SYLLABUS

(WITH EFFECT FROM 2018 -19)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2018–19)

VII to VIII Semester

Bachelor Degree

In

Information Science and Engineering

Out Come Based Education
with
Choice Based Credit System

P.E.S. College of Engineering,

Mandya - 571 401, Karnataka

(An Autonomous Institution Affiliated to VTU, Belagavi)
Grant -in- Aid Institution
(Government of Karnataka)
Accredited by NBA, New Delhi
Approved by AICTE, New Delhi.

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

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Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight Undergraduate and Six Postgraduate programs. It consists of four M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has recently become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills, Personality Development modules and Technical Skills have been added to the existing curriculum of the academic year 2018-19. Internship have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Technical Skills and Skill Oriented Lab are included in all undergraduate programs.

Dr. Umesh D R
Deputy Dean (Academic)
Associate Professor,
Dept. of CS & Engg

Dr. Girisha R
Dean (Academic)
Professor
Dept. of CS & Engg

PES College of Engineering

Vision

*"*PESCE shall be a leading institution imparting quality engineering and management education developing creative and socially responsible professionals.*"*

Mission

1. Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.
2. Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.
3. Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.
4. Promote research, product development and industry-institution interaction.

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

About the Department

The Department of Information science and Engineering takes pride in producing quality engineers over the past 17 years. The credit for all the flowery results goes to the highly motivating staff, from whom all students draw inspiration. The Department was started in the year 2000. The present intake of the undergraduate program is 60. The department has well equipped classrooms, computer laboratories with high-end systems, department library and good collection of software's. Also a research centre is a major credential to our department. We are proud to produce the first PhD student in our college. Faculty members of the department are involved in research activities in different fields such as Medical Image Processing, Pattern Recognition, and Data Mining etc. The department is using Outcome-based education (OBE), which is a recurring education reform model, and it is affiliated to Visvesvaraya Technological University (VTU). The department has achieved good Placement, conducted International /national Conferences and other sponsored short-term courses, workshops, National seminars and symposia. The laboratory facilities and the Internet access are available round the clock to the staff and students of the Information Science and Engineering

Vision

"The department strives to equip our graduates with Knowledge and Skills to contribute significantly to Information Science & Engineering and enhance quality research for the benefit of society".

Mission

M1: To provide students with state of art facilities and tools of Information Science & Engineering to become productive, global citizens and life-long learners.
M2: To prepare students for careers in IT industry, Higher education and Research.
M3: To inculcate leadership qualities among students to make them competent Information Science & Engineering professionals or entrepreneurs.

1.2. State the Program Educational Objectives (PEOs)

Graduates of the program will be able to

PEO1: Establish a productive Information Science & Engineering career in industry, government or academia.
PEO2: Interact with their peers in other disciplines by exhibiting professionalism and team work to contribute to the economic growth of the country.
PEO3: Promote the development of innovative systems and solutions to the problems in Information Science using hardware and software integration.
PEO4: Pursue higher studies in Engineering, Management or Research.

A. List of Program Outcomes (POs)

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.

PO10. 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.

PO11. 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.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B. List of Program Specific Outcomes (PSOs)
Information Science & Engineering Graduates will be able to:

PSO1. Analyze, design, develop and test the principles of System software and Database concepts for computer-based systems.

PSO2. Develop computer communication systems and applications for Information security.

PSO3. Apply the knowledge of Information Science and Engineering to solve any software and hardware related problems and to organize, manage and monitor IT Infrastructure.

VII Semester B.E(IS&E)			**Scheme of Teaching and Examination 2018-19**								
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs / Week**			**Credits**	**Examination Marks**			
				L	**T**	**P**		**CIE**	**SEE**	**Total**	
1	P18IS71	Data Science	IS&E	4	-	-	4	50	50	100	
2	P18IS72	Information and Network Security	IS&E	4	-	-	4	50	50	100	
3	P18IS73	Cyber Security	IS&E	4	-	-	4	50	50	100	
4	P18IS74X	Professional Elective – III	IS&E	2	2	-	3	50	50	100	
5	P18ISO75X	Open Elective – II	IS&E	3	-	-	3	50	50	100	
6	P18ISL76	Data Science Laboratory	IS&E	-	-	3	1.5	50	50	100	
7	P18ISL77	Devops Laboratory	IS&E	-	-	3	1.5	50	50	100	
8	P18IS78	Project Work Phase – I and Project seminar	IS&E	-	-	4	2	100	-	100	
Total							**23**	**450**	**350**	**800**	

List of Electives

Professional Elective – III			**Open Elective –II**		
Sl. No	**Course Code**	**Course title**	**Sl. No.**	**Course Code**	**Course title**
1.	P18IS741	Augmented and Virtual Reality	1.	P18ISO751	Foundations of IT
2.	P18IS742	Software Project Management	2.	P18ISO752	Software Engineering
3.	P18IS743	Distributed Systems	3.	P18ISO753	Machine Learning
4.	P18IS744	Block Chain Technology	4.	P18ISO754	Robotic Process Automation

VIII Semester B.E(IS&E) **Scheme of Teaching and Examination 2018-19**

Sl. No.	Course Code	Course Title	Teaching Department	Hrs / Week			Credits	Examination Marks		
				L	T	P		CIE	SEE	Total
1	P18IS81	Big data	IS&E	4	-	-	4	50	50	100
2	P18IS82X	Professional Elective - IV	IS&E	2	2	-	3	50	50	100
3	P18IS83	Internship	IS&E	-	-	-	2	50	50	100
4	P18IS84	Project Work Phase – II	IS&E	-	-	-	6	100	100	200
5	P18IS85	Self study course & Seminar	IS&E	-	-	4	2	50	-	50
Total							**17**	**300**	**250**	**550**

Professional Elective - IV

Sl. No	Course Code	Course title
1.	P18IS821	Management Information System
2.	P18IS822	Semantic Web
3.	P18IS823	Natural Language Processing
4.	P18IS824	Multicore Programming

Course Title: Data Science			
Course Code: P18IS71	**Semester: VII**	**L-T-P-H : 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites:

Data Structures, Discrete Mathematical Structures, Design and Analysis of Algorithms.

Course Learning Objectives (CLOs)

This course aims to

Describe the fundamentals of Data Science and Carry out EDA and to use basic machine learning algorithms on a given dataset by considering ethical issues using *R*.

Course Content

Unit-I

Introduction: What is Data Science? Big Data and Data Science hype - and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets needed.

Statistical Inference - Populations and samples, Statistical modeling, probability distributions, fitting a model.

Self-study component: Intro to R. **10 Hours**

Unit-II

Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm).

Three Basic Machine Learning Algorithms - Linear Regression, k-Nearest Neighbors (k-NN), k-means.

Self-study component: Exercise: Basic Machine Learning Algorithms. **10 Hours**

Unit-III

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web.

Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention, Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms, Filters; Wrappers; Decision Trees.

Self-study component: Random Forests. **11 Hours**

Unit-IV

Recommendation Systems: Building a User-Facing Data Product – Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

Mining Social-Network Graphs – Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs.

Self-study component: Neighborhood properties in graphs. **11 Hours**

Unit-V

Data Visualization – Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects, Exercise: create your own visualization of a complex dataset.

Data Science and Ethical Issues – Discussions on privacy, security, ethics, A look back at Data Science.

Self-study component: Next-generation data scientists. **10 Hours**

Text Book:

1.Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

Reference Books:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. V2.1, Cambridge University Press. 2014.
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.

Course Outcomes

After learning all the units of the course, the student is able to

1. Explain Data Science process and Statistical Inference.
2. Apply basic tools (plots, graphs, summary statistics) to carry out EDA and identify basic Machine Learning algorithms to use in applications.
3. Use APIs and other tools to scrap the Web and identify basic Feature Generation and Feature Selection algorithms to use in applications.
4. Build own recommendation system.
5. Create effective visualization of a given data (to communicate or persuade ethically).

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1										1			
CO2	2	2		1	2				1	1		1		1	1
CO3	2	2		1	2							1		1	1
CO4	2	2	2	1	2							1		1	1
CO5	1	1		1	2			1	1	1		1		1	1

Course title: Information and Network Security			
Course Code: P18IS72	**Semester: VII**	**L-T-P-H : 4 : 0 : 0 : 4**	**Credit: 4**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Course Learning Objectives(CLOs)

This course aims to

1. Learn basic principles of Information security and its applications
2. Design various cryptographic algorithms that used for encryption and decryption purposes
3. Understand the concept public key cryptography

Course Contents

Unit-I

PLANNING FOR SECURITY: Introduction; Information Security Policy, Standards, and Practices; The Information Security, Blue Print; Contingency plan a model for contingency plan. **SECURITY TECHNOLOGY-1:** Introduction; Physical design; Firewalls; Protecting Remote Connections
Self Study: A model for contingency plan **10 Hours**

Unit-II

SECURITY TECHNOLOGY – 2: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell, systems; Scanning and Analysis Tools. **CRYPTOGRAPHY:** Introduction; A short History of Cryptography; Principles of Cryptography; Cryptography, Tools
Self Study: Attacks on Cryptosystems. **10 Hours**

Unit-III

INTRODUCTION TO NETWORK SECURITY, AUTHENTICATIONAPPLICATIONS: Attacks, services, and Mechanisms; Security Attacks; Security Services; A model for Internetwork Security. Internet Standards and RFCs. Kerberos, X.509 Directory Authentication Service. **ELECTRONIC MAIL SECURITY:** Pretty Good Privacy (PGP)
Self Study: S/MIME. **12 Hours**

Unit-IV

IP SECURITY: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating, Combining Security Associations; Key Management.
Self Study: Security Payload **10 Hours**

Unit-V

WEB SECURITY: Web security requirements; Secure Socket layer (SSL), Transport Layer Security, Secure Electronic Transaction. Intruders, Viruses, and Worms: Viruses and Related Threats, Firewalls: Firewall Design Principles
Self Study: Trusted Systems. **10 Hours**

Text Books:

1. Principles of Information Security - Michael E. Whitman and Herbert J. Mattord, 2ndEdition, Thompson, 2005.
2. Network Security Essentials Applications and Standards -William Stallings, PersonEducation, 2000

Reference Book:

1. Cryptography and Network Security - Behrouz A. Forouzan, Tata McGraw-Hill,2007.

Course Outcomes

After learning all the units of the course, the student is able to

1. Understand the Structure of Security framework and Its Blueprints
2. Analyze the different Security technologies used
3. Understand the basic standards of Network Security
4. Understand the basics of IP Security
5. Identify the various Threats in Web Security

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3								2					2	
CO2				2		2		2		2				2	
CO3		2	2											2	
CO4		3												2	2
CO5			3		3									2	

Course title: Cyber Security			
Course Code: P18IS73	**Semester: VII**	**L-T-P-H : 4 : 0 : 0 : 4**	**Credit: 4**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisite: Computer Network

Course Learning Objectives (CLOs)

This course aims to

1. Summarize the different classes of attacks Define types of incidents including categories, responses and timelines for response and threats and risks within context of the cyber security architecture.
2. Appraise cyber security incidents to apply appropriate response and current structure of cyber security roles across the enterprise, including the roles and responsibilities of the relevant organizations.
3. Evaluate decision making outcomes of cyber security scenarios and trends and patterns that will determine the future state of cyber security and the Assess the strengths and weaknesses of the certification and accreditation approach to cyber security.

Course Content

Unit-I

Introduction to Cyber Security: Definition of Cyber Security and Cyber Security Policy, Domains of Cyber Security Policy, Laws and Regulations, Enterprise Policy, Technology Operations, Technology Configuration, Strategy versus Policy; Cyber **Security Evolution:** Productivity, Internet, e-Commerce, Countermeasures, Challenges.

Self-Study: Cyber Security objectives, cyber security metrics **11 Hours**

Unit-II

Introduction to Cyber Crime: Definition and evolution of Cyber Crimes, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes; **Cyberoffenses:** Introduction, How criminal plan the attacks, Social engineering, Cyberstalking, Cybercafe and cybercrimes, Botnets: The fuel for cybercrime.

Self-Study: Counting vulnerabilities, security framework **10 Hours**

Unit-III

Tools and method used in Cybercrime: Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL injection, Buffer overflow.

Self-Study: Security policy objectives, cyber security management . **10 Hours**

Unit-IV

Phishing and Identity Theft: Introduction, Phishing: methods of phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, phishing countermeasures; identity Theft (ID Theft): personally identifiable information, types of identity theft, techniques of ID theft, identity theft countermeasures, how to efface your online identity.

Self-Study: Cyber Governance Issues, Net Neutrality, Internet Names and Numbers. **10 Hours**

Unit-V

Cybercrimes and Cyber Security: The legal perspectives: Introduction, Cybercrime and the legal landscape around the world, why do we need cyber laws: the Indian context, The Indian IT act, Challenges to Indian law and cybercrime scenario in India.
Self-Study: Copyrights and Trademark, Email and Messaging. **11 Hours**

Text books:

1. Nina Godbole, SunitBelapur, "**Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives**", Wiley India Publications, copyright 2011, reprint 2015
2. Jennifer L. Bayuk, Jason Healey, Paul Rohmeyer, "**Cyber Security Policy Guidebook**" Wiley Publications**.**

Referenced book:

1. James Graham, Richard Howard, Ryan Olsan, "**Cyber Security Essentials**" CRC Press.

Course Outcomes

After learning all the units of the course, the student is able to

1. Explain the concepts of confidentiality, availability and integrity in Information Assurance, including physical, software, devices, policies and people.
2. Explaining important principles, and theories used throughout the field of cyber security.
3. Applying knowledge in the field of cyber security to analyze real world problems.
4. Effectively integrating knowledge in the field of cyber security to propose solutions to real world problems.
5. Identify the legal perspectives in cyber security and challenges to Indian law.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													1
CO2	2	2												2	1
CO3	2	2		2										2	2
CO4	1	2		1										2	1
CO5				1		2		2			2			2	

Professional Elective-III

Course title: Augmented And Virtual Reality			
Course Code: P18IS741	**Semester: VII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Ability to understand the principles of hardware and other requirements for VR/AR and software tools.
2. Analyze the conceptual pipeline of 3D viewing process, Input Techniques/functions/Event handling.
3. To create Animation techniques for the solutions of real world problem.

Course Content

Unit-I

Virtual Reality and Virtual Environments: Human factors: Eye: accommodation, to Stereopsis, Visual field, Synthetic images versus reality. Ear: sound perception to Sound direction and stage, Head- related transfer functions, Measuring HRTFs, Ambisonics. The somatic senses: Tactile and Haptic technology. Virtual reality hardware & software: Sensor hardware, Head coupled displays, Acoustic Hardware, Integrated VR systems. Modeling Virtual worlds, Physical simulation, VR toolkits.

Self study/Industry Partner Potion: Understanding AR Application Development Workflow, Exploring Unity Interface, Unity views, Unity Project views, manage scenes, Understanding Tags, Unity Project view and Inspector view. **10 Hours**

Unit-II

Input Devices & Output Devices, Requirements for VR: Virtual databases, Real time image generation, database interaction, Physical simulation, Immersive and Non-Immersive VR systems, Hybrid VR systems, the cave, benefits of virtual reality. 3D Viewing Process- A Review, Examples of 3D viewing, A Simple Graphics Package, Segmented Display Files, Display File Compilation, Geometric Models, Picture Structure. Graphical Input techniques, Input Functions and Event Handling. **11 Hours**

Self study/Industry Partner Potion: Introducing AR Camera, Understand the AR UI Design, Understand the AR Sound Design, Understand AR Best Practices.

Unit-III

The generic VR system: Virtual Environment, Computer environment, VR Technology, Modes of Interaction, VR Systems. Computing Architectures for VR: The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures.

Self study/Industry Partner Potion: Using Objects and Assets, Define Prefabs, Game Objects, Components, Models, Hierarchy Window, explore tool bar. Placing 3D objects, Lighting Configuration. **11 Hours**

Unit-IV

MODELING: Geometric Modeling, Kinematics Modeling, Behavior Modeling, Model Management, VR PROGRAMMING:Toolkits and Scene Graphs, World ToolKit, Java 3D General Haptics Open Software Toolkit, PeopleShop.

Self study/Industry Partner Potion: Lighting, Textures and materials **10 Hours**

Unit-V

Animation: Conventional and Computer-Assisted Animation, Animation Languages, Methods of Controlling Animation, Basic Rules of Animation, Problems Peculiar to Animation. Animating the Virtual Environment: The dynamics of numbers: Linear interpolation, Non-linear interpolation, parametric interpolation. The animation of objects: Linear translation, Non-linear translation, Linear and Non-linear angular rotation. Shape, object parametric line/surface patch Inbetweening. Free-form deformation, Particle systems. Physics based modeling and simulation.

Self study/Industry Partner Potion: Animating Objects in the Unity Editor, Deploying AR applications. **10 Hours**

Text Books:

1. Virtual Reality Technology,2ndedition,Grigore C. Burdea, Philippe Coffet, A John Wiley & Sons, Inc., Publication.
2. Virtual Reality Systems, John Vince, Published by Dorling Kindersley (India) pvt ltd., licensees of Pearson Education in south Asia.
3. Principles of Interactive computer graphics, second edition, William M Newman & Robert F. Sproull, McGraw-Hill International student edition.

Reference Books:

1. Computer Graphics, second Edition in C, James. D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Kindle edition.
2. Virtual Reality & Augmented Reality in Industry by DengzheMa,JürgenGausemeier, Xiumin Fan, Michael Grafe By : Springer publications.
3. Computer Vision and Augmented Reality by KerdvibulvechChutisant, Publisher: LAP Lambert Academic Publishing ,Edition: 2013
4. Principles and practice: Augmented Reality, By: Dieter SCHMALSTIEG, Tobias HOLLERER, Addison-Wesley Professional.

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of Basic Science and Computer Graphics to discern the principles of hardware and other requirements for VR/AR and software tools.
2. Design and develop a virtual/augmented Environment using / analyzing the conceptual pipeline of 3D viewing process, Input Techniques/functions/Event handling, to create a sustainable development of products.
3. Illustrate the contextual knowledge of Generic VR system and Computing Architectures for VR/AR applications.
4. Apply the knowledge of Modeling and VR Programming to develop projects in multidisciplinary areas.
5. Design of Animation techniques for the solutions of real world problem for effective communication.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3				2	2					2			2
CO2		3	3	2	2	2	2					2		2	
CO3			3	2	2	2						2			2
CO4		3	2	2	2	2					2				2
CO5										2	2	2			2

Course Title: Software Project Management			
Course Code:P18IS742	**Semester: VII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Expose knowledge to the students on how to evaluate and assess the project and to find the cost of the project using cost benefit evaluation techniques. It also discusses the risk involved in the project and the appropriate strategies for minimizing potential risks.
2. Develop an activity planning for a project and to estimate the overall duration of the project by analyzing the risks involved in it.
3. Control the progress of projects and to assess the risk of slip pages of that project's requirements can be controlled.

Course Content

Unit-I

Introduction to Software Project Management: Project Definition – Contract Management – Activities covered By Software Project Management – Overview of Project Planning.

Self-Study: Stepwise Project Planning **10 Hours**

Unit-II

Project Evaluation Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques.

Self-Study: Risk Evaluation **10 Hours**

Unit-III

Activity Planning Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification, Risk Planning And Control.

Self-Study: Hazard Analysis. **12 Hours**

Unit-IV

Monitoring and Control Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value–PrioritizingMonitoring–GettingProjectBackToTarget–ChangeControl–ManagingContracts– Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management.

Self-Study: Contract Acceptance. **10 Hours**

Unit-V

Managing People and Organizing Teams Introduction – Understanding Behavior – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldham – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety.

Self-Study: Health and Safety Case Studies. **10 Hours**

Text Books

1. Bob Hughes, Mike Cotterell, and Rajib Mall "Software Project Management", Fifth Edition, Tata McGraw Hill, 2012.

References Books

1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Royce, "Software Project Management", Pearson Education,1999.
3. Jalote, "Software Project Management in Practice", Pearson Education,2002.

Course Outcomes

After learning all the units of the course, the student is able to

1. Identify the stakeholders of a project, their objectives and ways of measuring the success in meeting those objectives.
2. Find the cost of the project using cost benefit evaluation techniques
3. Identify the factors putting a project at risk, categorize and prioritize action for risk elimination or containment.
4. Analyze the progress of project, measure the risk of slippage and control changes to a projects requirements.
5. Identify some of factors that influence people's behavior in a project environment and understand the characteristics of the various team structures that can be employed.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3					2			2		1		
CO2	1	2	2					2			1		1		
CO3	1	2	2					2			2		1		
CO4	2	2	2					2			2		1		
CO5	2	2	2					2			2		1		

Course title: Distributed Systems			
Course Code: P18IS743	**Semester: VII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites: Operating system, computer Network

Course Learning Objectives(CLOs)

This course aims to:

1. Understand the fundamental principles of distributed system.
2. Implement the mechanism of RPC and file system in distributed environments.
3. Summarize process synchronization and thread synchronization in distributed systems.
4. Understand concurrency control methods and deadlock occurrence in Distributed systems.
5. Analyze security algorithms and replication services in distributed environment.

Course Content

Unit-I

INTRODUCTION: Introduction to Distributed systems-examples of distributed systems- Trends indistributedsystem-Focusonresourcesharingandthechallenges-IntroductiontosystemModels- physical models-architectural models- fundamental models - Introduction to networking and internetworking-types of network-network principles-internet protocols. Introduction to inter- process communications-external data representation.

Self Study: Marshalling. **12 Hours**

Unit-II

DISTRIBUTED OBJECTS AND FILE SYSTEM: Introduction to distributed objects - Introduction to remote invocation-request reply protocols-Remote procedure call - Java RMI case Study-IntroductiontoDistributedFileSystem-Fileservicearchitecture-Sunnetworkfilesystem - Introduction to Name Services- Name Services.

Self Study: DNS - Directory and directory services. **10 Hours**

Unit-III

DISTRIBUTED OPERATING SYSTEM SUPPORT: The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks.

Self Study: Distributed debugging – Distributed mutual exclusion. **10 Hours**

Unit-IV

TRANSACTION AND CONCURRENCY CONTROL – DISTRIBUTED TRANSACTIONS Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Concurrency control in distributed transactions.

Self Study: Distributed deadlocks – Transaction recovery **10 Hours**

Unit-V

SECURITY AND REPLICATION Overview of security techniques - Cryptographic algorithms – Digital signatures - Cryptography pragmatics – Replication Introduction –system model and the role of group communication, fault tolerant services.

Self Study: Transactions with replicated data. **10 Hours**

Text books:

1**.** George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design", Fifth Edition, Addison-Wesley, 2011.

Reference Books:

1. A.t S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, PHI,2012.
2. MukeshSinghal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, Tata Mcgraw - Hill Education,2011.

Course Outcomes

After learning all the units of the course, the student is able to

1. Demonstrate principles used in distributed environment.
2. Develop RPC mechanism to access remote application and demonstrate file system in distributed systems.
3. Identify process and thread based synchronization in various distributed systems.
4. Describe concurrency control methods and deadlock occurrences in Distributed systems.
5. Compare security algorithms and fault tolerance services in distributed environment.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO’s)**												**PSO’s**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1		1		2					2	1	1
CO2	3	2	2	2		1		2					2	2	1
CO3	1	2	1	1		1		2					2	2	1
CO4	2	1	1	2		2		2					2	2	1
CO5	2	2	2	1		2		2					2	3	1

Course title: Block Chain Technology			
Course Code: P18IS744	**Semester: VII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Pre-requisite: Cryptography and Network Security.

Course Learning Objectives (CLOs)

This course aims to

1. To impart knowledge about building and deploying blockchain applications.
2. To facilitate learning of using blockchain for applications other than crypto currency.
3. To explore platforms such as Ethereum, Hyperledger Fabric to build applications on blockchain.

Course Content

Unit-I

Introduction: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic crypto currency.
Self Study Component: Distributed systems, History of Blockchain. **11Hours**

Unit-II

Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay Working with Consensus in Bitcoin: Distributed consensus in openenvironments, Consensus in a Bitcoin network, Proof of Work (PoW): basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty.
Self Study Component: Mining Pool **11 Hours**

Unit-III

Permissioned Blockchain: Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned blockchain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm.
Self Study Component:BFT over Asynchronous systems **10 Hours**

Unit-IV

Enterprise Application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade - Trade Finance Network, Supply Chain Financing.
Self Study Component: Identity on Blockchain **10 Hours**

Unit-V

Hyperledger Fabric: Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum.
Self Study Component: Ripple and Corda **10 Hours**

Text Books:

1. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

Reference Books:

1. Iran Bashir "Mastering Blockchain", Second Edition Paperback, 2018.
2. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
3. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing

Course Outcomes

After learning all the units of the course, the student is able to

1. Discover the secure and efficient transactions with Bitcoin.
2. Identify and analyze the applications of Bitcoin script.
3. Experiment with Bitcoin mining.
4. Develop private Blockchain environment and develop a smart contract on Ethereum.
5. Build the Hyperledger architecture and the consensus mechanism applied in the Hyperledger.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	2	2								2	2		
CO2	1	2	2												
CO3	1	2	2												
CO4	1	1	1	1								2	2		
CO5	1	2	2										2		

Course title: Foundations of IT			
Course Code: P18ISO751	**Semester: VII**	**L-T-P-H : 3:0:0:3**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites: Subject requires student to know about
1. Basics of computers
2. Basic C programming skills

Course Learning Objectives (CLOs)

This course aims to
1**. Explain** the fundamentals of data structures and its types
2. **Learn** the basic operations on stacks, queues and singly linked list
3. **Understand** fundamental concepts of relational database and its design
4. **Familiarise** with basics of software engineering approaches and modelling with UML

Course Content

Unit-I

Introduction to Data structures Definition, Classification of Data Structures Stacks: Representing stack in C, Implementation of push, pop and display operations using arrays, Infix, Postfix, Prefix expressions Ordinary Queue: Representing queues in C, Implementation of basic operations on ordinary queue Singly Linked List: Basic operations on SLL: Insert front & rear; delete front & rear; display
Self Study: Circular Linked list **10 Hours**

Unit-II

Relational Database Management System Database: Introduction, An example**,** Relational model concepts: Domains, Attributes, Tuples, and Relations, Characteristics of Relations, Relational Model Notation**,**Relational Databases and Relational Database Schemas, Integrity, Referential Integrity, and Foreign Keys, Insert Operation, Delete Operation, Update Operation, Transaction Concept.
Self Study: Case study - Library Management System **10 Hours**

Unit-III

Structured Query Language (SQL): SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL
Self Study: Case study- ATM operations **11 Hours**

Unit-IV

Software Engineering Fundamentals: Software Engineering definition, software process models, process activities, coping with change, the rational unified process, agile methods, plan-driven and agile development.
Self Study: Types of Software testing **10 Hours**

Unit-V

Object Oriented modelling with UML
Introduction: Object Orientation, OO development, OO themes, **Modelling Concepts:** Modelling, abstraction, the three models, **Class Modelling:** Object and class concepts, Link and associations concepts, Generalization and Inheritance, A sample class model, **Advanced Class Modelling:** Advanced object and class concepts, Association ends, N-ary associations, Aggregation
State Modelling: Events, States, Transitions and Conditions, State diagrams, State diagram behavior
Interaction Modelling: Use case models, Sequence models, Activity models.
Self Study: Deployment diagram **11 Hours**

Text Books :

1. Data Structures using C and C++ by YedidyahLangsam and Moshe J. Augenstein and Aaron M.Tenanbaum, PHI, 2nd Edition.
2. Fundamentals of Database Systems – Elmasri and Navathe, 6th Edition, Addison-Wesley, 2011
3. Software Engineering – Ian Somerville, 10th Edition, 2016, Pearson
4. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.

Reference Books :

1. Fundamentals of Data Structures in C - Horowitz, Sahani, Anderson-Freed, Second Edition, University Press, 2nd Edition. Understand primitive and derived data structure.
2. Database Management Systems – Raghu Ramakrishna and Johannes Gehrke – 3rd Edition, McGraw-Hill, 2003.
3. Software Engineering: A Practitioners Approach - Roger S. Pressman, 7th Edition, McGraw-Hill, 2007.

Course Outcomes

After learning all the units of the course, the student is able to

1. Design and implement data structures like stack, queues and singly linked lists
2. Design relational models for a given application using schema definition and constraints.
3. Develop queries using SQL to retrieve the required information from database.
4. Explain the various types of software process models.
5. Apply object oriented modelling with UML for developing applications

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		1												
CO2	2		1												
CO3	2		1		1									1	
CO4	1	1	1								1				1
CO5	1	1	1		1						1				1

Course Title: Software Engineering			
Course Code: P17ISO752	**Semester : VII**	**L- T – P - H : 3:0:0:3**	**Credit : 3**
Contact period : Lecture: 52 Hrs, Exam:3 hrs		**Weightage: CIE: 50;SEE:50**	

Course learning objectives(CLOs)

This course aims to

1. Acquire and develop many valuable skills such as the ability to use computer aided software And Evaluate requirements for a software system
2. Apply the process of analysis and design using object oriented approach.
3. Recognize current trends in the area of software engineering
4. Identify the importance of testing in assuring the quality of software with an understanding of managing risks during the progress of the project.

Course contents

Unit-I

Overview, and Requirements

Introduction: FAQ's about software engineering, Professional and ethical responsibility; software process models, process iteration, software specification, software design and implementation, software validation, software evaluation; Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; the software requirements document; requirements engineering processes: feasibility studies, requirements elicitation and analysis, requirement validation and management.

Self Study: CASE Tools. **12 Hours**

Unit-II

Software Design

Architectural Design: system structuring, control models, modular decomposition, domain-specific architectures; object oriented design: Objects and Object Classes, An Object-Oriented design process.

Self Study: Design evolution. **10 Hours**

Unit-III

Critical System, Verification and Validation

Dependability: critical systems, availability and reliability, safety, security; critical system specification, verification and validation: Verification and Validation: Planning; Software inspections; Automated static analysis, clean room software development; software testing: defect testing, integration testing, object oriented testing, testing workbenches.

Self Study: V&V **10 Hours**

Unit-IV

Management

Managing People: limits to thinking, group working, choosing and keeping people, the people capability maturity model; software cost estimation: productivity, estimation techniques, algorithmic cost modeling, project duration and staffing; quality management: quality assurance and standards, quality planning, quality control.

Self Study: Software Cost Estimation. **10 Hours**

Unit- V

Evolution

software change: program evolution dynamics, software maintenance, architectural evolution; software Re-engineering: source code translation, reverse engineering, program structure improvement, program modularization, data re-engineering.

Self Study: Reverse Engineering Process. **10 Hours**

Text book:

1. Software Engineering– Ian Somerville, 8th Edition, Pearson Education, 2007.

Reference books:

1. Software Engineering: A Practitioners Approach - Roger S. Pressman, 7th Edition,McGraw-Hill, 2007.
2. Software Engineering Theory and Practice -Shari Lawrence Pfleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.
3. Software Engineering Principles and Practice –Waman S Jawadekar, Tata McGraw Hill, 2004
4. Software Engineering – Pankaj Jalote, Tata Mc Graw Hill.

Course outcomes

After learning all the units of the course, the student is able to

1. Demonstrate an understanding of the principles and techniques of Software Engineering
2. Analyze the various steps involved in the design process and the different design approaches which include function-oriented design and object-oriented design
3. Understand the activities in project management, requirement engineering process and to identify the different types of system models
4. Apply the knowledge of design engineering in software development
5. Provide an understanding of the principles of software engineering in a broader system context and the notions of software engineering process and management.

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	2	1	2			1	1						1	1	1
CO 2	2		2			1							1		1
CO 3	2	1									2				1
CO 4	2		2										1		1
CO 5	1	1						1			1		1		1

Course title: Machine Learning			
Course Code: P18ISO753	**Semester: VII**	**L-T-P-H : 3:0:0:3**	**Credit:3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Fundamental concepts of Machine Learning
2. Approaches for building good data sets and model evaluation
3. Regression and classification algorithms and its implementation
4. Clustering algorithm and forecasting in Machine learning

Course Content

Unit - I

Introduction To Machine Learning and Python: Introduction to Analytics and Machine Learning, Why Machine Learning?, Framework for Developing Machine Learning Models, Why Python?, Python Stack for Data Science, Getting Started with Anaconda Platform, Introduction to Python. **10 Hours**

Self Study: Binomial distribution in Probability

Unit-II

Descriptive Analytics: Working with DataFrames in Python, Handling Missing Values, Exploration of Data using Visualization.

10 Hours

Self Study: Normal distribution in Probability

Unit-III

Linear Regression: Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model, Model Diagnostics, Multiple Linear Regression

11 Hours

Self Study: Analysis of Variance (ANOVA)

Unit-IV

Classification Problems: Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Classification Tree (Decision Tree Learning)

11 Hours

Self Study: K-Nearest Neighbors (KNN) algorithm

Unit-V

Clustering: Overview, How Does Clustering Work?, K-Means Clustering, Creating Product Segments Using Clustering

Forecasting: Forecasting Overview, Components of Time-Series Data, Moving Average

10 Hours

Self Study: Decomposing Time Series

Text Book:

1. Machine Learning using Python, Manoranjan Pradhan, U Dinesh Kumar, Wiley.

Reference Book:

1. Python Machine Learning - Second Edition, Sebastian Raschka, Vahid Mirjalili, Packt Publishers, 2017.

Course Outcomes

After learning all the units of the course, the student is able to

1. Understand fundamental concepts of Machine learning and Python
2. Implementation of data preprocessing on datasets and visualisation in Python
3. Implementation of Linear regression algorithms
4. Implementation of Classification algorithms
5. Implementation of Clustering algorithm and analysing time-series data

Course Articulation Matrix (CAM)

Course Outcomes	Program Outcomes (PO's)												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2				1									1	1
CO2	2	1			1										1
CO3	2	1			1										1
CO4	2	1			1										1
CO5	2	1			1										1

Course Title: Robotic Process Automation			
Course Code: P18ISO754	**Semester: VII**	**L-T-P-H : 3 : 0 : 0 : 3**	**Credits: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites: Prior programming knowledge of either Visual Basic or C# will be useful.

Course Learning Objectives (CLOs)

This course aims to,

Understand Robotic Process Automation technology and Learn UiPath programming techniques using UiPath Studio.

Course Content

Unit - I

What is Robotic Process Automation? What is Robotic Process Automation? Scope and techniques of automation Robotic process automation, About UiPath, The future of automation.

Record and Play: Record and Play, UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder.

Self-study: Step-by-step examples using the recorder.

10 Hours

Unit - II

Sequence, Flowchart, and Control Flow: Sequence, Flowchart, and Control Flow, Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example, using Sequence and Control flow.

Data Manipulation: Data Manipulation, Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example.

Self-study: CSV/Excel to data table and vice versa (with a step-by-step example).

10 Hours

Unit - III

Taking Control of the Controls: Taking Control of the Controls, Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points.

Tame that Application with Plugins and Extensions: Tame that Application with Plugins and Extensions, Terminal plugin, SAP automation, Java plugin, Citrix automation, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management.

Self-study: Extensions – Java, Chrome, and Firefox.

11 Hours

Unit - IV

Handling User Events and Assistant Bots: Handling User Events and Assistant Bots, What are assistant bots? Monitoring system event triggers, monitoring image and element triggers, Launching an assistant bot on a keyboard event.

Exception Handling, Debugging, and Logging: Exception Handling, Debugging, and Logging, Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, debugging techniques, Collecting crash dumps.

Self-study: Error reporting.

10 Hours

Unit - V

Managing and Maintaining the Code: Managing and Maintaining the Code, Project organization, Nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines, or Sequences.

Deploying and Maintaining the Bot: Deploying and Maintaining the Bot, Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, License management.

Self-study: Publishing and managing updates.

10 Hours

Text Book:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool – UiPath by Alok Mani Tripathi, Packtpub, March 2018.

Reference Books:

1. Learning ServiceNow by Tim Woodruff, Packtpub, March 2017.
2. **ServiceNow Automation** by Ashish Rudra Srivastava, Packtpub.

Course Outcomes

After learning all the units of the course, the student is able to

1. Explain Robotic Process Automation & Record and Play feature of UiPath Studio.
2. Build Bots using UiPath programming techniques & data manipulation techniques.
3. Extract control of the controls& Tame the application with Plugins and Extensions.
4. Handle User Events and Assistant Bots, Exceptions, Debugging, and Logging.
5. Supervise the code & also Deploy and Maintain the Bot.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1				2							1			1
CO2	2	1	1		2							1			1
CO3	2	1	1		2							1			1
CO4	2	1	1		2							1			1
CO5	2	1	1		2							1			1

Course Title: Data Science Laboratory			
Course Code: P18ISL76	**Semester: VII**	**L-T-P-H : 0:0:3:3**	**Credits: 1.5**
Contact Period: Lecture: 36Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

Explore Data science process on structured data using *R*.

Course Content

1. Program to perform Data exploration and Pre-processing on a given dataset.
2. Program to implement Linear regression for a given dataset.
3. Program to implement Multiple Linear regression for a given dataset.
4. Program to implement *K*-NN algorithm on a given dataset.
5. Build model to perform clustering using *K*-means and also determine the optimal value of *K* using Elbow method.
6. Program to implement Naive Bayes classifier on a given dataset.
7. Build models using Decision trees.
8. Build your own recommendation system.

Note: The above programs / models have to be implemented using *R Studio*.

Course Outcomes

After learning all programs of the course, the student is able to

1. Develop codes using *R* programming language.
2. Implement Data science process on structured data using *R*.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1		2							1			1
CO2	2	1	1	1	2							1			1

Course Title: Devops Laboratory			
Course Code: P18ISL77	**Semester: VII**	**L-T-P-H : 0:0:3:3**	**Credits: 1.5**
Contact Period: Lecture: 36Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Practice Work

Note: This Practice should be done in linux to create a hands-on experience in command line interface.

1. Linux Basics (Including GIT Basics)
2. Network Basics
3. Shell / Bash Scripting
4. Docker Basics

Lab Questions

1. A developer called Ram has newly joined GitHub community; He needs to push the development works into GitHub for collaborating with other team members. Perform the as stated below -

   1.1 Could you please help Ram with the commands to execute and update the files in GitHub.

   1.2 Initiate the process with initial ReadMe.md file.

   1.3 List the total contributors in the project.

   1.4 Identify top contributors of top 5 open pull requests by these contributors. Also, show the top 5 closed pull requests by them.

   1.5 Identify the number of forks that have been made of the selected repo.

2. Assume that Ram is ready with the application development, he need to provide the application setup and deployment script to deploy the application. Please help Ram in writing the shell script to deploy the application. {Assume it is a JBOSS/Apache Application}.

3. Create an EC2 instance with tomcat server application and retrieve the web application in tomcat web manager.

4. Write a dockerfile which has base ubuntu latest and apache latest. Run the apache default when you create a containers and apache welcome page should be displayed with your name.

5. Create a Deployment Named webapp in the web Namespace and Verify Connectivity and forward the traffic from the pods.

6. Create a Deployment and a service to expose your web front end and a database server to serve as the backend database. Also create a network policy that will deny communication by default. Apply those labels and create a communication over the PORT 3309 to the database server.

7. Create a Jenkins job by building maven project. after the build trigger process automatically.

Course Outcomes

After learning all programs of the course, the student is able to

1. Remember the importance of DevOps tools used in software development life cycle.
2. Examine the different Version Control strategies.
3. Analyze & Illustrate the Containerization of OS images and deployment of applications over Docker.
4. Summarize the importance of Software Configuration Management in DevOps.
5. Understand the importance of Jenkins to Build, Deploy and Test Software Applications.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3			2								2			2
CO2	3	3		2		3							1		
CO3	3				3	2							1	2	
CO4	3				3										2
CO5	3		3	3	3										

Course Title: Project Work Phase – I and Project Seminar			
Course Code: P18IS78	**Semester: VII**	**L:T:P:H: 0:0:0:4**	**Credits :02**
Weight age: CIE:100			

Project Work: The Project Work (Phase I + Phase II) carries 8 credits (2 credits+6 credits) and spreads over TWO semesters, i.e. during 7th and 8th semesters.

I. Project Phase – I and Project seminar Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and seminar presentation skill.

II. The Assessment marks (CIE) in the case of Project Work - Phase I, shall be based on the evaluation at the end of the 7th semester by a committee consisting of Head of the concerned department, two senior faculty members of the department, one of them may be the internal guide. The work may be evaluated

by the committee for award of Assessment marks (CIE) based on a Report [comprising of synopsis, Introduction, Literature survey, Objective and Methodology], presentation and viva voce.

III. The project work shall be carried out by candidate(s) independently/in a group (maximum of four) during the seventh and eighth semester under the guidance of one of the faculty members of the Department of study. If the project work is of inter-disciplinary nature, a co-guide shall be taken from the same or any other relevant Department. If a project work has to be carried out in any industry / factory / organization, outside the campus, the permission for the same and the name of co-guide at any of these organizations shall be intimated to the authorities at the beginning of seventh semester by the Head of the Department.

Course title: Big Data			
Course Code:P18IS81	**Semester: VIII**	**L-T-P-H : 4 : 0 : 0 : 4**	**Credit: 4**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites:

1. Proficiency in programming language such as, Java, Python, R
2. Basic understanding of SQL and data pre-processing

Course Learning Objectives(CLOs)

This course aims to:

1. To provide students with the fundamentals and essentials of Big Data.
2. To discuss the challenges traditional data mining algorithms face when analyzing Big Data
3. To enable the students to Optimize businesses decisions and create competitive advantage with Big Data analytics.
4. To impart the architectural concepts of Hadoop and map reduce paradigm and to enable the students to make use of programming tools PIG & HIVE in Hadoop echo system.

Course Content

Unit–I

Introduction to Big Data: Introduction, Big Data, Defining Big Data, why Big Data and why now? Big Data example. **Working with Big data:** Introduction, Data explosion, Data volume, Data velocity, Data variety. **Big Data Processing Architecture:** Introduction, Introduction, Data processing revisited, Data processing techniques, Data processing infrastructure challenges, Shared-everything and shared-nothing architecture, Big data processing.
Self-Study: Telco big data study. **10 Hours**

Unit-II

Introducing big data Technologies: Introduction, Distributed data processing, Big data processing requirements. **NoSQL data management:** Introduction to NoSQL, Why NoSQL? Types of NoSQL, Schema less databases, Materialized views, Distribution models, Sharding.**Understanding Hadoop ecosystem:** Hadoop, HDFS, Map-Reduce, YARN, Hbase, Hive, Pig and Pig latin, Sqoop, Zookeeper.

Self-study: Flume, Oozie **11 Hours**

Unit–III

Getting Ready to Use R and Hadoop: Understanding Hadoop features, learning the HDFS and Map-Reduce architecture.**Writing Hadoop Map-Reduce Programs:** Understanding the basics of Map-Reduce, Introducing Hadoop Map-Reduce, Understanding the Hadoop Map-Reduce fundamentals, writing a Hadoop Map-Reduce example.
Self-study: Installing Hadoop **10 Hours**

Unit–IV

Testing and Debugging Map-Reduce Applications: Debugging Hadoop Map-Reduce locally, performing unit test for Map-Reduce applications, performing local application testing with eclipse, logging for Hadoop testing, application log processing, defensive programming in Map-Reduce. Understanding Hadoop YARN architecture: Background of YARN, Advantages of YARN, YARN architecture, working of YARN, YARN schedulers, Backward compatibility with YARN, YARN configurations, YARN commands, YARN containers, Registry.

Self-study: Log management in Hadoop. **11 Hours**

Unit-V

Exploring Hive: Introducing Hive, Getting started with Hive, Hive services, Data types in Hive, Built-in functions in Hive, Hive DDL, Data manipulation in Hive, Data retrieval Queries, using joins in Hive. **Analyzing Data with Pig:** Introduction to Pig, Running Pig, Getting started with Pig Latin, working with operation in Pig, Debugging Pig, working with functions in pig, error handling in pig.
Self-study: **Using Oozie:** Introducing Oozie. **10 Hours**

Text Books:

1. Data Warehousing in the Age of Big Data by Krish Krishnan, Morgan Kaufmann 2013.
2. VigneshPrajapati, “Big Data Analytics with R and Haoop”, Packet Publishing 2013.
3. DT Editorial Services, “Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)”, Dream tech Press edition 2016.
4.

Reference Books:

1. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1stEdition, AmbigaDhiraj, Wiely CIO Series, 2013.
2. ArvindSathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS Business Series, 2012.
4. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012

Course Outcomes

After learning all the units of the course, the student is able to

1. Demonstrate the characteristics of Big Data using Map Reduce.
2. Apply data modeling techniques to large data sets using HDFS.
3. Develop applications for Big Data analytics with the use of Pig.
4. Evaluate Local and Distributed Modes using Pig.
5. Make use of Hive Data Manipulation Language for Querying and Analyzing Data

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1		2	2										1
CO2	2	2	1	3	3							2			1
CO3	2	2	2	3	3	2									1
CO4	2	1	2		3	2									1
CO5	1		1									2			1

Course title: Management Information System			
Course Code:P18IS821	**Semester: VIII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to,

1. To enable students evaluate the role of information systems in today's competitive business environment
2. To enable students understand the various knowledge representation methods and different expert system structures as strategic weapons to counter the threats to business and make business more competitive.
3. Apply a framework for evaluating information-related ethical dilemmas commonly faced by managers.
4. Enhance self-confidence, ability to make proper decisions and effective communication, and Pursue lifelong learning and continuing education.

Course Content

Unit–I

Foundation Concepts

Foundations of Information Systems in Business: The Real World of Information Systems, The Fundamental Roles of IS in Business, Types of Information Systems, Managerial Challenges of Information Technology, **The Components of Information Systems: System Concepts:** A Foundation, Components of Information Systems, Information System Resources, Information System Activities. **Competing with Information Technology:** Strategic IT, Strategic Uses of Information Technology, Building a Customer-Focused Business, The Value Chain and Strategic IS, Reengineering Business Processes, Becoming an Agile Company, Creating a Virtual Company, Building a Knowledge-Creating Company. **11 Hours**

Self Study: The Role of e-Business in Business, Trends in Information Systems.

Unit–II

Business Applications - 1

E-Business Systems: Introduction, Cross-Functional Enterprise Applications, Enterprise Application Integration, Transaction Processing Systems, Enterprise Collaboration Systems. **Functional Business Systems:** Introduction, Marketing Systems, Targeted Marketing, Manufacturing Systems, Human Resource Systems, Accounting Systems. **Enterprise Business Systems:** Introduction, what is CRM? The Three Phases of CRM, Benefits and Challenges of CRM, trends in CRM. **Enterprise Resource Planning:** Introduction, what is ERP? Benefits and Challenges of ERP, Trends in ERP. **Supply Chain Management:** introduction, what is SCM? Benefits and Challenges of SCM, Trends in SCM.

Self Study: Sales Force Automation, Financial Management Systems **10 Hours**

Unit–III

Business Applications - 2

E-Commerce Fundamentals: Introduction to e-Commerce, Scope of E-commerce, Essential e-Commerce Processes, Electronic Payment Processes, e-Commerce Trends, e-Commerce Success Factors, Web Store Requirements, Business-to-Business e-Commerce, e-Commerce Marketplaces, Clicks and Bricks in e-Commerce. **Decision Support in Business:** Introduction, Decision Support Trends, Decision Support Systems, Management Information Systems, Online Analytical Processing, Using Design Support Systems, Executive Information Systems, Enterprise Portals and Decision

Support, Knowledge management system**.** **10 Hours**
Self Study: Business and AI, The Domains of Artificial Intelligence.

Unit-IV

Development Processes

Developing Business/IT Strategies: Planning Fundamentals: Introduction, Organizational Planning, the Scenario Approach, Planning for Competitive Advantage, Business Models and Planning , Business/IT Architecture Planning, Identifying Business/IT Strategies, Business Application Planning. Implementation Challenges: Implementation, Implementing Information Technology, End-User Resistance and Involvement, Change Management. Developing Business/IT Solutions: IS Development, the Systems Approach, Systems Analysis and Design, Starting the Systems Development Process, Systems Analysis, system design, End user development.
Self Study: Implementing Business Systems. **10 Hours**

Unit–V

Management Challenges

Security, Ethical, and Societal Challenges of IT: Introduction, Ethical Responsibility of Business Professionals, Computer Crime, Privacy Issues, the Current State of Cyber Law and other Challenges. Security Management of Information Technology: Introduction, Tools of Security Management,Inter-Networked Security Defenses, Other Security Measures, System Controls and Audits.Managing Information Technology**:** Business and IT, Managing Information Technology, Business/IT Planning, Managing the IT Function, Organizing IT, Outsourcing and Offshoring IT and IS, Failures in IT Management, Management Involvement.

Self Study: Managing Global IT. **11 Hours**

Text Books:

1. James A. O' Brien, George M. Marakas: "Management Information Systems", 7th Edition, Tata McGraw Hill, Reprint 2013.

Reference Books:

1. Kenneth C. LaudonJone and P. Laudon, "Management Information Systems", 13 th Edition, Pearson Education Limited2014.
2. Ralph M. Stair and George W. Reynolds**, "Principles** of Information Systems - A Managerial Approach", 9 th edition, Course Technology2013.
3. W.S. Jawadekar: Management Information Systems, Tata McGraw Hill2008.

Course Outcomes

After learning all the units of the course, the student is able to

1. Identify the business applications in MIS.
2. Explain the Changing Business Environment for Information Technology.
3. Illustrate the Computer Hardware and Software Work Service Level Agreements.
4. Implementation of information technology solutions in organization.
5. Explain issues and challenges in security and professional ethics.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				2		2					2			1	1
CO2		2										2		1	
CO3	1		3												
CO4	2	1	2												
CO5	2	2	2					2							

Course title: Semantic Web			
Course Code: P18IS822	**Semester: VIII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisite: Basics of Web Technology

Course Learning Objectives (CLOs)

This course aims to

1. Able to understand the Basics of Semantic web and RDF
2. Able to describe RDF and its taxonomy and ontology
3. Understand the concept of Owl and its various classes

Course Contents

Unit-I

The basics of semantic web: Traditional web to semantic web – WWW and its usage- meta data and its creation, addition in the web page; meta data tools - search engines for semantic web – search engine for web page mark up problem and query building problem.

Self Study: Search Engine for "Common Vocabulary" Problem **10 Hours**

Unit-II

Resource description frame work (rdf): RDF and its basic elements-Why we need RDF-RDF triples-RDF tools Fundamental rules of RDF- relationship between DC,and RDF and XML and RDF core elements of RDF- ontology and taxonomy-inferencing based on RDF.

Self Study: A Hypothetical Real-World Example of aggregation and distributed information **11 Hours**

Unit-III

Web ontology language (owl): The basics idea of Web ontology language– OWL to define classes- OWL to define properties-set operators-Three faces of OWL-Ontology Matching and Distributed Information- Validating OWL ontology.

Self Study: Camera Ontology Rewritten in OWL **10 Hours**

Unit-IV

Semantic web services: Web services – web services standards – web services to semantic web services- UDDI and its usage- Concept of OWL-S and its building blocks - mapping OWL-S to UDDI- WSDL-S overview and its usage.

Self Study: Matchmaking Engines **10 Hours**

Unit-V

Real world examples and applications of semantic web: Swoogle- architecture, usage and examples of using Swoogle; FOAF – Explanation, vocabulary –creating FOAF documents – overview of semantic markup – semantic web search engines.

Self Study: Semantic Markup Issues **11 Hours**

Text Book:

1. Liyang Yu , "Introduction to the Semantic Web and Semantic web services" Chapman & Hall/CRC, Taylor & Francis group, 2007.

Reference Books:

1. Johan Hjelm, "Creating the Semantic Web with RDF ", Wiley, 2001
2. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, 2004. 234 CS-Engg&Tech-SRM-2013

3. Karin K. Breitman K., Marco Antonio Casanova, Walt Truszkowski, "Semantic web: concepts, Technologies and applications" Walt Truszkowski - 2007.

Course Outcomes

After learning all the units of the course, the student is able to

1. Understand the concepts of semantic web technology
2. Create ontology's in RDFS, including classes and subclasses, properties and sub properties, domains and ranges, instances, and facets, and determine resulting inference and querying capabilities
3. Describe OWL and its usage in semantic web
4. Understand various technologies related to semantic web services
5. Create reusable formal models, and processes to create/update/query such models that help to describe formal semantics used in a multimedia application

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3													2
CO2	3	3													2
CO3	3	3													2
CO4	3	3		2											
CO5	3	3										2			

Course title: Natural Language Processing			
Course Code:P18IS823	**Semester: VIII**	**L-T-P-H : 2:2:0:4**	**Credit: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Pre Requisites: Basics of Python programming

Course Learning Objectives (CLOs)

This course aims to

1. Learn the concepts of natural language processing and corpus Linguistics
2. Be familiar with Processing of Raw Text
3. Learn the concept of Extracting Information from text and analyze the structure of sentence.

Course Content

Unit–I

Language Processing and Python: Computing with Language: Texts and Words, A closer Look at Python: Texts as Lists of Words, Computing with Language: Simple Statistics, Back to Python: Making Decisions and Taking Control, Automatic Natural Language Understanding. **Accessing Text Corpora and Lexical Resources:** Accessing Text Corpora, Conditional Frequency Distributions, More python: Reusing Code, Lexical Resources.
Self Study: WordNet **11 Hours**

Unit-II

Processing Raw Text: Accessing Text from Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, and Regular Expressions for Tokenizing text, Segmentation.
Self Study: Formatting: From List to Strings. **10 Hours**

Unit-III

Writing Structured Programs: Back to the Basics, Sequences, Questions of style, Functions: The Foundation of Structured Programming, Doing more with functions, Program Development, Algorithm Design.
Self Study: A sample of python Libraries. **10 Hours**

Unit-IV

Categorizing and Tagging Words:
Using a Tagger, Tagged Corpora, Mapping Words to Properties Using Python Dictionaries, Automatic tagging, N-Gram Tagging, Transformation-Based Tagging. **Learning to Classify Text:** Supervised Classification, Further Examples of Supervised Classification, Evaluation, Decision Trees, Naïve Bayes Classifiers, Maximum Entropy Classifiers.
Self study: How to determine the category of a word, Modeling Linguistic Patterns **11 Hours**

Unit-V

Extracting Information from Text: Information extraction, Chunking, developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition. **Analyzing Sentence Structure:** Some Grammatical Dilemmas, What's the use of syntax, Context-Free Grammar, parsing with Context-Free Grammars, Dependencies and Dependency Grammar.
Self Study: Relation Extraction **10 Hours**

Text Books:

1. Steven Bird, Ewan Klein & Edward Loper, "Natural language Processing with Python", O'Reilly, Ninth Indian Reprint 2019.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company,1995.
3. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press,2008.
4. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

Course outcomes

After learning all the units of the course, the student is able to

1. Develop python code use of text corpora, lexical resources and Natural Language Processing.
2. Illustrate python code to Process Raw Text.
3. Construct Structured Program for text processing.
4. Build models of language using salient features to perform language processing tasks.
5. Analyze the sentence which is used to build a syntax tree and extracting the information from the text.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1									1			2
CO2	3	2	1									1			1
CO3	3	2	2									1			2
CO4	3	2	1									1			1
CO5	3	2	1									1			2

Course Title: Multi-Core Programming			
Course Code: P18IS824	**Semester: VIII**	**L-T-P-H : 2:2:0:4**	**Credits: 3**
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs		**Weightage: CIE:50%, SEE: 50%**	

Prerequisites:

Knowledge of Computer Architecture, Operating Systems and at least one high-level language, preferably C / C++.

Course Learning Objectives (CLOs)

This course aims to

Identify the issues involved in multi-core architectures, parallel programming and Explore OpenMP programming model.

Course Content

Unit-I

Introduction to Multi-core Architecture:
Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law.

System Overview of Threading:
Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization.

Self-Study: Growing Returns: Gustafson's Law, System Virtualization. **11 Hours**

Unit-II

Fundamental Concepts of Parallel Programming:
Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion.

Threading and Parallel Programming Constructs:
Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier.

Self-Study: Other Alternatives, Implementation-dependent Threading Features.

11 Hours

Unit-III

Threading APIs:
Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization.

Self-Study: Signaling, Compilation and Linking. **10 Hours**

Unit-IV

OpenMP: A Portable Solution for Threading:

Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multithread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging.

Self-Study: Performance.

10 Hours

Unit-V

Solutions to Common Parallel Programming Problems:

Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32.

Self-Study: Data Organization for High Performance.

10 Hours

Text Book:

1. Multicore Programming, Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts, Intel Press, 2006.

Reference Books:

1. Thomas Rauber and Gudula Runger Parallel Programming for Multicore and cluster systems, Springer International Edition, 2009.
2. Hennessey and Patterson Computer Architecture: A quantitative Approach, Morgan Kaufman Publishers.
3. Michael J.Quin "Parallel Programming in C with MPI and Open MP", McGraw Hill, 2004.

Web Link:

http://www.intel.com/multi-core/

Course Outcomes

After learning all the units of the course, the student is able to

1. Identify the issues involved in multi-core architectures.
2. Explain fundamental concepts of parallel programming and its design issues.
3. Apply an appropriate threading API's for developing applications.
4. Apply OpenMP programming model.
5. Circumvent common parallel programming problems.

Course Articulation Matrix (CAM)															
Course Outcomes	**Program Outcomes (PO's)**												**PSO's**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1											1			1
CO2	2	1	1									1			1
CO3	2	1			2							1			1
CO4	2	1	1		2							1			1
CO5	2	1	1		2							1			1

Course Title: Internship		
Course Code: P18IS83	**Semester: VIII**	**Credits :02**
Exam Hours : 03 Hr	**Weight age: CIE:50; SEE:50**	

Guidelines for Internship:

I. Internship is of minimum eight weeks duration and to be completed between the vacation period of VI & VII semester and VII & VIII semester.

II. The internship can be carried out in any industry/ R & D Organization/ Research/ Institute/ Educational institute of repute/ Internshala (ACITE MoU Internship).

III. The Department/college shall nominate staff member/s to facilitate, guide and supervise students under internship.

IV. The Internal Guide has to visit place of internship at least once during the student's internship.

V. The students shall report the progress of the internship to the guide in regular intervals and seek his/her advice.

VI. After the completion of Internship, students shall submit a report with completion and attendance certificates to the Head of the Department with the approval of both internal and external guides.

VII. There will be 50 marks CIE (Seminar: 25, Internship report: 25) and 50 marks for Viva Voce conducted during Semester End Examination (SEE) of VIII Semester. For the conduction of Internship Semester End Examination following instructions are issued:

a. The Semester End Examination (SEE) for 50 marks shall be conducted similar to final semester project work / lab examination.
b. Internal & External Examiners shall be appointed by the BoE – Chairperson in consultation with HoD and approval of the same by the Principal & Controller of Examination.
c. External Examiner may be from the Industry. If the external examiner from the industry is not available, alternative arrangement shall be made by the BoE - Chairperson by appointing a faculty from out of the available faculty in the department, wherein the student is studying.

VIII. The students are permitted to carry out the internship anywhere in India or abroad. The Institution will not provide any kind of financial assistance to any student for carrying out the Internship.

IX. Failing to undergo Internship: Internship is one of the head for obtaining degree, therefore completion of internship is mandatory.

Course Title: Project Work Phase – II		
Course Code: P18IS84	**Semester: VIII**	**Credits :06**
Weight age: CIE:100 SEE:100		

Project Work: The Project Work (Phase I + Phase II) carries 8 credits (2 credits+6 credits) and spreads over TWO semesters, i.e. during 7th and 8th semesters.

I. Project Phase – I and Project seminar Comprises of Literature Survey, Problem identification, Objectives and Methodology. CIE marks shall be based on the report covering Literature Survey, Problem identification, Objectives and Methodology and seminar presentation skill.

II. The Assessment marks (CIE) in the case of Project Work - Phase I, shall be based on the evaluation at the end of the 7th semester by a committee consisting of Head of the concerned department, two senior faculty members of the department, one of them may be the internal guide. The work may be evaluated by the committee for award of Assessment marks (CIE) based on a Report [comprising of synopsis, Introduction, Literature survey, Objective and Methodology], presentation and viva voce.

III. The project work shall be carried out by candidate(s) independently/in a group (maximum of four) during the seventh and eighth semester under the guidance of one of the faculty members of the Department of study. If the project work is of inter-disciplinary nature, a co-guide shall be taken from the same or any other relevant Department. If a project work has to be carried out in any industry / factory / organization, outside the campus, the permission for the same and the name of co-guide at any of these organizations shall be intimated to the authorities at the beginning of seventh semester by the Head of the Department.

IV. The weekly progress of the Project work shall be monitored and reviewed by the Project Guide assigned by DUGC. The method of evaluation, including intermediate assessment shall be evolved by the pertinent DUGC.

V. A candidate shall submit N+3 (No. of candidates+3) copies of the Report of the Project Work to Head, DUGC on or before the specified date. The report shall be in the format prescribed by the Institute. The candidate shall submit a report of the project work (dissertation) duly approved by the guide and co-guide. The project report shall be countersigned by the guide, co-guide (if any) and the Head of the Department

VI. The last date for the submission of Report shall be Two weeks before the closure of the semester in which the project work credits have been registered for and is expected to be completed or as announced by the COE. The date of submission of the dissertation may be extended up to a maximum of eight academic years, from the date of commencement of the first semester in which the candidate has taken admission to the course.

VII. The final evaluation (CIE & SEE) for Project Work - Phase II is done by a Project Work Evaluation Committee (PWEC) constituted by the pertinent DUGC. There shall be an open seminar followed by a viva – voce examination

as part of the final evaluation. After the final evaluation, appropriate letter grade is awarded.

VIII. If in the opinion of the PWEC, the Project Report is acceptable with minor modifications for the minimum passing grade 'E' (Fair) in the case of project, the PWEC shall value and instruct the candidate suitably to incorporate the necessary modifications and to resubmit it to the Chairman, PWEC. After such resubmission, the Chairman, PWEC will certify that the necessary modification has been incorporated.

IX. The Assessment marks in case of Project Work - Phase II and seminar shall be based on the evaluation, as per the guidelines, at the end of the 8th semester by a committee consisting of Head of the concerned department, two senior faculty members of the department (one of them may be the internal guide).

X. The Assessment marks sheet shall bear the signature of all those concerned, along with the date and seal of the Principal.

Course Title: Self-Study Course & Seminar			
Course Code: P18IS85	**Semester: VIII**	**L:T:P:H: 0:0:4:4**	**Credits :02**
Weight age: CIE: 50			

In the Self-Study course & Seminar, the student has to choose & study the courses related to the program discipline with her/his own efforts under the guidance of a Course Instructor/Project guide, using study materials available in open sources i.e. Massive Open Online Course (MOOC) NPTEL Courses. The intention of the course is to encourage the habit of self-learning.

Further, in addition to the above, the department has to release the pool of courses from the list of available 8 weeks NPTEL online courses. The student has to register for the course from the available pool during VII / VIII Semester and the same will be reflected in the Grade Card of the VIII Semester. The 50 marks CIE assessment is based on the final NPTEL score (i.e. Online assignments: 25% + Proctored exam: 75%). The NPTEL score will be mapped directly to the CIE marks as per the calculation below only if he /she has completed the NPTEL course (i.e. Certification).

CIE = (NPTEL Score X 1.5) / 2 = [Maximum CIE should be 50 Marks]

[Ex. – 1: If NPTEL Score is 60 then the CIE will be = (60 X 1.5)/2 = 45

Ex. – 2: If NPTEL Score is 80 then the CIE will be = (80 X 1.5)/2 = 50 (Max. CIE should be 50 Marks)]

If the student fails to complete the NPTEL course at the end of the VIII Semester, then the department has to constitute a committee consisting of the Head of the department, two senior faculty members of the department, one of them may be the internal guide. The evaluation is based on a Report, Presentation, and Viva-Voce and the assessment is a relative evaluation in context to the student completed NPTEL course Certification (i.e. the CIE Score should be less than the score of the student cleared NPTEL Course).