VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

ACCREDITED BY NAAC WITH 'A++' GRADE

Ibrahimbagh, Hyderabad-31

Approved by A.I.C.T.E., New Delhi and

Affiliated to Osmania University, Hyderabad-07

Sponsored

by

VASAVI ACADEMY OF EDUCATION

Hyderabad

SCHEME OF INSTRUCTION AND SYLLABI UNDER CBCS FOR B.E. (CSE) VII and VIII Semesters

With effect from 2023-24

(For the batch admitted in 2020-21)

(R-20)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Phones: +91-40-23146020, 23146021

Fax: +91-40-23146090

Institute Vision

Striving for a symbiosis of technological excellence and human values

Institute Mission

To arm young brains with competitive technology and nurture holistic development of the individuals for a better tomorrow

Department Vision

To be a center for academic excellence in the field of Computer Science and Engineering education to enable graduates to be ethical and competent professionals

Department Mission

To enable students to develop logic and problem solving approach that will help build their careers in the innovative field of computing and provide creative solutions for the benefit of society.

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B.E (CSE) Program Educational Objectives (PEO's)	
Graduates should be able to utilize the knowledge gained from their academic program to:	
PEO I	Solve problems in a modern technological society as valuable and productive engineers.
PEO II	Function and communicate effectively, both individually and within multidisciplinary teams.
PEO III	Be sensitive to the consequences of their work, both ethically and professionally, for productive professional careers.
PEO IV	Continue the process of life-long learning.

B.E. (CSE) PROGRAM OUTCOMES (PO's) Engineering Graduates will be able to:	
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**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.
PO3	**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.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

P1O	**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.
P11	**Project management and finance:** Demonstrate knowledge and understanding of the 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.
P12	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

B.E (CSE) PROGRAM SPECIFIC OUTCOMES (PSO's)	
PSO I	Graduates will have knowledge of programming and designing algorithms to develop solutions for engineering problems pertaining to AI&ML.
PSO II	Graduates will be able to develop models in Machine Learning, Deep Learning using knowledge of AI and modern tools.
PSO III	Graduates will apply AI&ML techniques for real world applications in the areas of Cyber Security, Image processing, Natural Language Processing and IoT.

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION(R-20)
FOR B.E 2020-21 ADMITTED BATCH VII SEMESTER (A.Y. 2023-24)

B.E CSE (AI&ML) VII Semester								
Course Code	Name of the Course	Scheme of Instruction			Scheme of Examination			
		Hours per Week			Duration in Hrs	Maximum Marks		Credits
		L	T	P/D		SEE	CIE	
THEORY								
UII20PC710CS	Distributed Systems and Cloud Computing	3	-	-	3	60	40	3
UII20PC720CS	Natural Language Processing	3	-	-	3	60	40	3
UII20PE7X0CS	Professional Elective-II	3	-	-	3	60	40	3
UII20PE7X0CS	Professional Elective-III	3	-	-	3	60	40	3
UII20PE7X0CS	Professional Elective-IV	3	-	-	3	60	40	3
PRACTICALS								
UII20PC711CS	Distributed Systems and Cloud Computing Lab	-	-	2	3	50	30	1
UII20PC721CS	Natural Language Processing Lab	-	-	2	3	50	30	1
UII20PW729CS	Project Seminar	-	-	2	-	-	30	1
	NPTEL Course	-	-	-	-	-	-	2
	TOTAL	**15**	**0**	**6**	**-**	**400**	**290**	**20**
	GRAND TOTAL	**21**				**690**		
Student should acquire one NPTEL course certification of 8 weeks duration (2 credits) during I Sem to VII Sem								

With effect from the Academic Year 2023-24

VASAVI COLLEGE OF ENGINEERING(Autonomous)

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IBRAHIMBAGH, HYDERABAD – 500 031

Department of Computer Science & Engineering

DISTRIBUTED SYSTEMS & CLOUD COMPUTING

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week):3:0:0	SEE Marks :60	Course Code: **UII20PC710CS**
Credits :3	CIE Marks :40	Duration of SEE : 3Hours

COURSEOBJECTIVES	**COURSEOUTCOMES** On completion of the course, students will be able to
1 Explain distributed system and cloud models 2 Apply distributed computational model and understand the need for cloud computing.	1 Explain distributed system models and cloud service & deployment models. 2 Analyze the need for virtualization in a cloud environment and apply it in compute, Memory and storage levels 3 Explain Container based virtualization and orchestration of containers using Kubernetes 4 Explain distributed computation model on large datasets using parallel and distributed programming approaches over cloud platforms 5 Explain the role of trust, load balancing

UNIT I:

Distributed System Models & Enabling technology: Scalable computing over the internet, Technologies for network-based system, System models for distributed & cloud, Software environments for distributed & Cloud.

Introduction to Cloud Computing: Cloud Computing in a Nutshell, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles of Cloud Computing, Service Models, Challenges and Risks.

SLA Management in the cloud: Types of SLA, Life cycle of SLA, SLA management in cloud.

UNIT II:

Virtual Machines and Virtualization of Cluster and Data Centers: Levels of Virtualization, Virtualization Structures/Tools and Mechanisms-KVM, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Centre Automation.

UNIT III:

Container based Virtualization: Creating and running containers-Docker, Deploying a Kubernetes Cluster, Managing virtual machines on Kubernetes cluster-Kubervirt, AWS Lambda and Azure function.

UNIT IV:

Cloud Programming & Software Environments: Features of Cloud & Grid, Parallel & Distributed programming paradigms, Map-Reduce, HDFS, Programming support of Google Cloud, Google File System, Big Table, Amazon AWS & Azure.

Case Study: OpenStack & Aneka

UNIT V:

Trust Management and Security: Trust, Reputation and Security Management in P2P Systems, Load Balancing- HAProxy, Data Security, Identity and Access Management in cloud. Consensus and related problems. Edge Computing, Multi cloud and Federated cloud

Learning Resources:

1. Kai Hwang. Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing, From parallel processing to the internet of things", Elsevier, 2012.
2. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "DISTRIBUTED SYSTEMS Concepts and Design", Fifth Edition, Addison-Wesley, 2012.
3. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, "Cloud Computing: principles and paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing (c) 2011.
4. Brendan Burns, Joe Beda, and Kelsey Hightowe: "Kubernetes: Up and Running" 2nd Edition, Oreilly, 2019
5. Raluca Ada Popa, Catherine M.S. Redfiled, NickolaiZeldovich, and Hari Balakrishnan, "Crypt DB" Protecting confidentiality with encrypted Query Processing" 23rd ACM Symposium on Operating Systems principles (SOSP 2011), Cascais, Portugal October 2011.

6. Craig Gentry,A fully Homomorhic Encryption Scheme, Doctoral Dissertation, September 2009
7. Ajay D. Kshemkalyani and Mukesh Singhal,Distributed Computing: Principles, Algorithms, and Systems, Cambridge, 2008
8. https://onlinecourses.nptel.ac.in/noc18_cs45/
9. https://cloud.google.com/load-balancing/docs/
10. https://docs.microsoft.com/en-us/azure/load-balancer/load-balancer-overview
11. https://www.docker.com/resources/what-container
12. http://www.haproxy.org/

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

With effect from the Academic Year 2023-24

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Department of Computer Science & Engineering

NATURAL LANGUAGE PROCESSING

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks:60	Course Code: **UI20PC720CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1. Learn the concept so Natural Language processing. 2. Gain knowledge understanding of relevant terminology, concepts in Natural Language Processing.	1. Apply N-grams for language modeling. 2. Apply part-of speech tagging algorithms for labeling text data. Analyse the syntax of sentences using parsing techniques. 3. Analyse documents using TF-IDF vector model. Extract sentiment and affect from the given text 4. Apply RNNs for language modeling. 5. Apply Neural networks for Masked Language Models and machine translation.

UNIT-I

Introduction: Introduction – current trending use cases in the area of NLP, Knowledge in Speech and Language processing, Ambiguity, Models and algorithms, Language, Thought and understanding.

Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, words, corpora, Text Normalization, Minimum Edit Distance.

N-gram Language Models: N-Grams, Smoothing.

Naïve Bayes and Sentiment classification: Naive Bayes classifiers, Training the Naive Bayes Classifier, Worked example, Optimizing for Sentiment Analysis.

UNIT-II:

Part-of-Speech Tagging: English word classes, The Penn Treebank Part-of-Speech Tagset, HMM Part-of-Speech Tagging.

Constituency Parsing: Ambiguity, CKY parsing.

Statistical Parsing: Probabilistic Context-Free Grammars, Probabilistic CKY Parsing of PCFGs.

Dependency Parsing: Dependency Relations, Dependency Formalisms, Dependency Treebanks, Transition-Based Dependency Parsing.

UNIT-III:

Vector Semantics and embeddings: Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Pointwise Mutual Information (PMI),Applications of the TF-IDFor PPMI vector models, Word2vec

Lexicons for Sentiment, Affect and Connotation: Defining Emotion, Available Sentiment and Affect Lexicons, Semi-supervised Induction of Affect Lexicons, Supervised Learning of Word Sentiment.

UNIT IV:

Neural Networks and Neural language Models: Feedforward Neural Networks, Feedforward Networks for NLP Classification and language modeling.

RNNs: Recurrent Neural Networks, RNNs as language models, RNNs for other NLP tasks, Encoder-Decoder models with RNNs, Attention.

Transformers: Self Attention Networks - Transformers, Transformers as language models, Sampling, Beam Search, Large Language Models.

UNIT V:

Fine-Tuning and Masked Language Models: Bidirectional Transformer Encoders (BERT), Training Bidirectional Encoders, Transfer Learning through Fine-Tuning.

Dialogue Systems and Chat bots: Rule based and corpus based chat bots, The Dialogue-State Architecture.

Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Models.

Learning Resources:

1. Daniel Jurafsky & James H.Martin, "Speechand Language Processing", 3rd edition, Pearson Education. (https://web.stanford.edu/~jurafsky/slp3/ *Revised January, 2023*).
2. James Allan, Natural Language Understanding, 2nd edition(1995),Pearson Education.
3. Charnaick, Eugene, Statistical Language Learning, MIT Press, 1993.
4. Christopher D. Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing,(1999), The MIT Press.
5. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Retrieval, (2008), Oxford University Press.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

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Department of Computer Science & Engineering

REINFORCEMENT LEARNING
(Professional Elective-II)

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks:60	Course Code:**UII20PE710CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVE	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1. Understand issues and techniques involved in the reinforcement learning	1. Illustrates various elements of reinforcement techniques. 2. Model a control task in the framework of MDPs. 3. Compute optimal values and policies using complete environment knowledge 4. Apply Monte Carlo method for prediction. 5. Apply Temporal-Difference(TD) learning for prediction and Understand the On-policy Prediction with Approximation

UNIT – I

The Reinforcement Learning Problem: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Example.

Multi-arm Bandits: An k-Armed Bandit Problem, Action-Value Methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits algorithms.

UNIT – II

Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notation for Episodic and Continuing Tasks, Policies and value functions, Optimal Policies and Optimal Value Functions, Optimality and Approximation.

UNIT – III

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

UNIT – IV

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control.

UNIT – V

Temporal-Difference (TD) Learning: TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning: Off-Policy , Expected Sarsa.

On-policy Prediction with Approximation: Value Function Approximation, The Prediction objective, Stochastic-gradient and Semi – gradient Methods.

Learning Resources:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", 2nd Edition. MIT Press, 2018
2. Kyriakos G. Vamvoudakis, Yan Wan, Frank L. Lewis, Derya Cansever,"Handbook of ReinforcementLearning and Control (Studies in Systems, Decision and Control, 325)", 1st Edition.
3. Nimish Sanghi,"Deep Reinforcement Learning with Python: With PyTorch, TensorFlow and OpenAI Gym", 1st Edition.
4. Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, Jan Peters."Reinforcement Learning Algorithms: Analysis and Applications", 1st Edition.
5. https://nptel.ac.in/courses/106106143
6. https://www.coursera.org/specializations/reinforcement-learning

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

With effect from the Academic Year 2023-24

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IBRAHIMBAGH, HYDERABAD – 500 031

Department of Computer Science & Engineering

CYBER SECURITY

(Professional Elective-III)

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks:60	Course Code: **UII20PE760CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1. Learn the fundamentals of Cyber Security 2. Gain understanding of relevant terminology, concepts in Cyber Security.	1. Understand Cyber Security Fundamentals. 2. Gain knowledge about attacker techniques and motivation 3. Gain knowledge about exploitations used by the attackers 4. Understand the various kinds of malicious codes. 5. Gain knowledge about defense and analysis techniques.

UNIT-I

Cyber Security Fundamentals:

Network and Security Concepts – Information Assurance Fundamentals, Basic Cryptography, Symmetric Encryption, Public Key Encryption, The DNS, Firewalls.

OS Security Concepts, Microsoft Windows Security Principles – Window Tokens, Window Messaging, Windows Program Execution, The Windows Firewall.

Digital certificates – Concept and implementation details.

UNIT-II:

Attacker Techniques and Motivations:

Usage of Proxies by Attackers, Tunneling techniques.

Fraud Techniques – Phishing, Smishing, Vishing, Mobile malicious code, Rogue antivirus, Click fraud and Ransomware.

Threat Infrastructure – Botnets, Fast-Flux, Advanced Fast-Flux.

UNIT-III:

Exploitation:

Techniques to gain a foothold- Shell code, Integer overflow vulnerabilities, Stack based buffer overflow, Format string vulnerabilities, SQL injection, Malicious PDF files, Race conditions, Web exploit tools, Dos Conditions, Brute Force and dictionary attacks.

Misdirection, Reconnaissance, and Disruption Methods – Cross site scripting, Social Engineering, WarXing, DNS Amplification attacks

UNIT IV:

Malicious Code:

Self-replicating malicious code – worms and viruses.

Evading detection and Elevating Privileges – Obfuscation, VM Obfuscation, Persistent software techniques, Rootkits, Spyware, Attacks against privileged user accounts and escalation of privileges, token kidnapping, VM detection.

Stealing information and exploitation – Form grabbing, Man-in-the-middle attacks, DLL injections, Browser Helper objects.

UNIT V:

Defense and Analysis techniques:

Memory Forensics – Importance and capabilities of memory forensics, Memory analysis frameworks, Dumping physical memory, Installing and using volatality, Finding hidden processes, Volatality Analyst Pack.

Honeypots, Malicious code naming, Automated Malicious Code Analysis Systems: Passive Analysis, Active Analysis.

Intrusion Detection Systems

Learning Resources:

1. James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials", CRC Press, 2016.
2. Nina Godbole and Sunit Belapure, "Cyber Security", Wiley India, 2012.

With effect from the Academic Year 2023-24

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 90 Minutes

With effect from the Academic Year 2023-24

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Department of Computer Science & Engineering

UNMANNED AERIAL VEHICLES

(Professional Elective-IV)

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks:60	Course Code: **UI20PE724CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1. To gain insight into the basic elements of commercial-off-the-shelf (COTS) drone systems used in civilianmissions. 2. To introduce unmanned aerial systems (UAS) including drones and autonomous unmanned aerial vehicles(UAV) with sensors. 3. To Understand the regulatory procedures of drones, pilot certification and licensing and basic safetymeasures required of UAS / UAV.	1. Understand the evolution and classification of Drones / Unmanned aerial Vehicle (UAVs) 2. Gain knowledge on UAVs technology side of things (i.e., sensors, platforms, navigation, power source, communication, range, altitude and speed) 3. Illustrate the commercial applications used by various types of drones such as aerial photography, lawenforcement surveillance, and border enforcement. 4. Thorough knowledge on the hardware and software used for data collection, storage, analytical requirements and system life cycle. 5. Discuss Indian government airspace policy, regulations, and a comparison of other international regulations, and risk factors. 6. Realize the emerging technologies being integrated into the drone market including semi-autonomous and autonomous systems for various applications like crop sensing, emergency response missions, and coordinated swarms.

UNIT: I

Introduction to Autonomous Flights: History of Autonomous Flights – Principles of Flight – Flight Maneuvers – Showcase of DIY drones.

Technologies and Requirements: Critical Technologies – Navigation, Sensors and Payloads, Power Sources, Communications – COTS Drone Technologies.

UNIT: II

Design Fundamentals: UAV Classifications – Review of few Successful UAVs – Design Project Planning – Feasibility Analysis- Design Process – UAV Conceptual Design – UAV Preliminary Design – UAV Detail Design – Design Review, Evaluation, Feedback – UAV Design Steps.

Principles of UAVs: Airframe - Building the Little Dipper Airframe – Step by step build instructions – Power Train – Propellers – Motors – Total Lift – Wrapping UP.

UNIT: III

Control and Navigation: Flight Controller – Build Instructions of Flight Controller – GPS – Compass – Battery Monitor – Transmitter – Frequency Bands – Different Modes Around the World.

UNIT: IV

Telemetry Radios, Camera and First Person View (FPV) Equipment:

Software Monitoring and control – Popular Drone Cameras – FPV for Live stream – Key Flight Safety Rules – PreFlight Checklist and Flight Log information – Laws and Regulation.

UNIT: V

Overview of Commercial Drones and Kits: (9 Hours)

Parallax ELEV-8 Quadcopter - DJI Phantom 2 Vision - OpenROV - Actobotics Nomad - Brooklyn

Aerodrome Flack – Choosing Between Commercial Options – Making your own Airframe, Contemporary issues.

Learning Resources:

1. Terry Kilby and Belinda Kilby Make: Getting Started with Drones, First Edition, Maker Media Inc,San Francisco CA, 2016.
2. John Baichtal “Building your own Drones A beginners Guide to Drones, UAVs and ROVs”, QuePublishing 2016.

Reference Books:

1. Mohammad H. Sadraey "Design of Unmanned Aerial Systems" First Edition, John Wiley & Sons, Inc.,USA 2020.
2. A.R. Jha, "Theory, Design, and Applications of Unmanned Aerial Vehicles", First Edition, CRCPress, 2020.
3. Alain Cardon and Mohamed Itmi "New Autonomous Systems" Volume 1, John Wiley & Sons, Inc.Hoboken, USA. 2016.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

With effect from the Academic Year 2023-24

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Department of Computer Science & Engineering

BLOCKCHAIN PLATFORMS AND APPLICATIONS

(Professional Elective-IV)

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week):3:0:0	SEE Marks:60	Course Code:**UII20PE744CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1 To provide understanding and significance of Blockchain. 2 To familiarize with platforms such as Ethereum, Hyperledger Fabric involved in building Blockchain applications. 3 To impart knowledge about the applications of Blockchain in various sectors.	1 Understand the significance of Blockchain technology and its associated components. 2 Understand the need for consensus protocols in Blockchain. 3 Experience the Ethereum and Solidity Programming 4 Understand the basics of Hyperledger fabric. 5 Incorporate Blockchain in financial software Systems and supply chain environments.

UNIT - I

Introduction: Overview of distributed systems; Introduction to Blockchain; Properties of Blockchain; Evolution of Blockchain, Components of Blockchain, Ecosystem, Hash Functions, Merkle Trees; Types of Blockchain; Blockchain Platforms.

Cryptography: Privacy and Security on Blockchain.

UNIT - II

Distributed consensus: Consensus algorithms, Consensus in a Bitcoin network, Proof of Work (PoW), Proof of Stake, Proof of Burn, Proof of Elapsed Time; Consensus models for permissioned block chain, Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine

general problem, Byzantine fault tolerant system, BFT over Asynchronous systems.

UNIT - III

Ethereum: Introduction to Ethereum Smart Contracts; Mining in Ethereum; Consensus mechanism in Ethereum; Technologies that support Ethereum;

Ethereum Programming Languages-Solidity-Basic Syntax,Types, Variables, Variables Scope, Operators, Loops, Decision Making, Strings, Arrays, Enums, Structs, Mapping, Conversions , Ether Units, Solidity Functions, Solidity Common Patterns – Restricted Access, Withdrawal Pattern, Contracts, Inheritance, Constructors, Abstract Contracts, Interfaces, Interfaces, Events, Error Handling.

UNIT – IV

Hyperledger Fabric: Introduction to Hyperledger Fabric; Hyperledger Fabric architecture; Consensus in Hyperledger Fabric; Hyperledger API and Application Model;

UNIT – V

Use Case I: Blockchain in Financial Software and Systems (FSS): Settlements, KYC, Insurance.

Use case II: Blockchain in trade/supply chain:- Tuna fish Problem

Use Case III: Blockchain for Government: Digital identity, land records and other kinds of record keeping between government entities.

Learning Resources:

1. Imran Bashir, "Mastering Blockchain : A deep dive into distributed ledgers, consensus protocols,smart contracts, DApps, cryptocurrencies, Ethereum, and more", Packt Publishing,Third Edition, 2020,
2. Mark Gates, “Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money”, Wise Fox Publishing and Mark Gates, 2017.
3. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, “Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer”, 2018.
4. ArshdeepBahga, Vijay Madisetti, “Blockchain Applications: A Hands-On Approach”, ArshdeepBahga, Vijay Madisetti publishers 2017.

Suggested Reading:

1. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly Media, Inc., 2014.
2. Melanie Swa, “Blockchain”, O'Reilly Media, 2014.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits, 2017
   https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.htm
4. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

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Department of Computer Science & Engineering

DISTRIBUTED SYSTEMS & CLOUD COMPUTING LAB

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks:50	Course Code: **UII20PC711CS**
Credits : 1	CIE Marks:30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1 Implement distributed transactions 2 Install, configure and deploy applications using various cloud platforms	1 Launch and run highly available cloud services using AWS (Amazon web Services) 2 Create a virtual machine in a private cloud using OpenStack 3 Create and deploy an application on a Docker container 4 Implement a distributed application using MapReduce programming model 5 Demonstrate cloud security, load balancing and auto scaling features

Programming Exercises:

1. Hosting a static website in Amazon S3 Bucket.
2. Create a virtual machine using Amazon EC2.
3. Adding storage to EC2 using amazon EFS.
4. Create an Amazon RDS database and perform CRUD operations.
5. Deploy a Node.js application on a Docker Container
6. Running Containers on Amazon Elastic Kubernetes Service (Amazon EKS).
7. Implement a serverless architecture using Amazon Lambda
8. Build a Virtual Private Cloud to produce a customized network.
9. Streaming dynamic content using Amazon CloudFront.

10. Implement a distributed application on Hadoop framework to count word frequency with MapReduce.
11. Demonstrate Identity and access management for controlling account access.
12. Implement Elastic load balancing and auto scaling service.

Learning Resources:

1. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, DISTRIBUTED SYSTEMS Concepts and Design, Fifth Edition, Addison-Wesley, 2012.
2. Kai Hwang. Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing from parallel processing to the internet of things", Elsevier, 2012.
3. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, "Cloud Computing: principles and paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing (c) 2011.
4. Raluca Ada Popa, Catherine M.S. Redfiled, NickolaiZeldovich, and Hari Balakrishnan, "Crypt DB" Protecting confidentiality with encrypted Query Processing" 23rd ACM Symposium on Operating Systems principles (SOSP 2011), Cascais, Portugal October 2011.
5. Craig Gentry, A fully Homomorhic Encryption Scheme, Doctoral Dissertation, September 2009.
6. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge, 2008.
7. https://www.virtualbox.org/wiki/Documentation
8. https://cloud.google.com/docs
9. https://docs.aws.amazon.com/
10. https://docs.microsoft.com/en-us/azure/?product=featured
11. https://wiki.openstack.org/wiki/Documentation
12. http://www.manjrasoft.com/aneka_architecture.html
13. https://www.docker.com/resources/what-container
14. http://www.haproxy.org/

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test : 2Hours			

With effect from the Academic Year 2023-24

VASAVI COLLEGE OF ENGINEERING(Autonomous)

ACCREDITED BY NAAC WITH 'A++' GRADE

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Computer Science & Engineering

NATURAL LANGUAGE PROCESSING LAB

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks:50	Course Code**:UII20PC721CS**
Credits : 1	CIE Marks:30	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1. Apply dynamic programming design strategy for NLP tasks 2. Design Feedforward and Recurrent Neural Networks for performing Language Modelling	1. Implement the word tokenization for NLP pre-processing 2. Implement the N-gram and Neural language models. 3. Implement parsing algorithms for grammar checking 4. Implement solution for sentiment analysis 5. Implement the NLP task namely document classification

The following experiments are to implemented using Python library nltk and spaCY and without using the library wherever applicable. And each student is expected to develop and submit a mini project in the area of NLP at the end of the course.

1. Implement a word tokenization using UNIX utilities
2. Implement a word tokenization using regular expressions
3. Implement Minimum Edit Distance (MED) algorithm for spelling correction
4. Implement n-gram language model
5. Implement Naïve Bayes classification for sentiment analysis
6. Implement POS tagging using HMM
7. Implement CKY parsing algorithm

8. Implement PCKY parsing algorithm
9. Compute cosine similarity between the words using term-document matrix and term-term matrix
10. Compute tf-idf matrix for the given document set
11. Implement language model using Feedforward Neural Network
12. Implement language model using RNN
13. Perform Text Analytics

Learning Resources:

1. DanielJurafsky&JamesH.Martin,"SpeechandLanguageProcessing",3rdedition,PearsonEducation. (https://web.stanford.edu/~jurafsky/slp3/)
2. James Allan, Natural Language Understanding, 2nd edition(1995), Pearson Education
3. Charnaick, Eugene, Statistical Language Learning, MIT Press, 1993
4. Christopher D.Manning, HinrichSchutze, Foundations of Statistical Natural Language Processing, (1999),The MIT Press.
5. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Retrieval, (2008), Oxford University Press.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 2 Hours			

With effect from the Academic Year 2023-24

VASAVI COLLEGE OF ENGINEERING(Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Computer Science & Engineering

PROJECT SEMINAR

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P (Hrs./week): 0:0:2	SEE Marks : --	Course Code:**UII20PW729CS**
Credits : 1	CIE Marks : 30	Duration of SEE : --

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1 Select a Problem by reviewing Literature 2 Present the selected topic effectively in oral & written form	1 Select a problem related to Computer science area by reviewing the Literature 2 Analyze the existing solutions for the problem identified 3 Identify the gaps in the existing solutions 4 Present the analysis of the identified problem 5 Design a Document according to the format

Oral presentation is an important aspect of Engineering education. The objective of the Project seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his/her specialization of the Project.

Project Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of a seminar presentation.

- Problem Definition and Specification
- Literature survey
- Broad Knowledge of available techniques to solve a particular problem
- Organization of the material
- Presentation

Each student is required to :

1. Submit a one page synopsis before the seminar talk.
2. Give a 20 minute presentation followed by a 10 minute discussion.

3. Submit a report on the seminar topic with a list of references.

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged. For award of the Sessional marks, students are to be judged by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussions.

With effect from the Academic Year 2023-24

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION (R-20)
FOR B.E 2020-21 ADMITTED BATCH VIII SEMESTER (A.Y 2023-24)

B.E CSE (AI&ML) VIII Semester								
Course Code	Name of the Course	Scheme of Instruction			Scheme of Examination			
		Hours per Week			Duration in Hrs	Maximum Marks		Credits
		L	T	P/D		SEE	CIE	
THEORY								
UII20PE8X0CS	Professional Elective – V	3	-	-	3	60	40	3
UII20PE8X0CS	Professional Elective – VI	3	-	-	3	60	40	3
PRACTICALS								
UII20PW819CS	Project / Internship	-	-	12	Viva-Voce	50	50	6
	TOTAL	**6**	**-**	**12**		**170**	**130**	**12**
	GRAND TOTAL	**18**				**300**		

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IBRAHIMBAGH, HYDERABAD – 500 031

Department of Computer Science & Engineering

ADHOC AND SENSOR NETWORKS

(Professional Elective-V)

SYLLABUS FOR B.E. VIII-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks:60	Course Code:**UII20PE820CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1 Understand the design issues and applications of an Ad hoc and sensor network.	1 Compare topologies based on position-based routing approaches. Explain the environment and communication systems in an Adhoc network. 2 Categorize data transmission techniques in MANETs and the network architecture of wireless mesh networks. 3 Demonstrate Cognitive Radio technologies and TCP issues in Ad hoc networks. 4 Explain the design and network issues of a sensor network. 5 Identify the security mechanisms of an ad hoc and sensor network. Integrate MANETs, WLANs, and cellular networks.

UNIT-I:

Introduction: Introduction, Application of MANETs, Challenges

Routing in Ad Hoc Networks: Topology Based Routing Protocols – Proactive Routing, Reactive Routing and Hybrid Routing, Position Based Routing - Principles and Issues, Location Services, Forwarding Strategies

UNIT-II: Broadcasting, Multicasting and Geocasting

Wireless Mesh Networks: Introduction, Network Architecture, Challenging technologies

UNIT-III:

Cognitive Radio and Networks: Introduction, Spectrum Access Models, Cognitive Radio Technologies and Challenges, The IEEE 802.22 Standard

TCP over Ad Hoc Networks: TCP protocol overview, Solutions for TCP over Ad hoc

UNIT-IV:

Sensor Networks Design Considerations: Introduction, Design Issues, Localization Scheme, clustering of SNs, MAC layer, The Self-organizing MAC for WSNs and the Eaves-drop-and-Register protocol.

Sensor Networks in Controlled Environment and Actuators: Regularly placed sensors**,** Design Issues, Network Issues

Applications of Sensor Networks: Body Area Network, Habitat monitoring, Health Care Monitoring, Greenhouse monitoring

UNIT-V:

Security in Ad Hoc and Sensor Networks:

Distributed systems security, Secure routing, Cooperation in MANETs, WSN Security.

Integrating MANETs, WLANs and Cellular Networks: Ingredients of a heterogeneous architecture, Protocol Stack, Comparison of the Integrated Architectures

Learning Resources:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks : Theory and Applications", Second Edition, World Scientific Publishers, 2011
2. Prasant Mohapatra and Sriramamurtyhy, "Ad Hoc Networks: Technologies and Protocols", Springer International Edition, 2009.
3. Kazem Sohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks', A John Wiley & Sons Inc. Publication, 2007.
4. https://nptel.ac.in/courses/106105160/

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

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Department of Computer Science & Engineering

IMAGE PROCESSING

(Professional Elective-V)

SYLLABUS FOR B.E. VIII-SEMESTER

L:T:P(Hrs./week):3:0:0	SEE Marks : 60	Course Code: **UII20PE840CS**
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1 Understand the fundamentals of image processing algorithms. 2 Apply image processing algorithms to solve real problems.	1 Distinguish sampling and quantization processes in obtaining digital images from continuously sensed data and describe the steps in image processing. 2 Apply techniques in spatial domain to enhance and segment digital images. 3 Apply Fourier transformation and other transformation techniques to enhance digital image. 4 Describe methods to encode raw image data into standard compressed image format. 5 Demonstrate most commonly applied image restoration and color models and their use in basic image processing.

UNIT-I:

Introduction to Digital Image Processing, Origins and Applications of Digital Image Processing. Fundamental Steps in Digital Image Processing, Components of Digital Image Processing System. Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization.

UNIT-II:

Intensity Transformations and Spatial Filtering: Histogram Processing, Fundamental of Spatial Filtering, Smoothing and Sharpening Spatial Filters.

Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation.

UNIT-III: Filtering in the Frequency Domain:
Preliminary Concepts, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of One Variable, Extension to Function of Two Variables, Image Smoothing and Sharpening using Frequency Domain Filters.

UNIT-IV:
Image Compression: Fidelity Criteria, Image Compression Models, Image Formats, Containers and Compression Standards, Compression Methods: Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding.

UNIT-V:
Restoration: Noise Models, Inverse filtering, Least squares filtering.
Color Image Processing: Color fundamentals, Color models, Pseudocolor Image Processing , Basics of full color image processing.

Learning Resources:

1. Gonzalez R.C., Woods R.E, Digital Image Processing, Third Edition (2007), Prentice Hall, USA.
2. Jayaraman S, Esakkirajan S, Veerakumar T, Digital image processing, 13th reprint (2014), McGraw Hill Education, New Delhi.
3. William K. Pratt, Digital Image Processing, 3rd Edition (2001) , John Wiley & Sons Inc, UK.
4. McAndrew, Introduction to Digital Image Processing, (2004), Cengage Learning.
5. Sonka, Hlavac, Boyle, Digital Image Processing and Computer Vision, (2008), Cengage Learning.
6. Rosenfeld A. Kak AC, Digital Picture Processing Vol.I & II Acad, Press, 2nd Edition.
7. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing- spring-2011/introduction/.
8. http://freevideolectures.com/Course/2316/Digital-Image-Processing- IIT-Kharagpur

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

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IBRAHIMBAGH, HYDERABAD – 500 031

Department of Computer Science & Engineering

ADVANCED DATABASES
(Professional Elective-VI)

SYLLABUS FOR B.E. VIII-SEMESTER

L:T:P (Hrs./week): 3:0:0	SEE Marks:60	Course Code:**UI20PE860CS**
Credits : 3	CIE Marks:40	Duration of SEE : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES *On completion of the course, students will be able to*
1 Apply knowledge of advanced database management techniques to provide solution for a database intensive problem.	1 create and query tables in object relational and object oriented databases 2 create, query and process data in XML files 3 describe query processing mechanisms and query optimization 4 explain inter query, intra query parallelism and distributed database processing techniques 5 apply performance tuning methods and describe data representation in spatial, geographical and temporal databases

UNIT-I: Object Based Databases: Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.

UNIT-II: XML: Motivation, Structure of XML data, XML Document Schema, Querying and Transformation, Application program Interfaces to XML, Storage of XML Data, XML applications.

UNIT-III: Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions.

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans, Materialized Views.

UNIT-IV: Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Interoperation Parallelism, Interoperation Parallelism.
Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Heterogeneous Distributed Databases, and Cloud-Based Databases.

UNIT-V: Advanced Application Development: Performance Tuning, Performance Benchmarks, Other Issues in Application Development, Standardization.
Spatial and Temporal Data and Mobility: Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases, Mobility and Personal Databases.

Learning Resources:

1. Abraham Silberschatz, Henry F Korth, Sudharshan S, Database System Concepts, 6th Edition(2011), McGraw-Hill International Edition.
2. RamezElmasri, Durvasul VLN Somyazulu, Shamkant B Navathe, Shyam K Gupta, Fundamentals of Database Systems, 4th Edition(2006), Pearson Education.
3. Date CJ, Kannan A, Swamynathan S, An Introduction to Database System , 8th Edition(2006) Pearson Education.
4. Raghu Ramakrishna, and Johannes Gehrke, Database Management Systems, 3rd Edition(2003), McGraw Hill.
5. http://nptel.ac.in/courses/106106093/

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Test	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5

Duration of Internal Tests : 1 Hour 30 Minutes

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Department of Computer Science & Engineering

PROJECT/ INTERNSHIP

SYLLABUS FOR B.E. VIII-SEMESTER

L:T:P (Hrs./week): 0:0:12	SEE Marks:50	Course Code: **UII20PW819CS**
Credits : 6	CIE Marks:50	Duration of SEE : Viva-Voce

COURSE OBJECTIVES	**COURSE OUTCOMES** *On completion of the course, students will be able to*
• Review the literature to find a problem in Computer science area • Design a system for identified problem, analyze , implement and demonstrate the Problem identified	1. Perform literature survey and find a problem in the interested area 2. Analyze the feasibility of selected problem to design a solution 3. Design a system to address the proposed problem 4. Develop a system based on the design ,verify the correctness of the system with exhaustive test cases and provide the conclusion for the proposed system 5. Demonstrate the work done in the project

The aim of Project is to implement and evaluate the proposal made as part of the literature survey. Students can also be encouraged to do full time internship as part of project.

Project coordinator will coordinate the following:

Grouping of students (maximum of 2 to 3 in a group)
Allotment of projects and project supervisors
Project monitoring at regular intervals

The students placed in internships need to write the new proposal in consultation with industry coordinator and internal project guide within two weeks from the commencement of instruction.

All projects (internship and departmental) will be monitored twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well the supervisor. The first review of projects for 15 marks is conducted after completion of five weeks. The second review for another 35 marks is conducted after 14 weeks of instruction.

The students are required to submit copies of their project report following IEEE standards one week before the last instruction date.

	B. E. List of Professional Electives - Stream wise								
		Artificial Intelligence & Data Engineering		Systems & Networks		Software Engineering		Applications	
		Course Code	Title	Course Code	Title	Course Code	Title	Course Code	Title
Sem -VI	PE -I	UII20PE610CS	Neural Networks	UII20PE 620CS	Advanced Computer Architecture	UII20PE 630CS	Software Project Management	UII20PE640CS	**Internet of Things**
Sem -VII	PE-II	UII20PE710CS	**Reinforcement Learning**	UII20PE 720CS	Information Storage Management	UII20PE 730CS	Software Design tools and methodologies	UII20PE 740CS	Human Computer Interaction
	PE-III	UII20PE750CS	Data Mining	UII20PE 760CS	**Cyber Security**	UII20PE 770CS	Software Testing Methodologies	UII20PE 780CS	Multi Agent Intelligence Systems
	PE -IV	UII20PE714CS	Data Science	UII20PE 724CS	**Unmanned Aerial Vehicles**	UII20PE 734CS	Software Processes and Agile Practices	UII20PE 744CS	**Block chain Platforms and Applications**
Sem -VIII	PE-V	UII20PE810CS	Robotic Process Automation	UII20PE 820CS	**Adhoc and Sensor Networks**	UII20PE 830CS	Software Quality Management	UII20PE 840CS	**Image Processing**
	PE -VI	UII20PE850CS	Bigdata Analytics	UII20PE 860CS	**Advanced Databases**	UII20PE 870CS	Secure Software Design	UII20PE 880CS	Computer Vision