI Booleanretrieval.Thetermvocabularyandpostingslists.Dictionariesand tolerant retrieval. Index construction. Index compression	8Hrs.
ModuleII Scoring,termweighting,andthevectorspacemodel.Computingscoresina complete search system. Evaluation in information retrieval. Relevance feedbackandqueryexpansion.	8Hrs.
ModuleIII XMLretrieval.Probabilisticinformationretrieval.Languagemodelsfor information retrieval. Text classification. Vector space classification.	8Hrs.
ModuleIV Supportvectormachinesandmachinelearningondocuments,Flatclustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.	9Hrs.
ModuleV Websearchbasics. Webcrawlingandindexes, Linkanalysis.	9Hrs.

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestionsineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:

1. IntroductiontoInformationRetrieval,ChristopherD.ManningandPrabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008.
2. InformationStorageandRetrievalSystems:TheoryandImplementation,Kowalski, Gerald,MarkTMaybury, Springer.

Reference:

1.ModernInformationRetrieval,RicardoBaeza-Yates,PearsonEducation,2007

Course Outcome Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	Describemodelslikevector-space,probabilisticandlanguagemodelstoidentify the similarityofqueryanddocument
CO2	Implementretrievalsystemsforwebsearchtasks.
CO3	Analyzerankedretrievalofaverylargenumberofdocumentswithhyperlinksbetween them.
CO4	Demonstrategenesisanddiversityofinformationretrievalsituationsfortextandhyper media.

VIRTUALREALITYANDAUGMENTEDREALITY		
CourseCode:	21AI72A	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite: Thestudentsshouldhavethegoodknowledgeof C#programming, computer graphics with open GL and real time 3D concepts.		
CourseLearningObjectives: Toenablethestudentstoobtaintheknowledgeof Virtual Augmented Reality in the following topics. • To understand opportunities and the main issues related to designing and developing VR/AR systems architectures, both in local and in distributed (even web-based) contexts. • To understand development of VR/AR applications with a multimodal perspective and approach.		

Modules	**Teaching Hours**
ModuleI **Introduction:** ThethreeI'sofvirtualreality,commercialVR technology and the five classic components of a VR system. **Input Devices**: (Trackers, Navigation, and Gesture Interfaces): Three dimensionalpositiontrackers,navigationandmanipulation,interfaces andgesture interfaces.	8Hrs.
ModuleII **OutputDevices:** Graphicsdisplays, sounddisplays&hapticfeedback.	9Hrs.
ModuleIII **Modeling:**Geometricmodeling,kinematicsmodeling,physical modeling, behavior modeling, model management.	8Hrs.
ModuleIV **HumanFactors:**Methodologyandterminology,userperformance studies, VR health and safety issues.	8Hrs.
ModuleV **Applications:**Medicalapplications,militaryapplications,robotics	9Hrs.

applications.

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestions ineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:

1. AugmentedReality: APracticalGuidebyStephen Cawoodand Mark Fiala**.**
2. AugmentedRealityPrinciplesandPracticesbyDieterSchmalstiegandTobiasHollerer.

Reference:

1. UnderstandingVirtualReality, interface,ApplicationandDesign,WilliamR.Sherman, Alan Craig,Elsevier(MorganKaufmann).
2. 3DModelingandsurfacing,BillFleming,Elsevier(MorganKauffman).
3. 3DGameEngineDesign,DavidH.Eberly,Elsevier.
4. VirtualRealitySystems,JohnVince,PearsonEducation.
5. WhatisVirtualReality?http://vr.isdale.com/WhatIsVR/frames/WhatIsVR4.1.html.
6. AugmentedandMixedReality,http://www.mic.atr.co.jp/~poup/research/ar/.

CourseOutcome

Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	Describethe componentsofthevirtualrealitysystem.
CO2	Describevariousinputandoutputdevicesusedforvirtual Reality.
CO3	Applythedifferentmodelingconceptstovisualvirtualization.
CO4	Analyzetheperformanceofgivensimpleapplicationsrelatedtovirtualreality.
CO5	Design3D technologywithvirtualprogrammingconceptsindifferent applications.

QuantumComputing		
Subject Code:	21AI72B	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite:Thestudentsshouldhavethebasicknowledgeofcalculusandlinear algebra		
CourseLearningObjectives • Learnaboutqubitsandgatingoperations, • constructquantumcircuits • learnaboutquantumalgorithms		
Modules		**Teaching Hours**
ModuleI **Introduction**:Elementaryquantummechanics:,linearalgebraforquantum mechanics, Quantum states in Hilbert space,The Bloch sphere, Density operators, generalized measurements, no-cloning theorem.		8Hrs.
ModuleII **Quantumcorrelations**:Bellinequalitiesandentanglement,Schmidt decomposition, superdense coding, teleportation.		8Hrs.
ModuleIII **Quantumcryptography**:quantumkey distribution		8Hrs.
ModuleIV **Quantumgates andalgorithms:**Universalsetofgates,quantumcircuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring		9Hrs.
ModuleV **Programming a quantum computer**: The IBMQ, coding a quantum computer usinga simulator tocarryoutbasicquantummeasurementandstate analysis.		9Hrs.
Questionpaperpattern: 1. Thequestionpaper willhaveTEN questions. 2. TherewillbeTWOquestions ineachmodule, coveringallthe topics. 3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.		
Textbooks: (1) PhillipKaye,RaymondLaflamme et.al.,AnintroductiontoQuantumComputing,Oxford University press, 2007. (2) ChrisBernhardt,QuantumComputingforEveryone,TheMITPress,Cambridge,2020 (3) DavidMcMahon-QuantumComputingExplained-Wiley-Interscience,IEEEComputer Society (2008)		
Reference:(1)QuantumComputationandQuantumInformation, M.A. Nielsen&I.Chuang, Cambridge University Press (2013). (2)QuantumComputing, AGentleIntroduction, Eleanor G.RieffelandWolfgangH.PolakMIT		

press(2014)
Course Outcome Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	Learnaboutqubitsandgatingoperations
CO2	Constructquantumcircuitsandlearnaboutquantumalgorithms
CO3	HowtouseQiskittoconstructandrun quantumcircuitsonsimulators
CO4	HowtouseQiskittoconstructquantumhardwareusingPython

Image&VideoProcessing		
CourseCode:	21AI72C	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite:Thestudentsshouldhavetheknowledgeof Fouriertransformation and probabilistic approach.		
CourseLearningObjectives Toenablethestudentstoobtaintheknowledgeof**ImageandVideoProcessing** inthe following topics. • Understandofthefundamentalconceptsrelatedtomultidimensionalvideo processing,featureextraction,patternanalysisvisualgeometricmodeling, stochastic optimization etc. • Explore and contribute to research and further developments in the field of image and video processing		
Modules		**Teaching Hours**
ModuleI **CAMERAS:** Pinhole Cameras, Radiometry – Measuring Light: Light inSpace, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models,Color:ThePhysicsofColor,HumanColorPerception,Representing Color,AModelforImageColor,SurfaceColorfromImageColor.		8Hrs.
ModuleII **LinearFilters:**LinearFiltersandConvolution,ShiftInvariantLinearSystems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids,Application:SynthesisbySamplingLocalModels,Shapefrom Texture		8Hrs.

ModuleIII **The Geometry of Multiple Views: Two Views, Stereopsis:** Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image SegmentationbyClusteringPixels,SegmentationbyGraph-Theoretic Clustering,	8Hrs.
ModuleIV **Segmentation by Fitting a Model**: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing DataProblems, Fitting, and Segmentation, TheEM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, LinearDynamicModels,KalmanFiltering,DataAssociation,Applicationsand Examples.	9Hrs.
ModuleV **Geometric Camera Models**: Elements of Analytical Euclidean Geometry, Camera Parameters andthePerspectiveProjection, AffineCameras and Affine ProjectionEquations, GeometricCamera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, ObtainingHypothesesUsingInvariants,Verification,Application:Registration InMedicalImagingSystems, CurvedSurfacesandAlignment.	9Hrs.

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestions ineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:1.DavidA. ForsythandJeanPonce:Computer Vision–AModernApproach, PHI Learning(IndianEdition),2009

Reference:1.E.R.Davies:Computer andMachineVision–Theory,Algorithmsand Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Course Outcome

Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	Implementfundamentalimageprocessingtechniquesrequiredforcomputervision
CO2	Performshapeanalysis
CO3	Implementboundarytrackingtechniques
CO4	Applychaincodesandotherregiondescriptors&ApplyHoughTransformforline,circle, andellipsedetections
CO5	Apply3Dvisiontechniques,Implementmotionrelatedtechniques,Developapplications usingcomputervisiontechniques

BigDataAnalytics		
CourseCode:	21AI73OE1	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite: ThestudentsshouldhavetheknowledgeofDBMS.		
CourseLearningObjectives: ToenablethestudentstoobtaintheknowledgeofBigDataAnalyticsinthe following topics. • Toexplorethefundamentalconceptsofbigdataanalytics. • Tolearntoanalyzethebigdatausingintelligenttechniques. • TounderstandtheapplicationsusingMapReduceConcepts. • TointroduceprogrammingtoolsPIG&HIVE inHadoopechosystem		
Modules		**Teaching Hours**
Module1 **INTRODUCTION TO BIG DATA** TypesofDigitalData,Characteristics ofData,EvolutionofBigData, Definition ofBig Data, Challenges with Big Data, What is Big Data?: Volume, velocity, variety, Other characteristics ofData Whichare not Definitional Traits of Big Data: Why Big Data? Are we just an informationconsumerordowealsoproduceinformation?:Traditional business intelligence (B1) versus Big data: A typical data warehouse environment:, A typical hadoop environment:, What is new today?:, Coexistence of Big data and data warehouse, What is changing in the realms of Big data? . **Big Data Analytics** What is big data analytics? What is big data analyticsIsn't?ClassificationAnalytics,GratestchallengesthatpreventbusinessforCapitalizing on Big Data, Top challenges facing Big data, What kindoftechnologiesarewelookingtowardtohelp meet the challenges posed by big data ?.		8Hrs.
ModuleII **THEBIGDATATECHNOLOGY LANDSCAPE** NoSQL(Not OnlySQL),Where is it used?, What is it?, TypesofNoSQL Databases, WhyNoSQL?, Advantages of NoSQL, What We Miss With NoSQL?, Use of NoSQL in Industry,NoSQLVendors,SQL versus NoSQL,New SQL, Comparison of SQL, NoSQL, and NewSQL, **HADOOP**:FeaturesofHadoop,KeyAdvantagesofHadoop,Versionof Hadoop, Overview of Hadoop Ecosysytems, Hadoop Distributions, Hadoop versus SQL, Integrated Hadoop Systems Offered by Leading Market Vendors, Cloud-Based Hadoop Solutions, **INTRODUCTIONTOHADOOP** IntroducingHadoop,Data:TheTreasureTrove,WhyHadoop?,Why not RDBMS?, RDBMS versus Hadoop,, Distributed Computing Challenges, Hardware Failure, Howto process this Gigantic storeof data?, HistoryofHadoop,Thename "Hadoop"HadoopOverview,key aspects of Hadoop, Hadoop Components, Hadoop Conceptual Layer,		9Hrs.

High-level Architecture of Hadoop, use case of Hadoop, Clickstream Data, Hadoop Distributors, HDFS:Hadoop Distributed File System), HDFS Daemons, Anatomy of file read, Anatomy of file write, Replica placementstrategy,workingwithHDFSCommands,Specialfeaturesof HDFS, processing Data with hadoop, MapReduce Daemons, How does MapReduce work?, MapReduce Example, Managing Resources and applications with Hadoop YARN (Yet Another Resource Negotiator), Limitations of Hadoop 1.0 Architecture, HDFS Limitation, Hadoop 2:HDFS, Hadoop2 YARN: Taking Hadoop beyond Batch, Interacting withHadoopEcosystem, pig,Hive,Sqoop,Hbase.	
ModuleIII **INTORDUCTION TO MongoDB** WhatisMongo DB?,WhyMongo DB?,UsingJavaScriptObject Notation(JSON), Creating or generation a unique key, support for dynamicqueries,storingbinarydata,replication,sharding,updating information in-place, terms used in RDBMS and MongoDB, create database, drop database, data types in MongoDB, MongoDB Querylanguage, insert method,save() method,Addinganewfieldtoan existing document – update method, removing anexisting field froman existingdocument,-removemethod,findingdocumentsbasedonsearch criteria-find method, dealing withNULL values, count, Limit, Sort,and skip, Arrays , Aggregate Function, MapReduce Function, Java Script Programming, Cursors in MongoDB, Indexes, MongoImport,MongoExport,AutomaticGenerationofunique numbers for the "- id" field. **INTRODUCTIONTOCASSANDRA** ApacheCassandra,Anintroduction,FeaturesofCassandra,Peer-to-peer network, gossip and failure detection, partitioner, Replication Factor, Anti-Entropy and Read Repair, Writes in Cassandra,Hinted handoffs, tunable consistency, CQL Data types, CQLSH, Logging into cqlsh, keyspaces, CRUD(Create, Read, Update, and Delete) Operations, collections, Set collection, list collection, Map collection, More practice on Collections(SET and LIST), Using Map:Key, value pair, using a counter, time to live (TTL), Alter commands, Alter table to changethedatatypeofacolumn, altertabletodeleteacolumn, dropa table, dropa database, import and export,exportto CSV,Import from CSV,Import fromSTDIN,ExporttoSTDOUT,Queryingsystem Tables , Practice examples	9Hrs.
Module IV **INTRODUCTIONTOMAPREDUCEPROGRAMMING** Introduction,Mapper,Reducer,Combiner,Partitioner,Searching, Sorting,Compression. **INTRODUCTION TO HIVE:** What is Hive? History of Hive and recent releasesofHive,Hivefeatures,HiveIntegrationandworkflow, Hive data units, Hive Architecture, Hive Data Types, Primitive Data Types, CollectionData Types, Hive File Format, Text file, Sequential File, Rcfile (Record Columnar File), Hive Query Language(HQL), DDL (Date Definition Language) Statements, DML(DataManipulationLanguage)Statements,startingHiveshell, Database,Tables,Partitions,Bucketing,Views,Sub-query,Joins,	8Hrs.

Aggregation,GroupByandHaving,RCfileImplementation,SerDe, User-Defined Function(UDF). **INTRODUCTIONTOPIG** what is pig?, Keygeaturesofpig, The Anatomyof pig, pig onHadoop, Pig philosophy, Use case for Piog:ETL Processing, Pig latin overview, pig latin statements, pig latin:keywords, pig latin: Identifiers, Pig latin: Comments,PigLatin:Casesensitivity,Operatorsinpiglatin,Datatypes in Pig, Simple data types, complex data types, Running pig, Interactive mode,batchmode,ExecutionmodesofPig, localMode,mapreduce Mode, HDFS Commands,	
ModuleV RelationalOperatorsinPIGFILTER,FOREACH,GROUP,DISTINCT, LIMIT, ORDER BY, JOIN, UNION, SPLIT, SAMPLE, Eval function: AVG,MAX,COUNT,ComplexDataTypes:TUPLE,MAP,Piggybank, user-defined functions(UDF), Parameter Substitution, Diagnostic Operator,WordCountExampleusingPig, WhentousePig?, Whennot to use Pig?, Pig at Yahoo, Pig versus Hive. **INTRODUCTIONTOMACHINELEARNING** Introductiontomachinelearning,Machinelearningdefinition,machine learning algorithms, regression model – linear regression, clustering, collaborative filtering, Association Rule mining, Decision Tree. **CASESTUDIESPNUTS:**Yahoo!'shosteddataserving platform. FindingaNeedleinahaystack:Facebook'sphotostorage	9Hrs.

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestions ineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:

1.BigdataandAnalytics:SeemaAcharya(Infosysltd),Subhashinihellappan(Infosys ltd)

Reference:

1. NoreenBurlingame,ThelittlebookonBigData,NewStreetpublisher(eBook) http://www.prlog.org/11800911-just-published-the-little-book-of-big-data-2012-edition.html
2. NormanMatloff,TheArtofRProgramming: ATourofStatisticalSoftwareDesign, ISBN-13: 978-1-59327-384-2; ISBN-10: 1-59327-384-3
3. http://www.johndcook.com/R_language_for_programmers.html
4. http://bigdatauniversity.com/
5. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction

Course Outcome

Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	IllustrateBig-datafundamentalsandchallenges inbigdataanalytics.
CO2	DemonstrateHadoop,NOSQLframeworkstoefficientlystoreretrieveand processBigData.
CO3	Applybigdataprogrammingtomanipulate, store,andanalyzethe data.

CO4	IllustrateHiveandPigfeatures, itsarchitectureanddataformatforDDLand DMLoperations.
CO5	Applystatisticalanalysisformachine learningalgorithms.

CellularTechnology		
CourseCode:	21AI74OE1	Credits:3
CIE:50Marks	SEE:50Marks	SEE:03Hrs.
Hours/Week:03Hrs(Theory)		Total Hours:42Hrs.
Prerequisite:		
CourseLearningObjectives • Tomakestudentsfamiliarwithfundamentalsofmobilecommunicationsystems. • Toidentifythelimitationsof2Gand2.5Gwirelessmobilecommunicationand the • Designof3Gandbeyondmobilecommunicationsystems.		
Modules		**Teaching Hours**
ModuleI **Mobile Radio Propagation -**Large Scale Path Loss - Free Space Propagation Model, Relating Power to Electric Field, Three Basic PropagationMechanisms-Reflection(GroundReflection),Diffraction, Scattering, Practical Link Budget, **Fading andMultipath -**Broadband wireless channel, DelaySpread and Coherence Bandwidth, Doppler Spread and Coherence Time, Angular spreadandCoherenceDistance(fext 1-2.4)StatisticalChannelModelof a Broadband Fading Channel **TheCellularConcept-**CellularConcept,AnalysisofCellular Systems, Sectoring		8Hrs.
ModuleII **GSM and TDMA Technology** **GSMSystemoverview-**Introduction,GSMNetworkandSystem Architecture, GSM Channel Concept. **GSMSystemOperations-**GSMIdentities,SystemOperations-Traffic cases, GSM Infrastructure Communications (User Interface)		8Hrs.
Module III **CDMATechnologyCDMASystemOverview-**Introduction,CDMA Network and System Architecture **CDMABasics-**CDMAChannelConcepts,CDMASystem(Layer 3)operations,3GCDMA		8Hrs.
ModuleIV **LTE-4G** **Key Enablers for LTE 4G-** OFDM, SC-FDE, SC-FDMA, Channel DependantMultiuserResourceScheduling,Multi-AntennaTechniques,		9Hrs.

FlatIPArchitecture,LTENetworkArchitecture. **Multi-Carrier Modulation -** Multicarrier concepts, OFDM Basics, OFDM in LTE, Timing and Frequency Synchronization, Peak to AverageRation,SCFrequencyDomainEqualization,Computational Complexity Advantage of OFDM and SC-FDE.	
ModuleV **LTE - 4G OFDMA and SC-FDMA -** Multiple Access for OFDM Systems, OFDMA, SCFDMA, Multiuser Diversity and Opportunistic Scheduling,OFDMAandSC-FDMAinLTE,OFDMAsystemDesign Considerations. **TheLTEStandard-**IntroductiontoLTEandHierarchicalChannel StructureofLTE,DownlinkOFDMARadio Resources,UplinkSC-FDMA Radio Resources.	9Hrs.

Questionpaperpattern:

1. Thequestionpaper willhaveTEN questions.
2. TherewillbeTWOquestions ineachmodule, coveringallthe topics.
3. ThestudentneedtoanswerFIVE fullquestions,selectingONE fullquestionfromeach module.

Textbooks:

FundamentalsofLTE"ArunabhaGhosh,JanZhang,JeffereyAndrews,RiazMohammed, Pearson education (Formerly Prentice Hall, Communications Engg and Emerging Technologies), ISBN-13: 978-0-13- 703311-9.

2"Introductionto WirelessTelecommunicationsSystemsandNetworks",GaryMullet, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN -13: 978-81-315-0559-5.

Reference:

1. "WirelessCommunications:PrinciplesandPractice"TheodoreRappaport,2•Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.

2. LTE forUMTSEvolutionto LTE-Advanced'HarriHolmaandAnttiToskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print ISBN: 9780470660003. 2

Course Outcome

Attheend ofthecoursethestudentwillbeableto:

CO#	Course Outcome
CO1	Understandthe CommunicationtheorybothPhysicalandnetworkingassociated withGSM,CDMA&LTE4G systems.
CO2	Explainconceptsofpropagationmechanisms likeReflection, Diffraction, Scatteringinwirelesschannels.
CO3	Developaschemeforidlemode,callsetup,callprogresshandlingandcalltear downina GSMcellularnetwork.
CO4	Developaschemeforidlemode,callsetup,callprogresshandlingandcalltear downinaCDMAcellularnetwork.

CO5	UnderstandtheBasicoperationsof AirinterfaceinaLTE4G system.

PROJECTWORK		
CourseCode	**21AIP75**	Credits:10
CIE:50	SEE:50	SEE: 03hours
Prerequisite: ThestudentsshouldhaveThoroughknowledgeofSoftwareEngineeringand Mastering any one programming language.		
CourseObjectives: • Tounderstandthe currentrequirementoftheIndustries. • Tounderstandthedifferentsoftwaredevelopmentandtestingmethodologies. • Tounderstandandapplyarchitecturalmodel,dataflowandcontrolflowdiagrams. • Toacquiregooddocumentation,demonstrationskillsandimpactofapplicationon society		
ProjectPhase –IComprisesof:		Teaching Hours

1. LiteratureSurvey 2. RequirementAnalysis - S/wRequirements - H/wRequirements 3. DesignModulepresentation 4. Application 5. SystemRequirementSpecificationdocument SRSdocumentcontainssynopsis,problemformulationandrequirement analysisbasedonabovefactors.Documentshouldbesubmittedbytheendof VIISem.ProjectPhase-Iwouldbeevaluatedfor2creditsbymeansof presentation.	

Courseoutcomes:

Oncompletionofthecourse,thestudent willhavetheabilityto:

CourseCode	CO#	CourseOutcome(CO)
	CO1	Demonstrate the skills of performing surveys on current industrial requirements.
	CO2	Analyze the requirements and apply appropriate software development methodology.
	CO3	Implement and Validate the architectural model, data flow and control flow structures.
	CO4	Demonstrate the documentation and presentation skills
	CO5	ImplementtheSocietalandEthicalsystems.

VIII-SEMESTER

TECHNICALSEMINAR		
Course Code	21AIS81	Credits:01
CIE:50	SEE:---	Totalhours: 14 hrs

Prerequisite: TheStudentsshouldhavetheknowledgeofcurrenttechnologies,Creativityand programming skills.

CourseObjectives:

- Tounderstandthecurrenttrendsintheindustries
- Toapplythedocumentation techniques.
- Toexhibitthepresentationskillsandinteractiveskills.
- Toapplytheanalysisskills.

Modules	TeachingHours
SEMINARCOMPRISESOF: • Technicalsurvey–identifyingtherecentdevelopmentinthe modern technology. • Technicalrequirement–identifyingthecurrentindustrialskills. • Co-relatedtechnologies–identifyingtheco-relatedtechnologies. • Reportgeneration–preparingtheIEEEstandarddocumentsofthesame. • Seminar document contains Abstract, introduction, problem formulation, design and application based on the above factors. Document should be submitted in the mid of semester. • Seminarwillbeevaluated for1creditbymeansofpresentation.	**14Hours**

Courseoutcomes: Oncompletionofthecourse,thestudentwillhavetheabilityto:

CourseCode	CO#	CourseOutcome(CO)
	CO1	Todemonstratethedifferentsurveystounderstandthecurrentindustrial requirements.
	CO2	Toanalyzedifferenttechnicalrequirementsanddemonstrateinteractiveskills.
	CO3	Todemonstratethepresentationskills.
	CO4	Todemonstratetheanalyticalskills.
	CO5	Toexaminetheintensityoftheinteractive sessions.

INTERNSHIP		
CourseCode	**21AII82**	Credits:15
CIE:50	SEE.50	SEE: 03hours
Research Internship /Industry Internship of sufficient duration encourages students early on in their career. Its main goal is to give an opportunity to improve their analytical and technical skills in an international environment. Internship can be in an industry or at an appropriate work place. Research internships and industrial internships have differentpurposes and come with their set of benefits. A prior experience in any field is always preferred over a fresh start. Therefore, one of them can be selected depending on the interestthe students have. Internships pose unexpected challenges and make students to think appropriately, tackle difficulties with ease andact in a scholarly way to get past the hurdles and practical constraints. An internship is always beneficial however good or bad it is. Internships not only enhanceone'slearningbutalsoidentifieshim/herassomeonewhohasthecommitmenttoapproachinga project and completing it with or without the guidance. The internship learning is an impetus to professional development. While research internship is a step stone to higher studies, an industry internship is a pathway for a placement. Those who are self-motivated and interested in search of new things thatare original andunique canchoose a researchinternship. Those whoare interestedin the real industry-experienceandaspiretogetajobsoonaftergraduationcanchooseanindustryinternship.		