COURSESTRUCTURE
&
DETAILEDSYLLABUS
(R19 Regulation)
For
Bachelor of Technology
I, II, III & IV B. Tech. (CSE) with
Honors and Minors
(Applicable for Batches Admitted from 2019-2020)

Department of
COMPUTER SCIENCE & ENGINEERING
(Applicable for Batches Admitted from 2019-2020)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Lendi Institute of Engineering and Technology
(Approved by A.I.C.T.E & Permanent Affiliated to JNTUK, Kakinada)
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Lendi Institute of Engineering and Technology

COMPUTER SCIENCE AND ENGINEERING (CSE)

R19 Course Structure

I B. Tech I Semester

I Year - I Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19BS-MA1101	Mathematics –I(Numerical Method and ordinary differential equations)	BSC	3	0	0	3
2	R19EE- ES1102	Essentials of Electrical & Electronics Engineering	ESC	3	0	0	3
3	R19HS- EN1103	English	HMSC	3	0	0	3
4	R19BS-CH1104	Applied Chemistry	BSC	2	0	0	2
5	R19CS-ES1105	Problem Solving and Programming using C	ESC	3	0	0	3
6	R19HS-EN1106	Communicative English Lab- I	HMSC	0	0	3	1.5
7	R19CS-ES1107	Problem Solving and Programming using C Lab	ESC	0	0	3	1.5
8	R19EE- ES1108	Essentials of Electrical & Electronics Engineering Lab	ESC	0	0	2	1
9	R19HS-MC1109	Environmental Science	HSC	3	0	0	0
Total				**17**	**0**	**8**	**18**

Category	**Credits**
Basic Science Course	5
Engineering Science Courses	8.5
Humanities & Social Science	4.5
Total Credits	18

I B.Tech II Semester

I Year - II Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19BS-MA1201	Mathematics-II (Mathematical Methods for Computer Science)	BSC	3	0	0	3
2	R19BS-MA1202	Mathematics-II (Linear Algebra and Multivariable Calculus)	BSC	3	0	0	3
3	R19CS-ES1203	OOPS through C++	ESC	3	0	0	3
4	R19EC-ES1204	Digital Logic Design	ESC	3	0	0	3
5	R19BS-PH1205	Applied Physics	BSC	2	0	0	2
6	R19ME-ES1206	Engineering Drawing	ESC	1	0	3	2.5
7	R19BS-PH1207	Applied Sciences Lab	BSC	0	0	2	1
8	R19HS-EN1208	Comuticatve English Lab- II	HMSC	0	0	3	1.5
9	R19CS-ES1209	OOPS through C++ Lab	ESC	0	0	3	1.5
10	R19BS-MT1210	MAT Lab	BSC	0	0	3	1.5
			Total	**15**	**0**	**14**	**22**

Category	**Credits**
Basic Science Course	10.5
Engineering Science Courses	10
Humanities & Social Science	1.5
	22

Semester III (Second year)

II Year - I Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19BSH-MA2101	Mathematical Foundations of Computer Science	BSC	3	0	0	3
2.	R19CSE-PC2101	PPL	PCC	3	0	0	3
3.	R19CSE-PC2102	Python Programming	PCC	3	0	0	3
4.	R19CSE-PC2103	Data Structures through C++	PCC	3	0	0	3
5	R19CSE-PC2104	Computer Organization & Architecture	PCC	3	0	0	3
6	R19CSE-PC2105	Python Programming Lab	PCC	0	0	3	1.5
7	R19CSE-PC2106	Data Structures through C++ Lab	PCC	0	0	3	1.5
8	R19BSH-MC211	Essence of Indian Traditional Knowledge	MC	0	0	2	0
9	R19BSH-MC2102	Employment Skills-1	MC	3	0	0	0
10	R19CSE-MC21O1	MOOCS-1	MC	0	0	0	0
			Total	**18**	**0**	**8**	**18**

Category	**CREDITS**
Basic Science course	3
Professional core Courses	15
TOTAL CREDITS	**18**

Semester IV (Second year)

II Year - II Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19BSH-MA2201	Probability & Statistics	BSC	3	0	0	3
2.	R19CSE-PC2201	Java Programming	PCC	3	1	0	4
3.	R19CSE-PC2202	Operating Systems	PCC	3	0	0	3
4.	R19CSE-PC2203	Database Management Systems	PCC	3	0	0	3
5	R19CSE-PC2204	Formal Languages and Automata Theory	PCC	3	0	0	3
6	R19CSE-PC2205	Java Programming Lab	PCC	0	0	3	1.5
7	R19CSE-PC2206	UNIX Operating System Lab	PCC	0	0	3	1.5
8	R19CSE-PC2207	Database Managements Systems Lab	PCC	0	0	3	1.5
9	R19BSH-MC2201	Professional Ethics & Human Values	MC	3	0	0	0
10	R19BSH-MC2202	Constitution of India	MC	3	0	0	0
11	R19CSE-SI2201	Summer Internships	SI	0	0	0	0
12	R19CSE-MC2202	MOOCS-2	MC	0	0	0	0
			Total	**21**	**1**	**9**	**20.5**

Internship 2 Months (Mandatory) during summer vacation

Category	**CREDITS**
Basic Science Courses	**3**
Professional core Courses	**17.5**
TOTAL CREDITS	**20.5**

	Honors courses II Year - II Semester						
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1.	R19CS-HCDC2201	Data Communications(Track-1)	**HC**	**3**	**1**	0	4
2.	R19CS-HCIS2202	Information Security(Track -2)	**HC**	**3**	**1**	0	4
3.	R19CS-HCWF2203	Web UI Framework(Track-3)	**HC**	**3**	**1**	0	4
4.	R19CS-HCAP2204	Advanced Python Programming(Track-4)	**HC**	**3**	**1**	0	4
5.		**MOOCS:** 1. Intrusion detection System(MOOCS),Track-1 2. Cloud Security(MOOCS),TRACK-2 3. Django Framework (MOOCS),TRACK-3 Mongo DB (MOOCS),TRACK-4		**0**	0	0	2

Category	**CREDITS**
Honors Courses	4
MOOCS Course	2
TOTAL CREDITS	**6**

Semester V (Third year)

III Year - I Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSE-PC3101	Web Services	PCC	3	0	0	3
2.	R19CSE-PC3102	Computer Networks	PCC	3	0	0	3
3.	R19CSE-PC3103	Compiler Design	PCC	3	0	0	3
4.	R19CSE-PC3104	OOAD using UML	PCC	3	0	0	3
5	R19CSE-PE3101	**Professional Elective – I** 1. Computer Graphics 2. Advanced operating systems 3. Advanced Data Structures 4. Scripting Languages	PEC	3	0	0	3
6	R19CSE-PC3105	Computer Networks Lab	PCC	0	0	3	1.5
7	R19CSE-PC3106	OOAD &UML Lab	PCC	0	0	3	1.5
8	R19CSE-PC3107	Web Services Lab	PCC	0	0	3	1.5
9	R19BSH-MC3101	Employability Skills – II*	MC	3	0	0	0
10	R19CSE-PJ3101	Socially Relevant Projects(15 Hrs /Sem)	PR	0	0	0	0.5
			Total	**18**	**0**	**9**	**20**

Category	**CREDITS**
Professional core Courses	16.5
Professional Elective courses	3
Mandatory Course	0.5
TOTAL CREDITS	**20**

		Honors courses III Year - I Semester					
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1.	R19CS-HCTP3101	TCP/IP Protocol Suite (Track-1)	**HC**	**3**	**1**	0	4
2.	R19CS-HCSC3102	Secure Coding(Track -2)	**HC**	**3**	**1**	0	4
3.	R19CS-HCAJ3103	AngularJS Framework (Track-3)	**HC**	**3**	**1**	0	4
4.	R19CS-HCMD3104	Mathematical Essential For Data Science(Track-4)	**HC**	**3**	**1**	0	4
5.		**MOOCS:** 1. Introduction to Packet Tracer Tool (MOOCS),Track-1 2. Web Security (MOOCS),TRACK-2 3. Mobile UI Framework (MOOCS),TRACK-3 4. Data Visualization (MOOCS),TRACK-4		**0**	**0**	0	2

Category	**CREDITS**
Honors Courses	4
MOOCS Course	2
TOTAL CREDITS	**6**

Semester VI (Third year)

III Year - II Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSE-PC3201	Data Warehousing and Data Mining	PCC	3	0	0	3
2.	R19CSE-PC3202	Software Engineering	PCC	3	0	0	3
3.	R19CSE-PC3203	Design and Analysis of Algorithms	PCC	3	0	0	3
4.	R19CSE-PE3201	**Professional Elective – II** 1. Artificial Intelligence 2. Malware Analysis 3. Human Computer Interaction 4. Advanced computer networks	PEC	3	0	0	3
5	R19BSH-OE3201	**Open Elective- I(Interdisciplinary)** 1. Statistics with R 2. Entrepreneurship & Incubation 3. Optimization Techniques	OEC	3	0	0	3
6	R19CSE-PC3204	Software Architecture & Design Patterns (SADP)	PCC	3	0	0	3
7	R19CSE-PC3205	Data Mining Lab	PCC	0	0	3	1.5
8	R19CSE-PC3206	SADP Lab	PCC	0	0	3	1.5
9	R19CSE-SI3202	Summer Internships	SI	0	0	0	0
10	R19CSE-MC3201	MOOCS	MC	0	0	0	0
Internship 2 Months (Mandatory) during summer vacation				0	0	0	0
			Total	18	**0**	**6**	**21**

Category	CREDITS
Professional core Courses	15
Professional Elective courses	3
Open Elective Course/Job oriented elective	3
TOTAL CREDITS	**21**

	Honors courses III Year - II Semester						
S. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1.	R19CS-HCWN3201	Wireless Sensor Networks (Track-1)	**HC**	**3**	**0**	0	4
2.	R19CS-HCBTNF3202	Block Chain Technologies (Track -2)	**HC**	**3**	**0**	0	4
3.	R19CS-HC3203	.NET Framework (Track-3)	**HC**	**3**	**0**	0	4
4.	R19CS-HCNP3204	Natural Langauge Processing (Track-4)	**HC**	**3**	**0**	0	4

Category	CREDITS
Honors Courses	4
TOTAL CREDITS	**4**

Semester VII (Fourth year)

IV Year - I Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSE-PC4101	Cryptography and Network Security	PCC	3	0	0	3
2.	R19BSH-MC4102	Managerial Economics and Financial Accountancy	HSMC	3	0	0	3
3.	R19CSE-PC4103	Machine Learning	PCC	3	0	0	3
4.	R19CSE-OE4104	**Open Elective – II**(Inter Disciplinary) 1. Industrial IoT 2. Fuzzy sets, Logic & Systems 3. Microprocessors & Interfacing	OEC	3	0	0	3
5	R19CSE-PE4105	**Professional Elective – III** 1. Software Testing Methodologies 2. Soft Computing 3. Image Processing 4. Social Networks & Semantic Web	PEC	3	0	0	3
6	R19CSE -PE4106	**Professional Elective – IV** 1. Distributed Systems 2. Parallel Computing 3. Software Project Management 4. Intrusion Detection Systems	PEC	3	0	0	3
7	R19CSE-PR4107	Mini Project	PR	0	0	0	4
8	R19CSE-PC4108	Machine Learning Lab	PCC	0	0	3	1.5
			Total	**21**	**0**	**6**	**23.5**

Category	CREDITS
Professional core Courses	7.5
Professional Elective courses	6
Open Elective Course/Job oriented elective	**3**
Humanities and Social Science Elective	3
Mini Project	4
TOTAL CREDITS	**23.5**

	Honors courses IV Year - I Semester						
S. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1.	R19CS-HCIT3201	Internet of Things (IoT) (Track-1)	HC	**3**	**1**	0	4
2.	R19CS-HCVT3202	Vulnerability Assessment & Penetration Testing(Track -2)	HC	**3**	**1**	0	4
3.	R19CS-HCJF3203	Java Enterprise Framework (Track-3)	HC	**3**	**1**	0	4
4.	R19CS-HCDL3204	Deep Learning (Track-4)	HC	**3**	**1**	0	4

Category	**CREDITS**
Honors Courses	4
TOTAL CREDITS	**4**

Semester VIII (Fourth year)

IV Year - II Semester							
S. No.	**Course code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19BSH-OE4201	Management & organizational behaviour	HSMC	3	0	0	3
2.	R19CSE-OE4202	**Open Elective –III** (Inter Disciplinary) 1. Embedded Systems 2. Digital Signal Processing 3. Operations Research	OEC	3	0	0	3
3.	R19CSE-PE4203	**Professional Elective – V** 1. Information Retrieval Systems 2. Cloud Computing 3. Ethical Hacking 4. Big Data Analytics	PEC	3	0	0	3
4	R19BSH-MC4201	IPR	MC	3	0	0	0
5	R19CSE-PR4204	Project	PR	0	0	0	8
			Total	**12**	**0**	**0**	**17**

Category	**CREDITS**
Professional Elective courses	3
Open Elective Course/Inter Dessciplanary	3
Humanities and Social Science Elective	3
Project	8
TOTAL CREDITS	**17**

Subject Code	Subject Name	L	T	P	C
R19CS-PC4104	Cryptography & Network Security	3	0	0	3

Course Objectives:

1. Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers) are Introduced.
2. Introduction to Public-key cryptography (RSA, discrete logarithms) is provided.
3. Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, key management, key exchange, signature schemes are learnt.
4. An overview of e-mail and web security is provided.
5. An overview of viruses,firewalls and system security is provided.

Course Outcomes:

1. Understand the basics of Cryptography ,the goals, services and mechanisms.
2. Analyze the Symmetric Encryption Algorithms.
3. Analyze the Asymmetric Cryptographic Algorithms.
4. Understand the Digital signature Schemes.
5. Understand the email security and system security.

UNIT- I:

Basic Principles Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography

Learning Outcomes:

After Completion of this unit, student will be able to

- Understand what is meant by Cryptography
- Understand the goals, mechanisms and services of Cryptography.

UNIT- II:

Symmetric Encryption Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

Learning Outcomes:

After Completion of this unit, student will be able to

- Understand symmetric key Cryptography
- Analyse the various algorithms of Symmetric key Cryptography

UNIT- III:

Asymmetric Encryption Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography

Learning Outcomes:

After Completion of this unit, student will be able to

- Understand symmetric key Cryptography
- Analyse the various algorithms of Asymmetric key Cryptography

UNIT- IV:

Data Integrity, Digital Signature Schemes & Key Management Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.

Learning Outcomes:

After Completion of this unit, student will be able to

- Understand about Digital Signature and the security schemes.
- Understand the Hash functions and its importance

UNIT -V:

Network Security: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, IPSec, System Security.

Learning Outcomes:

After Completion of this unit, student will be able to

- Understand email-security.
- Understand the mechanisms of Transport Layer Security.
- Understand about system security.

Text Books:

1) Cryptography and Network Security, Behrouz A Forouzan, DebdeepMukhopadhyay, (3e) Mc Graw Hill.
2) Cryptography and Network Security, William Stallings, (6e) Pearson.
3) Everyday Cryptography, Keith M.Martin, Oxford.

Reference Books:

1.Network Security and Cryptography, Bernard Meneges, Cengage Learning

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**)**

SNO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2									1	3	3	1
CO2	3	2	2	2					1			1	2	2	1
CO3	3	3	3	2					1			1	3	3	2
CO4	3	3	3	2					1			1	3	3	2
CO5	3	3	2						1			1	3	3	2
CO*	3	3	2	2					1			1	3	3	2

MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

SYLLABUS COMMON TO ECE, EEE, CSSE, CS&IT

II B.TECH I & II SEMESTER, III B.TECH II SEMESTER

Subject Code	Subject Name	L	T	P	C
	MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS	3	0	0	3

Course Objectives:

- Inculcate the basic knowledge with the concepts of Economics & Demand and current business environment.(L2)
- Analyze various factors of production with proposed theories in relation to cost - volume profit analysis.(L4)
- Identify micro environment in which markets operate, how price determination is done under different kinds of competitions and know the different forms of Business organization. .(L4)
- Provide fundamental skills about accounting and explain the process of preparing accounting statements and analysis of financial statements. (L3)
- Apply the best investment decisions by means of time value of money.(L4)

Course Outcomes:

1. Equipped with the knowledge of fundamentals of economics, estimating the Demand for a product, Capable of analyzing Elasticity & Forecasting methods(L2)
2. Apply production concepts, assess the costs and Determine Break Even Point (BEP) of an enterprise for managerial decision making(L4)
3. Identify the influence and price determination of various markets structures and knowledge of the forms of business organization and Business cycles(L4)
4. Analyze and interpret the process & principles of accounting & apply financial statements for appropriate decisions to run the business profitably(L4)
5. Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity.(L4)

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Learning Outcomes:

At the end of this unit students will be able to:

- Awareness about basics of managerial economics(L1)
- Knowledge of the concepts of demand, elasticity of demand and methods of demand forecasting(L1)

Application:

1. Analyze the demand of a product by applying methods of the elasticity of demand.

Unit – II:

Theories of Production and Cost Analysis:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost

factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Learning Outcomes:

At the end of this unit students will be able to:

- Examine various issues involved in production decision analysis (L1)
- Construct how production function is carried out to achieve least cost combination of inputs(L3)
- Apply Break – Even Analysis and its importance in managerial decision making(L4)

Application:

Compute contribution, revenue, Cost comparison, Margin of safety for making accurate decisions related to profitability of particular Enterprise

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Goods and services Tax, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company.

Learning Outcomes:

At the end of this unit students will be able to:

- Identify the various market structures like Monopoly, Monopolistic competition (L4)
- Determine the appropriate pricing strategies to be applied in each market(L2)
- Compare the suitability of various organizational and ownership structures like sole trading, partnership. (L2)

Application: Analyse the leaps and bounds faced by the service providers in estimation of pricing in Telecom sector**.**

Unit – IV:

Introduction to Accounting & Financial Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements.

Learning Outcomes:

At the end of this unit students will be able to

- Knowledge about the framework for accounting process(L1)
- Analyze financial accounting decisions.(L3)

Application:

Prepare the financial accounting statements like Trading account, Profit and Loss account, Balance sheet of any organization.

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Learning Outcomes:

At the end of this unit students will be able to

- Analyze how capital budgeting decisions are carried out(L4)
- Knowledge of the concepts and various methods of capital budgeting(L1)

- Apply traditional or modern methods of Capital budgeting in business decision making(L3)

Application:

1. Assess long term investments and funds required in small scale organization**.**

Text Books:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. Varshney&Maheshwari, Managerial Economics, Sultan Chand& Sons, 2014.

References:

1. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
2. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
3. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
4. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
5. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

WEBLINKS

1. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-mefa/
2. Production and cost analysis- https://slideplayer.com/slide/5708722/
3.Accountinganalysis -https://www.readyratios.com/reference/accounting/accounting_analysis.html
4.https://nptel.ac.in/courses/110/101/110101131/

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**):**

SNO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2
CO1	-	-	-	-	-	2	1	-	-	-	-	1	-	1
CO2	1	1	-	-	-	2	-	-	-	-	-	1	2	1
CO3	-	-	-	-	-	2	2	-	-	-	-	1	-	1
CO4	-	-	-	-	-	2	1	-	-	-	2	1	-	1
CO5	-	2	-	-	-	2	1	-	-	-	2	1	-	1
CO*	1	1	-	-	-	2	1	-	-	-	2	1	1	1

Subject Code	Subject Name	L	T	P	C
R19CS-PC4103	Machine Learning	3	0	0	3

Course Objectives:

1. To familiarize with a set of well-known supervised unsupervised and semi-supervised learning algorithms.
2. The ability to implement some basic machine learning algorithms
3. Understanding of how machine learning algorithms are evaluated
4. To be able to formulate machine learning problems corresponding to different applications.
5. To understand a range of machine learning algorithms along with their strengths and weaknesses.

Course Outcomes:

1. Understand the characteristics of machine learning that make it useful to real-world Problems.
2. Understand various Machine Learning approches.
3. Understand data Classification using decision trees.
4. Apply theoretical foundations of Bayesian classifier to label data points
5. Understand the concept of Computational and instance based Learning.

UNIT - I:

Introduction

Well- posed learning problems, designing a learning system, Perspectives and issues in machine learning. Applications of machine learning

Concept Learning

Concept learning and the general to specific ordering. Introduction, A concept learning task, Concept learning as search, Find-s: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

Learning Outcomes: Student will be able to

1. Summarize the process of machine learning.(L2)
2. Recognize various machine learning Applications.(L1)
3. Recognize various steps in machine learning.(L1)
4. Understand various candidate elimination algorithms (L2)

UNIT – II

Decision Tree Learning

Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Learning Outcomes: Student will be able to

1. Summarize the process of classification.(L2)
2. Construct a decision tree for any sample data.(L3)

UNIT – III

Bayesian learning

Bayes theorem, Byes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, An example learning to classify text,

Bayesian belief networks

Learning Outcomes: Student will be able to

1.Calculate Bayes probability for any given data(L4)

2.Calculate Naïve Bayes probability.((L4)

3.Distinguish the process of Bayes and Naïve Bayes probability calculation (L4)

UNIT - IV:

Computational learning theory - 1

Probability learning an approximately correct hypothesis, Sample complexity for infinite Hypothesis spaces, The mistake bound model of learning- Instance- Based learning- Introduction.

Learning Outcomes: Student will be able to

1.Understand Probability learning and Instance- Based learning(L2)

UNIT - V

Computational learning theory – 2

K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Learning Outcomes: Student will be able to

1.Understand the concept of classification (L2)

2.Distinguish lazy Lazy and Eager Learning.(L4)

Text Books:

1.Tom M. Mitchell, Machine Learning, MGH

Reference Books:

1. Ethem Alpaydin, Introduction to machine learning, 2nd edition, PHI.
   Kevin P. Murphy, "Machine Learning," A Probabilistic Perspective, MIT Press, 2012

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM:2; LOW:1**):**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1										1	
CO2	3	3	2	2	2									2	1
CO3	3	3	1	2	2								1	2	2
CO4	3	3	1	2									1	2	2
CO5	3	3	3	2									1	2	2
CO*	3	3	1	2	2								1	2	2

Professional Elective- III

Subject Code	Subject Name	L	T	P	C
R19CSE-PE4105.1	Software Testing Methodologies	3	0	0	3

Course Objectives:

1. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
2. To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
3. To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
4. To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
5. To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.

Course Outcomes

1. Understand and apply Software Testing Knowledge.
2. Analyze and design to conduct a software test process.
3. Understanding of various software testing problems and able to design the solutions.
4. Apply knowledge to design the test cases effectively and ensure the quality of the product.
5. Apply knowledge to use modern software testing tools

Unit I:

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing.Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relating test life cycle to development life cycle Software Testing Methodology

Verification and Validation: Verification & Validation Activities, Verification of Requirements, High level and low level designs, How to verify code, Validation

Learning Outcomes:

By the end of the unit student can be able to

1. Understand the purpose of Testing (L2)
2. Apply software testing knowledge and engineering methods.(L3)
3. Verify and validate the test process (L5)

Unit II:

Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing

Dynamic Testing II: White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing

Static Testing: inspections, Structured Walk throughs, Technical reviews

Learning Outcomes:

By the end of the unit student can be able to

1. Design test cases using black box testing techniques (L6)
2. Design test cases using white box testing techniques (L6

Unit III:

Validation activities: Unit testing, Integration Testing,. Function testing, system testing, acceptance testing Regression testing: Progressives Vs regressive testing, Objectives of regression testing, When regression testing done?, Regression testing types.

Learning Outcomes:

By the end of the unit student can be able to

1. Design the test cases for regression testing. (L6)
2. Perform system testing. (L5)

Unit IV:

Efficient Test Suite Management: Test case deisgnWhy does a test suite grow, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite

Software Quality Management: Software Quality metrics, SQA models Debugging: process, techniques, correcting bugs, Basics of testing management tools, test link and Jira

Learning Outcomes:

By the end of the unit student can be able to

1. Design the test suite effectively (L6)
2. Define the quality metrics for the testing process (L1

Unit V:

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools, selenium tool.

Testing Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems, Testing mobile systems

Learning Outcomes:

By the end of the unit student can be able to

1. Automate the testing process. (L3)
2. Perform testing for webbased systems. (L5)

Text Books:

1. Software Testing, Principles and Practices, Naresh Chauhan, Oxford
2. Foundations of Software testing, Aditya P Mathur, 2nd, Pearson
3. Software Testing- Yogesh Singh, CAMBRIDGE

Reference books:

1. Software testing techniques – Baris Beizer, International Thomson computer press, second edition.
2. Software Testing, Principles, techniques and Tools, M G Limaye, TMH
3. Effective Methods for Software testing, Willian E Perry, 3ed, Wiley

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3		2	2				2			3	3		2
CO2	3	2	3		2				3			3	3	2	2
CO3	3	3	3						3				3		3
CO4	3	3	3	2	3				3			3	3	3	
CO5	2				3							3	2		3
CO.*	3	3	3	2	3				3	3		3	3	3	3

Subject Code	Subject Name	L	T	P	C
R19BSH-OE4101	Fuzzy Sets, Logic and Systems	3	0	0	3

Course Objectives:

- To familiarize the concepts of fuzzy sets, operations and fuzzy relations.
- To enlighten the learner with the concepts of fuzzy logic.
- To analyze the models in uncertainty using Fuzzification and Defuzzification methods.

Course Outcomes:

After successful completion of the course, the students are able to

1. Understand the basic concepts of fuzzy sets.(L2)
2. Understand the properties and characteristics of fuzzy relations and composition. (L2)
3. Estimate extrema of fuzzy functions. (L3)
4. Apply fuzzy logic to the inference system.(L3)
5. Apply Fuzzification and Defuzzification methods to the engineering problems. (L3)

Unit-I (9 hours)

Fuzzy Sets: Review on set theory and its operations, Membership function, characteristics of crisp set, fuzzy set, Type-n Fuzzy Set, Level-k fuzzy set, Relation between Universal Set and Fuzzy Set, α-cut set, Level set, Convex Fuzzy Set, Fuzzy Number, The Magnitude of Fuzzy Set, Subset of fuzzy set.

Operations of Fuzzy Set: Standard operations, Fuzzy complement, Fuzzy Partition, Fuzzy union, fuzzy intersection, other operations in fuzzy set, Difference in Fuzzy Set, Distance in Fuzzy Set.

Learning Outcomes:

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

- Understand the concept of membership function and different types of fuzzy sets. (L2)
- Understand different operators on fuzzy sets. (L2)
- Understand the operations on fuzzy sets to uncertainty. (L2)

Unit II (9 hours)

Fuzzy Relation and Fuzzy Composition: Cartesian Product of Fuzzy Set, crisp relation, properties of relation on a single set, fuzzy relation, extension of fuzzy set, Fuzzy Graph, Characteristics of Fuzzy Relation.

Learning Outcomes:

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

- Understand the concept of fuzzy relations and their characteristics. (L2)
- Apply the concept of fuzzy relation to construct a fuzzy graph. (L3)

Unit III (12hours)

Fuzzy Number: Concept of fuzzy number, operation on fuzzy number, Triangular fuzzy number.

Fuzzy Function: Fuzzy function, kinds of fuzzy function, Fuzzy extrema of function.

Learning Outcomes:

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

- Apply Fuzzy operations on fuzzy number and triangular fuzzy number. (L3)
- Find extrema of fuzzy functions.(L3)

Unit IV (9 hours)

Fuzzy Logic: Review on Classical Logic, Fuzzy Expression, Fuzzy logic, Operators in Fuzzy Expression, linguistic variable, Fuzzy Predicate, Fuzzy truth quantifier, Representation of Fuzzy Rule.

Learning Outcomes:

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

- Explain linguistic variables with different examples of membership function. (L2)
- Apply fuzzy logic to the inference system.(L3)

Unit V (9 hours)

Fuzzy Logic Systems(FLSs): Fuzzification, Defuzzification**,** Defuzzification Methods (Centre of gravity method and Mean of Maximum method), comparison between Fuzzification and Defuzzification, Fuzzy Logic Systems Architecture, Algorithm of a Fuzzy Logic System for solving real engineering problem, Application Areas of Fuzzy Logic systems in different fields, Advantages and Disadvantages of FLSs.

Learning Outcomes:

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

- Understand and compare Fuzzification and Defuzzification.(L3)
- Apply Fuzzification and Defuzzification methods to the engineering problems. (L3)

Text books

1. Kwang H. Lee, First Course on Fuzzy Theory and its Applications, Springer,2005.

References

1. George. J. Klir, Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice-Hall of India Pvt. Limited, 2008.
2. S.Rajasekharan, G.A.Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI, 2000
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3rd edition, John Wiley& sons Ltd,2004.
4. B.S Grewal, Higher Engineering Mathematics, 42nd edition, khanna publications, 2012.

Web Resources

1. https://swayam.gov.in/explorer
2. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_fuzzy_logic_systems.htm
3. https://www.tutorialspoint.com/difference-between-fuzzification-and-defuzzification#:~:text=Fuzzification%20is%20the%20process%20of,member%20into%20a%20crisp%20member.&text=Fuzzification%20converts%20a%20precise%20data%20into%20imprecise%20data.

IV Year-I Semester Syllabus

Subject Code	Subject Name	L	T	P	C
	Industrial internet of things	**3**	**0**	**0**	**3**

Course Objective:

1. To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.
2. Knowledge for the design and analysis of Industry 4.0Systems for Electronics Engineering students.
3. To gain knowledge in Industrial IoT layers and their protocols.
4. To know the Industrial Internet of Things (IIoT) reference architecture and business models.

Course Outcome:

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

1. Knowledge of theory and practice related to Industrial IoT Systems.
2. Ability to identify, formulate and solve engineering problems by using Industrial IoT.
3. Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.
4. Analyze the various Industrial IoT Layers and their relative importance.
5. Describe the Industrial IoT architecture and business models.

Unit 1:Introduction to Industrial IoT (IIoT) Systems:

IIoT-Introduction, Industrial IoT: Business Model and RefereceArchiterture: IIoT-Business Models, Industrial IoT-Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoTNetworking,The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry.

Unit 2: Implementation systems for IIoT:

Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.

Unit 3 :IIoT Data Monitoring & Control:

IoT Gate way, IoT Edge Systems and It's Programming, Introduction to Cloud computing-Architecture and data transfer, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

Unit 4:Cyber Physical Systems:

Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Cyber Physical system Intelligence , Introduction to Big Data and Advanced Analysis-Condition Monitoring.

Unit 5: Industrial IoT- Applications:

Healthcare, Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector.

Text Books:

1. Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress
2. "Industrial Internet of Things: CybermanufacturingSystems"by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017

List of References:

1. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
2. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
3. Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers.

CO-PO mapping table:

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

SNO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
C303.1	3	-	-	-	-	-	-	-	-	-	-	1	-	-	-
C303.2	3	3	-	-	-	-	-	-	-	-	-	1	1	1	-
C303.3	3	-	2	-	-	-	-	-	-	-	-	1	-	1	-
C303.4	3	3	-	-	-	-	-	-	-	-	-	1	-	1	-
C303.5	3	2	2	-	2	1	-	-	-	1	-	1	1	1	-
C403*	3	2	2	-	2	1	-	-	-	1	-	1	1	1	-

** For Entire Course, PO & PSO Mapping*

Subject Code	Subject Name	L	T	P	C
R19CS-PE4105.2	Soft Computing	3	0	0	3

Course Objectives:

1. To make the students to be familiar with the concept of classification techniques to solve real problems.
2. To Familiarize with Soft computing concepts.
3. To have a detailed study of neural networks, Fuzzy Logic and uses of Heuristics based on human experience.
4. To introduce the concepts of genetic algorithm and its applications to soft computing using some applications
5. To make the students to have general overview on selection and decision making strategies.

Course Outcomes

1.Understand the neural networks and architectures with directed graphs.
2.Analyse the Learning Process of Soft Computing.
3. Understand various Fuzzy sets.
4.Apply Fuzzy logic to Real time problems.
5.Analyze decision tree algorithms

Unit I:

Introduction: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural

Learning Outcomes:

After completion of this unit, student will be able to

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Learn neural networks and architectures with directed graphs

Unit II:

Learning Process: Error Correction learning, Memory based learning, Hebbian l earning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

Learning Outcomes:

After completion of this unit, student will be able to

- Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- Recognize the feasibility of applying a soft computing methodology for a particular problem

Unit III:

Classical & Fuzzy Sets: Introduction to classical sets – properties, operations and relations; Fuzzy sets – memberships, uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions.

Learning Outcomes:

After completion of this unit, student will be able to

- List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms.
- Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic

Unit IV:

Fuzzy Logic System Components

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods

Learning Outcomes:

After completion of this unit, student will be able to

- Apply basics of Fuzzy logic and neural networks.
- Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

Unit V:

Decision Tree Learning:

Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning

Learning Outcomes:

After completion of this unit, student will be able to

- Apply neural networks to pattern classification and regression problems.
- Effectively use existing software tools to solve real problems using a soft computing approach.
- To be able to solve Engineering problems using decision tree learning algorithms.

Text Books

i. Neural networks A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition2004
ii. Neural Networks, Fuzzy Logic, Genetic Algorithms: Sysnthesis and Applications by Rajasekharan and Pai, PHI Publications
iii. Machine Learning, Tom M. Mitchell, MGH

Reference Books:

- Simon Haykin , "Neural Networks: A Comprehensive Foundation ", PHI Publication.
- C. Eliasmith and CH. Anderson, "Neural Engineering ", PHI.
- John Yen and Reza Langari , "Fuzzy Logic¨Intelligence, Control and Information", Pearson Publication.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		1										1	1
CO2	2	1		1		1						1		1	
CO3	2	2			1					1			2	1	
CO4	2	2		2	1	3				1			2	1	
CO5	2	1	1	1	1	2	2					1	1	1	
CO*	2	2	1	1	1	1	2			1		1	2	1	1

Subject Code	Subject Name	L	T	P	C
R19CS-PC4105.3	Image Processing	3	0	0	3

Course objectives:

Students will be able to understand

1. The fundamentals of Computer Graphics and Image Processing
2. The basic concepts of edge detection
3. The concepts of segmentation and transformation techniques
4. The techniques of morphology.
5. The basics of image compression methods.
6. The basic concepts of Image Data Properties.

Course Outcomes :

Student will be able to

1. Understand the fundamentals of Image processing.
2. Apply transformations and reflection techniques.
3. Understand the Image pre processing techniques.
4. Understand the basic concepts of Morphology.
5. Analyze various Image Segmentation techniques

UNIT I:

Introduction: Applications of Computer Graphics and Image Processing, Fundamentals on Pixel concepts, effect of Aliasing and Jaggles, Advantages of high resolution systems

DDA line algorithms: Bresenhams line and circle derivations and algorithms

At the end of this module the student will:

1. Sumarize the fundamentals of Coputer Graphics and Image Processing. (L2)
2. Recall the applications of Image Processing (L1)

UNIT II:

2-D Transformations: Translations, Scaling, rotation, reflection and shear transformations, Homogeneous coordinates,

Composite Transformations- Reflection about an arbitrary line; Windowing and clipping, viewing

transformations, Cohen- Sutherland clipping algorithm

At the end of this module the student will:

1.Distinguish between 2D Transformations and Composite Transformation techniques.(L2)

2.Describe the transformation techniques.(L1)

UNIT III:

Digital Image Properties: Metric and topological properties of Digital Images, Histogram, entropy, Visual Perception, Image Quality, Color perceived by humans, Color Spaces, Palette Images, color Constancy

Color Images: Pixel brightness transformations, Local Preprocessing, image smoothing, Edge detectors, Robert Operators, Laplace, Prewitt, Sobel, Fri-chen, Canny Edge detection

At the end of this module the student will:

1.Classify the pixel transformations.(L2)

2.Summarize the image smoothing techniques.(L2)

UNIT IV:

Mathematical Morphology: Basic Mathematical Concepts, Binary dilation and Erosion, Opening and closing, Gray Scale dilation and erosion, Skeleton, Thinning , Thickening Ultimate erosion, Geodesic transformations, Morphology and reconstruction, Morphological Segmentation

At the end of this module the student will:

1.Recall the basic mathematical concepts.(L1)

2Explain the Morphological techniques.(L2)

UNIT V:

SEGMENTATION: Threshold detection methods, Optimal Thresholding, Edge based Segmentation-Edge image thresholding, Edge relaxation, Border tracing, Hough Transforms, Region based segmentation: Region Mergingm Region Splitting, Splitting and Merging, Watershed Segmentation.

At the end of this module the student will:

1.Identify Threshold detection techniques.(L2)

2.Discover splitting and merging techniques for image processing.(L3)

Text Books:

1. Computer Graphics C Version, Donald Hearn, M Paulli Baker , Pearson (Unit I and Unit II)
2. Image Processing, Analysis and Machine Vision, Millan Sonka, Vaclov Halvoc, Roger Boyle, Cengage Learning, 3ed, (Unit III, Unit IV, Unit V and Unit VI)

Reference Books:

1. Computer & Machine Vision, Theory , Algorithms , Practicles, E R Davies, Elsevier, 4ed
2. Digital Image Processing with MATLAB and LABVIEW, Vipul Singh, Elsevier
3. Digital Image Processing, R C Gonzalez &R E woods, Addison Pearson, 3ed.

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	1							2	2	2	2
CO2	3	2	1	2	1							1	2	2	2
CO3	2	2	1	2	1							1	2	2	2
CO4	3	3	2	2	1							1	2	2	2
CO5	3	2	1	2	1							2	2	2	2
CO.*	3	2	1	2	1							2	2	2	2

Subject Code	Subject Name	L	T	P	C
R19CS-PE4105.4	Software Project Management	3	0	0	3

Course Objectives:

1. Plan and manage projects at each stage of the software development life cycle (SDLC)
2. Train software project managers and other individuals involved in software project planning and tracking.
3. Understand successful software projects that support organization's strategic goals
4. Provides an oversight in the implementation of the software project management process.

Course Outcomes:

1. Understand the various software management activities.
2. Understand the organization's strategic plans and business justification throughout project lifecycle.
3. Analyze project cost estimation and perform cost benefit evoloution.
4. Evaluate outcomes of risk management plan.
5. Design framework for monitoring & control in Project Management.

Unit I:

Introduction Project Management: Software Project Management activities, Challenges in software projects, Stakeholders, Objectives & goals
Project Planning: Step-wise planning, Project Scope, Project Products & deliverables, Project activities, Effort estimation, Infrastructure.

Learning Outcomes:

Student will be able to

1.Plan software projects, including risk and quality management.(L2)
2.Recognize the importance of aligning the strategic direction of an organization with project selection.(L1)

Unit II:

Project Approach Lifecycle models, Choosing Technology, Prototyping Iterative & incremental Process Framework: Lifecycle phases, Process Artefacts, Process workflows

Learning Outcomes:

Student will be able to

1. Analyze the software estimate using various technologies
2. Applying process models in required fields of project
3. documenting software development project plans

Unit III:

Effort estimation & activity Planning Estimation techniques, Function Point analysis, SLOC, COCOMO, Use case-based estimation , Activity Identification Approaches, Network planning models, Critical path analysis

Learning Outcomes:

Student will be able to

1. Estimate software development size, effort, and schedule for new program proposals or enhancements to existing programs(L3)
2. Analyze the software estimate(L4)
3. Develop metrics on a software development program(L3)

Unit IV:

Risk Management Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach

Learning Outcomes:

Student will be able to

1. Assess and control risk engineering.(L3)
2. Evaluate performance using PERT technique.(L4)

Unit V:

Project Monitoring & Control , Resource Allocation Creating a framework for monitoring & control, Progress monitoring, Cost monitoring, Earned value Analysis, Defects Tracking, Issues Tracking, Status reports, Types of Resources, Identifying resource requirements, Resource scheduling

Learning Outcomes: Student will be able to

- Manage cost and schedules.(L3)
- Manage both the technical and socio-cultural aspects of the project.(L3)

Applications: For all software's.

Text Books

1. Software Project Management, Bob Hughes & Mike Cotterell, TATA Mcgraw-Hill
2. Software Project Management, Walker Royce: Pearson Education, 2005.
3. Software Project Management in practice, Pankaj Jalote, Pearson.

Reference Book:

1. Software Project Management, Joel Henry, Pearson Education.

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**)**

COs	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	1			1		1	1	2		1		2
C02	2	2	2	1	1	1	1	1	1	2	1	1		1	2
CO3	3	2	2	2	1	1	1				3	3	1	1	2
CO4	3	2	2	2	1	1				1	2	1		2	2
CO5	3	2				2	1	1	1	1	2	1		1	2
CO*	3	2	2	1	1	1	1	1	1	1	2	2	1	1	2

Professional Elective- IV

Subject Code	Subject Name	L	T	P	C
R19CS-PE4106.1	Distributed Systems	3	0	0	3

Course Objectives:

1. Understand how systems will communicate through network and to understand the Architectural design of Distributed Systems.
2. Understand and apply the various communication techniques and analyze the network IP address allocation.
3. Understand the Local and Remote procedure calls between processes.
4. Understand the role of operating Systems in Distributed Communication and the different technologies used for file sharing in Distributed Systems.
5. Apply Distributed algorithms for communication and to understand the Distributed Deadlocks and Replication requirement.

Course Outcomes:

1. Outline the characteristics of Distributed architecture.
2. Apply inter process communication in a distributed environment.
3. Apply standard protocols (RMI& RPC) in distributed systems.
4. Recall the fundamentals of OS in Distributed Environment and understand the Distributed File systems.
5. Understand the Transactions and replications in distributed systems.

Unit 1:

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges.

System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Learning Outcomes: student will be able to

- Outline the characteristics of file systems.(L2)
- Understand the challenges of system models.(L2)
- Understand the Design Requirements of Distributed Architecture.(L2)

Unit 2:

Interprocess Communication: Introduction, The API for the Internet Protocols- The Characteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast.

Learning Outcomes: Student will be able to

- Understand the Inter process communication. (L2)
- Apply the TCP stream communication.(L3)
- Outline IP Multicast and its ordering.(L2)

Unit 3:

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Model, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

Learning Outcomes: Student will be able to

- Understand the communication between objects.(L2)
- Apply Java RMI to different applications.(L3)
- Experiment with Remote Procedure call.(L3)

Unit 4:

Operating System Support: Introduction, The Operating System Layer, Protection, Processes and Threads –Address Space, Creation of a New Process, Threads.

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.

Learning Outcomes: Student will be able to

- Understand Operating system Layers.(L2)
- Illustrate the file server Architecture.(L2)
- Understand Peer to Peer Middleware Routing.(L2)

Unit 5:

Coordination and Agreement:

Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

Learning Outcomes: Student will be able to

- Compare coordination and Agreement.(L2)
- Understand system Model and Group communication.(L2)
- Summarize the challenges of Replication.(L2)

Text Books:

1. Ajay D Kshemkalyani, MukeshSighal, “Distributed Computing, Principles, Algorithms and Systems”,Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems-Concepts and Design”, Fourth Edition, PearsonPublication

Reference Books

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**)**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1									1			1
CO2	3	3	2	2								1	2		1
CO3	3	2	2									2	2		
CO4	3	2	1	1	2							1			1
CO5	3	2	2	2	2							1	1	2	
CO*	3	2	2	2	2							1	2	2	1

Subject Code	Subject Name	L	T	P	C
R19CS-PE4106.2	Parallel Computing	3	0	0	3

Course Objective:

1. Demonstrate an understanding of concepts, algorithms, and design principles underlying parallel computing,
2. Develop algorithm design and implementation skills
3. Gain practical experience in programming large scale parallel machines.

Course Outcomes:

After the completion of the course, student will be able to

1. Describe different parallel architectures and programming models
2. Develop an efficient parallel algorithm to solve it.
3. Apply parallel algorithm time complexity as a function of the problem size and number of processors.
4. Analyze parallel code performance, determine computational bottlenecks, and optimize the performance of the code.
5. Implement parallel algorithm using MPI, OpenMP, pthreads, or a combination of MPI and OpenMP.

UNIT -I:

Introduction to Parallel Computing: Scope of Parallel Computing, Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.

History: Introduction, Modern Scientific Method, Evolution of Super computing, Modem Parallel Computers, Seeking Concurrency, Data Clustering, Programming Parallel Computers.

Parallel Architectures: Introduction, Interconnection Networks, Processor Arrays, Multiprocessors, Multi computers, Flynn's Taxonomy.

UNIT -II:

Parallel Algorithm Design: Introduction, The Task/Channel Model, Foster's Design Methodology, Boundary Value Problem, Finding the Maximum, The n-Body Problem, Adding Data Input. Message-Passing Programming: Introduction, The Message- Passing Model, The Message-Passing Interface, Circuit Satisfiability, Introducing Collective Communication, Benchmarking Parallel Performance. Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.

UNIT -III:

The Sieve of Eratosthenes: Introduction, Sequential Algorithm, Sources of Parallelism, Data Decomposition options, Developing the Paralle1 Algorithm, Analysis of Parallel Sieve Algorithm, Documenting the Parallel Program, Benchmarking, Improvements. Performance Analysis: Introduction, Speedup and Efficiency, Amdahl's Law, Gustafson-Barsis's Law, The Karp-Flatt Metric, The Iso-efficiency Metric

UNIT -IV:

Matrix Multiplication: Introduction, Sequential Matrix Multiplication, Row wise

Block- Striped Parallel Algorithm, Cannon's Algorithm, Solving Linear Systems, Back Substitution, Gaussian Elimination, Iterative Methods, Sorting: Introduction, Quick sort, A Parallel Quick sort Algorithm, Hyper Quick sort Algorithm, Parallel Sorting by Regular Sampling.

UNIT -V:

Shared-Memory Programming: Introduction, The Shared-Memory Model, Parallell for Loops, Declaring Private Variables, Critical section, Reductions, Performance Improvements, More General Data Parallelism, Functional Parallelism. Combining MPI and OpenMP: Introduction, Conjugate Gradient Method, Jacobi Method. Analytical Modelling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics

Text Books:

Parallel Programming in C with MPI and OpenMP Michael J, Quinn Oregon State University.

Introduction to parallel computing by Ananth Grama, Anshul Gupta, Gorge Karypis, Vipin Kumar, Pearson.

Reference books:

Distributed and Cloud Computing: From Parallel Processing to the Internet of Things 1st Edition, Kai Hwang , Jack Dongarra, Geoffrey C. Fox.

Programming Massively Parallel Processors by D.Kirk and W. Hwu.

E-Resources:

i. https://nptel.ac.in/courses/106/102/106102114/

Subject Code	Subject Name	L	T	P	C
R19CS-PE4106.3	Social Networks & Semantic Web	3	0	0	3

Course objectives:

This course will enable students to

1. Explain the fundamentals of Semantic Webtechnologies.
2. Implementation of semantic web applications and the architectures of socialnetworking
3. Social network performanceanalysis

Course Outcomes

The students should be able to:

1. Understand the semantic web technologies like RDF Ontology .
2. Understand the various semantic webapplications
3. Identify the architectures and challenges in building socialnetworks
4. Analyze the performance of social networks using electronicsources
5. Create Semantic webApplications

Unit -I:

Web Intelligence Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semanticWeb.

Learning Objectives:

- Defining of Web Intelligence.
- Importance of various types intelligence i.e Machine Intelligence, Artificial Intelligence, Ontology etc.,
- Representation of Berners-Lee www

Unit- II:

Knowledge Representation for the Semantic Web Ontologies and their role in the semanticweb,Ontologies Languages for the SemanticWeb–Resource Description Framework(RDF)/ RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

Learning Objectives:

- Knowledge on Semantic Web Ontologies.
- Ontologies Languages for Semantic Web

Unit- III:

OntologyEngineering:OntologyEngineering,ConstructingOntology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and InferenceEngines.

Learning Objectives:

- Learning about Ontology Engineering
- Learning about Ontology Libraries and Mapping.

Unit -IV:

Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

Learning Objectives:

- Various services of Semantic Web Applications.
- Creating an OWL-S Ontology for Web Services.
- Learning of Web Search Agents.

Unit -V:

Social Network Analysis and semantic web :What is social Networks analysis,development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social networkfeatures.

Learning Objectives:

- Learning about network analysis using various electronic sources.
- Creation of blogs in online communities
- Building semantic web applications with social network features.

Text Books:

i. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
ii. Social Networks and the Semantic Web, Peter Mika, Springer,2007.

Reference Books:

i. Semantic Web Technologies, Trends and Research in Ontology BasedSystems.
ii. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & FrancisGroup).
iii. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor,O'Reilly.

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**):**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1		1		2						1	
CO2	3	2	3	2	2			2		2	2			3	2
CO3	2	3	3	2	3				2		1			3	2
CO4	2	2	3	2	3	2			2	1	1			3	2
CO5	2	2	3	2	2				2					3	2
CO*	2	3	3	2	2	1		2	2	1	2			3	2

** For Entire Course, PO & PSO Mapping*

Subject Code	Subject Name	L	T	P	C
R19CS-PE4106.4	Computer Graphics	3	0	0	3

Course Objectives:

1. To develop, design and implement two and three dimensional graphical structures
2. To enable students to acquire knowledge Multimedia compression and animations
3. To learn Creation, Management and Transmission of Multimedia objects

Course Outcomes:

1. Understand the algorithms to draw line, circle and ellipse.
2. Solve transformations related to the object.
3. Analyze algorithms of line, polygon, curve and text.
4. Classify surface detection methods.
5. Create shaded objects and Develop basic primitives with OPENGL.

UNIT-I:

2D Primitives Output primitives – Line, Circle and Ellipse drawing algorithms - Attributes of output primitives – Two dimensional Geometric transformations - Two dimensional viewing – Line, Polygon, Curve and Text clipping algorithms.

Learning outcomes: at the end of this unit, student will be able to

- Summarize the applications of Computer Graphics. [L2]
- Interpret algorithms to draw line, circle and ellipse. [L2]

UNIT-II:

3D Concepts Parallel and Perspective projections - Three dimensional object representation –Polygons, Curved lines, Splines, Quadric Surfaces, - Visualization of data sets -3Dtransformations – Viewing -Visible surface identification.

Learning outcomes: at the end of this unit, student will be able to

- Solve transformations related to 3D object.[L3]
- Infer object representations. [L2]

UNIT-III:

Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSPtree methods, area sub-division and octree methods.

Graphics Programming Color Models – RGB, YIQ, CMY, HSV – Animations – General Computer Animation, Raster, Key frame - Graphics programming using OPENGL – Basic graphics primitives –Drawing three dimensional objects - Drawing three dimensional scenes

Learning outcomes: at the end of this unit, student will be able to

- Classify surface detection methods. [L2]
- Explain depth sorting methods. [L2]
- Compare Color Models. [L2]
- Develop basic primitives with OPENGL.[L3]

UNIT-IV

Rendering and Overview of Ray Tracing: Introduction to Shading models – Flat and Smooth shading – Adding texture to faces–Adding shadows of objects, Rendering texture – Drawing Shadows.

Learning outcomes: at the end of this unit, student will be able to

- Analyze shading models.[L3]
- Created shaded objects. [L2]

UNIT-V

Overview of Ray Tracing: Intersecting rays with other primitives – Adding Surface texture –Reflections and Transparency – Boolean operations on Objects.

Learning outcomes: at the end of this unit, student will be able to

- Analyze rays with other primitives [L3]
- Classify Boolean operations on Objects. [L2]

Text Books:

1. Computer Graphics *C* version, Donald Hearn, M.Pauline Baker, Pearson
2. Computer Graphics with Virtual Reality Systems, Rajesh K Maurya, Wiley.

Reference Books

1. Introduction to Computer Graphics, Using Java 2D and 3D, Frank Klawonn, Springer
2. Computer Graphics, Steven Harrington, TMH.

Applications:

Morphing images (Photoshop)

Animation videos

Diagnosis in medical field

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**):**

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2												1
CO2	3	2	2												1
CO3	2	1	1									1	1		
CO4	2	2	2	1	1							1			1
CO5	2	1	1	1											1
CO*	3	2	2	1	1							1	1		1

Subject Code	Subject Name	L	T	P	C
R19CS-PC4108	Machine Learning Lab	0	0	3	1.5

Course Outcome's:

On completion of this course, the student will be able to

1. Implement machine learning algorithms to real world problems
2. Choose appropriate machine learning algorithm for a problem
3. Interpret the results of two different machine learning algorithms

Experiments:

1. Using Numpy calculate the mean,median ,mode,standard deviation and percentile.

2.Using Matplotlib show the Data distribution for a given dataset.

3.Predict the speed of 10 years old car

4.Implement and demonstrate the FIND-S algorithm for finding the most specifichypothesis based on a given set of training data samples. Read the training data from a .CSV file.

5.For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

6. Draw a polynomial regression line through the data.

7.Implement the Decision Tree Classifier using SKLearn.

8. Python Libraries for ML application such as Pandas

9.Implement the KNN algorithm.

10.Implement the K-means algorithm.

Text Books:

Hands–On Machine Learning with Scikit–Learn and TensorFlow 2nd Edition: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, 2019.

References:

1. https://scikit-learn.org/stable/tutorial/index.html
2. https://archive.ics.uci.edu/ml/index.php
3. https://towardsdatascience.com/pca-and-svd-explained-with-numpy-5d13b0d2a4d8
4. https://towardsdatascience.com/introduction-to-data-visualization-in-python-89a54c97fbe

Honors Courses

Subject Code	Subject Name	L	T	P	C
R19CS-HC1T4101	Internet of Things (IoT)	3	1	0	4

Course Objectives:

1. Introduce the fundamental concepts of IoT and physical computing
2. Expose the student to a variety of embedded boards and IoT Platforms
3. To introduce the Raspberry PI platform, that is widely used in IoT applications
4. Create a basic understanding of the communication protocols in IoT communications.
5. Familiarize the student with application program interfaces for IoT.
6. Enable students to create simple IoT applications and implementation of web based services on IoT devices.

Course outcomes:

1. Understand the architecture and principles of Internet of Things .
2. Outline the Arduino platform and its applications.
3. Develop applications using Raspberry Pi .
4. Apply protocols for a specific IoT application.
5. Understand the cloud platform and APIs for IoT application.

UNIT I

Overview of IoT:

The Internet of Things: An Overview; The Flavor of the Internet of Things; The "Internet" of "Things"; The Technology of the Internet of Things; Enchanted Objects; Who is Making the Internet of Things?; M2M Communications, Examples of IOT,Design Principles for Connected Devices; Calm and Ambient Technology; Privacy; Keeping Secrets; Whose Data Is It Anyway?; Web Thinking for Connected Devices; Small Pieces, Loosely Joined; First-Class Citizens On The Internet; Graceful Degradation; Business Models for Business Processes in the Internet Of Things

Learning Outcomes:

After completing this Unit, students will be able to

- Explain IoT architecture. [L2]
- Interpret the design principles that govern connected devices [L2]
- Summarize the roles of various organizations for IoT [L2]

UNIT II

Embedded Devices - I:

Embedded Computing Basics; Microcontrollers; System-on-Chips; Choosing Your Platform; Arduino; Introduction to Arduino Developing on the Arduino; Some Notes on the Hardware; Openness;

Learning Outcomes:

After completing this Unit, students will be able to

1. Explain the basics of microcontrollers [L2]
2. Outline the architecture of Arduino [L2]
3. Develop simple applications using Arduino [L3]

UNIT III

Embedded Devices - II:

Raspberry Pi ; Introduction to Raspberry Pi,Cases and Extension Boards; Developing on the Raspberry Pi; Some Notes on the Hardware; Openness; Other notable platforms; Mobile phones and tablets; Plug Computing: Always-on Internet of Things

Learning Outcomes:

After completing this Unit, students will be able to

1. Outline the architecture of Raspberry Pi [L2]
2. Develop simple applications using Raspberry Pi [L3]
3. Select a platform for a particular embedded computing application [L3]

UNIT IV

Communication in the IoT:

Internet Principles;InternetCommunications:AnOverview;Message Communication Protocols ,IP; TCP; The IP Protocol Suite (TCP/IP); UDP ; IP Addresses; DNS; Static IP Address Assignment ; Dynamic IP Address Assignment; IPv6 ; MAC Addresses ; TCP and UDP Ports ; An Example: HTTP Ports ; Other Common Ports; Application Layer Protocols- HTTP; HTTPS: Encrypted HTTP ; Other Application Layer Protocols & Constrained Application Protocol

Learning Outcomes:

After completing this Unit, students will be able to

1. Interpret different protocols and compare them [L2]
2. Select which protocol can be used for a specific application [L3]
3. Utilize the Internet communication protocols for IoT applications [L3]

UNIT V

Prototyping Online Components:

Getting Started with an API; Data Acquiring ,Organising data,Mashing Up APIs; Scraping; Legalities; Writing a New API; Clockodillo; Security; Implementing the API; Using Curl to Test; Going Further; Real-Time Reactions; Polling; Comet; Sensor Technology: Introduction of sensor technology, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless Sensor Network Technology ,Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms.

Learning Outcomes:

After completing this Unit, students will be able to

1. Select IoT APIs for an application [L3]
2. Design and develop a solution for a given application using APIs [L6]
3. Test for errors in the application [L4]
4. Implement Cloud platform for IOT applications and services[L3]

Text Books:

1 Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

2 Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education

3 Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti,Universities Press, 2015, ISBN: 9788173719547

Reference Books:

1. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

2. **Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759**

Reference sites:

https://www.arduino.cc/
https://www.raspberrypi.org/

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**):**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2		2	2
CO2	3		2		2				2			2		2	2
CO3	3		2		2				2			2		2	2
CO4	3	2	2									2		2	2
CO5	3	2										2		2	2
CO.*	3	2	2		2				2			2		2	2

** For Entire Course, PO & PSO Mapping*

Subject Code	Subject Name	L	T	P	C
R19CS-HCVT4102	Vulnerability Assessment & Penetration	3	1	0	4

Course Objectives:

1. To identify penetration testing process.
2. To identify the various information gathering and scanning procedures of security systems.
3. To identify various system hacking procedures.
4. To understand the impact of hacking in real time machines.
5. To understand the impact of hacking in wireless networks.

Course Outcomes:

1. Understand Penetration testing process.
2. Understand information gathering methodologies.
3. Analyze various Vulnerabilities assesments.
4. Apply System Hacking Techniques in real time applications.
5. Understand Bypassing WLAN Authentication

UNIT-I:

Introduction: Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non Disclosure Agreement Checklist, Phases of hacking, Open-source/proprietary Pentest Methodologies.

Learning outcomes: Student should be able to

1. Understand penetration testing phases. (L2)
2. Understand penetration testing types and strategies. (L2)
3. Understand hacking phases. (L2)

UNIT –II:

Information Gathering and Scanning : Information gathering methodologies- Foot printing, Competitive Intelligence- DNS Enumerations- Social Engineering attacks, Port Scanning- Network Scanning- Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting- Enumeration.

Learning outcomes: Student should be able to

1. Understand various information gathering methodologies. (L2)
2. Analyze various social engineering attacks. (L4)
3. Analyze Vulnerability Scanning approach. (L4)
4. Analyze operating system based Vulnerabilities. (L4)

UNIT-III:

System Hacking: Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Error- based, Union-based, Time-based, Blind SQL, Out-of-band, Injection Prevention Techniques.

Learning outcomes: Student should be able to

1. Understand various password cracking techniques. (L2)
2. Analyze various double encoding algorithms. (L4)
3. Analyze various security attacks. (L4)

UNIT IV:

Advanced System Hacking: **Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS - Stored, Reflected, DOM Based.**

Learning outcomes: Student should be able to

1. Analyze broken authentication techniques. (L4)
2. Analyze various XML entities. (L4)
3. Develop XML scripts for hacking . (L5)

UNIT V:

Wireless Pentest: Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Disassociation, Wireless Hacking Methodology, Wireless Traffic Analysis**.**

Learning outcomes: Student should be able to

1. Understand bypassing authentication in WLAN. (L2)
2. Analyze DDoS attacks. (L4)
3. Understand how clients are disassociated. (L2)
4. Analyze data patterns in wireless network. (L4)

Textbooks:

Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016 PacktPublishing

Reference Books:

- Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing.
- SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication

COURSE OUTCOMES VS POs MAPPING(DETAILED; HIGH: 3;MEDIUM:2;LOW:1**):**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2			2					2	2	2	2	2
CO2	3	2	2			2					2	2	2	2	2
CO3	3	2				2					2	2	2	2	2
CO4	3	2				2					2	2	2	2	2
CO5	3	2				2					2	2	2	2	2
CO.*	3	2	2			2					2	2	2	2	2

** For Entire Course, PO & PSO Mapping*

Subject Code	Subject Name	L	T	P	C
R19CS-HCJF4103	Java Enterprise Framework	3	1	0	4

Course Objectives:

1. Understand J2EE architecture and its configurations.
2. Understand project build tools and staging.
3. Implement Object Relational Mapping through Hibernate.
4. Implement Spring MVC for Web application development.
5. Implement Spring Boot to simplify web applications.

Course Outcomes:

1. Understand Enterprise level architectures and workspace configurations
2. Apply maven dependencies for building workspaces.
3. Apply Hibernate ORM for Object Persistence.
4. Apply Spring Dependency Injection for web applications.
5. Apply Spring boot annotations for simplifying the Web architecture.

Unit 1:

Introduction to J2EE: Distributed Multi-tier applications, J2EE Containers, MVC Architectures, J2EE Design Patterns.

Tools and Servers Configuration: Installation to Eclipse, Installation of Server, Configuring Server and database in Eclipse, Eclipse Shortcuts for code processing

Learning Outcomes: student will be able to

- Understand J2EE architecture and frameworks.(L2)
- Understand different Design Patterns.(L2)
- Understanding environment setup for servers and database in eclipse. (L2)

Unit 2:

Build Tools & GIT: Introduction to Maven, Understanding Archetypes and pom.xml, Maven Build Phases, Dependencies, Web Application using Maven, and Plug-ins with Maven.

Introduction to GIT, GitHub signup, Creating Repository, Pushing, Pulling, Merging and committing code.

Learning Outcomes: Student will be able to

- Understand Project Object Model using pom.xml (L2).
- Apply Dependencies and archetypes for web application. (L4).
- Create git repository for Web application with different operations. (L4)

Unit 3:

HIBERNATE: Introduction to Hibernate, Hibernate Architecture, Understanding Object Persistence, Hibernate Basics, Types of Relations, Querying Persistent Objects, Hibernate Query Language (HQL)

Learning Outcomes: Student will be able to

- Understand Hibernate Object relational mapping (L2)
- Create Hibernate objects for implementing relations between tables. (L4)
- Implement Hibernate queries for persisting java objects. (L4)

Unit 4:

Spring Framework: Spring Architecture and Container, Spring Setup in Eclispe, Spring Bean Factory, Bean factory VS Application Context, Dependency Injection (DI), Types of DI, Bean Auto Wiring, Collections with Spring, Bean Scopes, Event Handling in Spring, Inversion of Control(IOC), Aspect Oriented Programming (AOP).

Learning Outcomes: Student will be able to

- Understand architecture of spring container. (L2)
- Implement dependency injection for setting data for beans. (L4)
- Create spring beans for handling events and aspects. (L4)

Unit 5:

Spring Boot & JPA: Introduction to Spring Boot, Spring vs Spring Boot, Spring Boot Configurations, Controller, Repository, Service, Implementing CRUD operations, Spring Rest annotations, Rest Template, JPA Repository and annotations, Exploring Postman Rest Client.

Learning Outcomes: Student will be able to

- Understand Spring Boot configurations. (L2)
- Implementing Rest APIs using Spring boot annotations. L4)
- Apply CRUD operations using Spring Boot JPA Annotations. (L4)

Text Books:

1. Professional Java for Web Applications, By Nicholas S. Williams
2. Spring and Hibernate-2ed, by K. Santosh Kumar , McGraw-Hill Education
3. Spring Persistence with Hibernate, by Apress, Paul Tepper Fisher, Brain D Murphy
4. Developing Java Applications with Spring and Spring Boot, By Claudio Eduardo de Oliveria.

Reference Books:

1. Spring in Action, 4ed (Manning), by Craig Walls (Author) , Dream tech.
2. Java Persistence with Hibernate: Revised of Hibernate in Action, Dream tech, by Christian Bauer.

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO\	PSO2	PSO3
CO1	3	2	2	1	3						1	1	2	3	3
CO2	3	2	2	1	3						1	1	2	3	3
CO3	3	3	3	2	3						1	2	3	3	3
CO4	3	3	3	2	3						1	2	3	3	3
CO5	2	2	2	2	2						1	1	2	2	2
CO.*	3	2	2	2	3						1	1	2	3	3

Subject Code	Subject Name	L	T	P	C
R19CS-HCDL4104	Deep Learning	3	1	0	4

Course Objectives

• To provide exposure to these advances and facilitate in depth discussions on deep learning.

Course Outcomes:

1. Understand the fundamentals of learning techniques and layers.
2. Understand the Neural Network training, various random models.
3. Understand different types of deep learning network models.
4. Analyze the Probabilistic Neural Networks
5. Apply packages to Deep Learning models.

Course Content

UNIT-I :

Introduction: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network

Learning Outcomes: Student should be able to

1) Understand the fundamentals of Deep Learning. (L2).
2) Summarize the architecture of multi-layer network. (L2)

UNIT-II:

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization. Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

Learning Outcomes: Student should be able to

1) Understand back propagation and Optimization strategies. (L2)
2) Apply the training models on neural networks. (L4)

UNIT-III:

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

Learning Outcomes: Student should be able to

1) Understand the architectures of CNN, RNN and DBN. (L2)
2) Training deep feed forward networks for regularizations. (L4)

UNIT-IV:

Probabilistic Neural Network: Hopfield Net, Boltzmann machine, RBMs, Sigmoid net, Auto encoders.

Learning Outcomes: Student should be able to

1) Understand the Deep neural network auto-encoders.

UNIT-V:

Applications: Object recognition, sparse coding, computer vision, natural language processing. Introduction to Deep Learning Tools: Tensor Flow, Caffe, Theano, Torch.

Learning Outcomes: Student should be able to

1) Understand object detection and recognition strategies. (L2)
2) Training deep neural networks using Tensor Flow, Cafee and PyTorch etc. (L4)

Text Books

1. I. Goodfellow, Bengio Y., Courville A., "Deep learning", Volume 1, MIT Press.
2. François Duval, "Deep Learning for Beginners: Practical Guide with Python and Tensorflow", Data Science Series, CreateSpace Independent Publishers.

Reference Books

1. Sebastian Raschka, Vahid Mirjalili, "Python Machine Learning: Machine Learning and Deep
Learning with Python, scikit-learn, and TensorFlow", 2nd edition, Packt Publishers.

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH: 3; MEDIUM:2; LOW:1**):**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**	**2**								**1**		**2**	**1**
CO2	**3**	**3**	**2**	**2**								**1**		**2**	**1**
CO3	**3**	**3**	**2**	**2**								**1**		**2**	**1**
CO4	**3**	**3**	**2**	**2**								**1**		**2**	**1**
CO5	**3**	**3**	**2**	**2**	**2**							**1**		**2**	**1**
CO*	**3**	**3**	**2**	**2**	**2**							**1**		**2**	**1**

* For Entire Course, PO & PSO MappingPO1, PO2, PO3, PO4, PO5, PO12/PSO1, PSO2, PSO3

IV-II Semester

Open Elective- III

Subject Code	Subject Name	L	T	P	C
R19CS-OE4202.1	Embedded Systems	3	0	0	3

Course Objectives:

1. To introduce major components of an embedded system
2. To introduce 8-bit micro controller architecture
3. Understand OS basics and process scheduling.
4. Learn task communication and synchronization
5. Understand Embedded Product Development life cycle

Course Outcomes:

1. Understand the basic knowledge of embedded systems. (L2)
2. Analyze architecture of microcontroller. (L4)
3. Analyze various preemptive and Non-preemptive task scheduling algorithms. (L4)
4. Analyze various task communication and synchronization mechanisms in real time operating systems.(L4)
5. Understand the Embedded Product Development life cycle and development tools (L2)

Unit 1:

What is an embedded system Vs. General computing system, history, classification, major application areas, and purpose of embedded systems. Core of embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components.

Learning Outcomes: Student should be able to.

1. Differentiate embedded system and general computing system (L3)
2. Classify embedded systems based on performance, complexity and era in which they are evolved. (L3)
3. Discuss basic hardware and software units used in embedded systems.(L2)

Unit 2:

8—bit microcontrollers architecture: Characteristics, quality attributes application specific. Factors to be considered in selecting a controller, 8051 architecture, memory organization, registers, oscillator unit, ports, source current, sinking current, design examples.

Learning outcomes: Student should be able to

1. Analyze processor architectures (L4)
2. Select a processor for embedded system development (L5)

Unit 3

RTOS and Scheduling, Operating basics, types, RTOS, tasks, process and threads, multiprocessing and multitasking, types of multitasking, non preemptive, preemptive scheduling.

Learning Outcomes: Student should be able to.

1. Differentiate multitasking and multiprocessing . (L3)
2. Analyze process scheduling (L4)

Unit 4:

Task communication of RTOS, Shared memory, pipes, memory mapped objects, message passing, message queue, mailbox, signaling, RPC and sockets, task communication/synchronization issues, racing, deadlock, live lock, the dining philosopher's problem. The producer-consumer problem, Priority Inversion, Priority ceiling, Task Synchronization techniques, busy waiting, sleep and wakery, semaphore, mutex, critical section objects.

Learning Outcomes: Student should be able to.

1. Acquire knowledge on task communication techniques (L2)
2. Analyze task synchronization. (L4)

Unit 5:

Simulators, emulators, Debuggers, Embedded Product Development life cycle (EDLC), Trends in embedded Industry.

Learning Outcomes: Student should be able to.

1. Use tools for Embedded Software development(L3)
2. Acquire knowledge on EDLC (L2)

Text Books:

1) Introduction to embedded systems Shibu.K.V, TMH, 2009.
2) Embedded Software Primer, David Simon, Pearson.

References:

1 Ayala & Gadre: The 8051 Microcontroller & Embedded Systems using Assembly and C, CENGAGE.
2. Embedded Systems, Rajkamal, TMH, 2009.
3. The 8051 Microcontroller and Embedded Systems, Mazidi, Pearson.

Course Outcomes VS POs Mapping (High:3; Medium:2;Low:1**):**

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O 3
CO1	3	1	1												1
CO2	3	2	2									2	1		1
CO3	3	2	2		1							1	1		1
CO4	3	2	2									1			1
CO5	3	1	1		3							2	1		2
CO.*	3	2	2		2							2	1		1

Professional Elective- V

Subject Code	Subject Name	L	T	P	C
R19CS-PE4203.1	Information Retrieval Systems	3	0	0	3

Course Objective:

1. To learn about fundamentals of information retrieval system and its evaluation.
2. To understand about various information retrieval models like Boolean, vector, probabilistic, language and Content Based Image Retrieval.

Course Outcomes:After complete the course, Student can able to

1. Understand the fundamentals of information retrieval system and its evaluation system.
2. Understand the concept of Boolean retrieval model and vector space model.
3. Understand about probabilistic and language model for information retrieval.
4. Analyze text summarization and content-based image retrieval
5. Analyse the various algorithms for finding the relevance feedback.

Unit-1:

Fundamental of Information Retrieval: Introduction, Blocked Sort-Based Indexing, Single-Pass In-Memory Indexing, Distributed Indexing, Dynamic Indexing, Advanced Indexing. Information Retrieval Evaluation: introduction.

Learning out comes:

Able to understand the basic concepts of information retrieval system.

Analyse the evaluation system of information retrieval.

Unit-2

Boolean Information Retrieval Model: Introduction,Boolean Retrieval, Representation of Boolean Model. Vector Space Information Retrieval Model:Introduction, What Is Document Similarity, Cosine Similarity, TF-IDF Weighting, Named-Entity Recognition, State-of-the-Art NER Models.

Learning out comes:

Able to understand the concept of Boolean and vector information retrieval model.

Able to differentiate the Boolean and vector space model of informational retrieval system.

Unit-3

Probabilistic Information Retrieval Model: Introduction, Background, Probabilistic Information, Retrieval Models. Language Models for Information Retrieval: Introduction, Language Models, Types of Language Models, Query Likelihood Model.

Learning outcomes:

Able to understand the probabilistic and language models for information retrieval system.

Able to differentiate the probabilistic and language models for information retrieval system.

Unit-4

Text Summarization: Introduction, Abstractive Summarization Approach, Extractive Text, summarization Technique, The Role of Artificial Intelligence in IR. Content-based Image Retrieval: Introduction, Need of CBIR, Image colour Feature Extraction,ISFE-Image Shape Feature Extraction,ITFE-Image Texture Feature Extraction

Learning outcomes:

Able to understand the text summarization.

Able to understand the basics of Content Based Image Retrieval.

Unit-5

Relevance Feedback: Introduction,The Rocchio Algorithm for RF,Algorithm, Probabilistic RF, Assumptions for RF, RF Disadvantages,Pseudo/Blind RF,Indirect RF, RF on Web

Learning outcomes:

Able to Analyse various algorithms of relevance feedback for information retrieval system.

Text book:

Information Retrieval: Models and Concepts, Badal Soni, Suganya Devi.K, 1st Edition Wiley Publications.

Reference Books:

Introduction to information retrieval, Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, Cambridge Press,2008.

Information Retrieval System: A Linguistic Study, R C Pandey,Abhijeet Publications.

Course Outcomes- Program Outcomes Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1							1	1	1		
CO2	2	1	2	1	1						1	1	1		
CO3	2	1	2	1	1						1	1	1		
CO4	2	1	2	1	1						1	1	1		
CO5	2	1	1	1	1						1	1	1		
CO*	2	1	2	1	1						1	1	1		

Subject Code	Subject Name	L	T	P	C
R19CS-PC4203.2	Cloud Computing	3	0	0	3

Course Objectives:

1. Cloud Computing is a large scale distributed computing paradigm which has become a driving force for information technology over the past several years.
2. This course introduce cloud computing technology to undergraduate engineering students, so they can learn, apply and use this technology in their future careers.

Course Outcomes

Upon completion of the course, it is expected that student will be able to:

1. Understand different computing paradigms
2. Understand the basics of cloud computing and different cloud deployment models.
3. Understand different cloud implementation and management strategies.
4. Understand different cloud service models.
5. Analyze and use different cloud services/applications/tools available from key cloud providers.

UNIT-I:

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing..

UNIT-II:

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud Computing, Cloud Computing is a Service, Cloud Computing is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models

UNIT-III:

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud Application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

UNIT-IV:

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platformas a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

UNIT-V:

Cloud Providers and Applications: EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue service,

Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rackspace, VMware, Manjra soft, Aneka Platform**.**

Text Book:

Essentials of Cloud Computing, K. Chandrasekhran, CRC press.

Reference Books:

- Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley.
- Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier.
- Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, SubraKumaraswamy, ShahedLatif, O'Reilly.

Subject Code	Subject Name	L	T	P	C
R19CS-PC4203.3	Ethical Hacking	3	0	0	3

Course Outcomes:

On completion of this course, the student will be able to

1. Understand the various hacking methods through passwords.
2. Analyze system security vulnerability through registry editing
3. Understand the system vulnerability exploit attacks.
4. Analyze security assessment using Perl scripts.
5. Understand various issues related to Viruses

Unit- I

Introduction about Passwords:

Hacking Windows: BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, URL Address Bar, Netscape Communicator, Cookies, URL History, The Registry, Babysitter Programs

At the end of the module the student shall be able to:

- Understanding about various passwords (L2)
- Understanding about securing the passwords (L2)
- Applying and Analyzing software related issues related to Cookies (L4)

Unit- II

Booting Process and Registry Editing:

Advanced Windows Hacking: Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.

At the end of the module the student shall be able to:

- Understanding about bootable files (L2)
- Understanding and analyzing the concept of registry(L2,L4)
- Applying and analyzing fragmentation of drives (L4)

Unit- III

Password Recovery:

Getting Past the Password: Passwords: An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks, Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords.

At the end of the module the student shall be able to:

- Understanding about password recovery (L2)
- Understanding and applying Windows and Unix passwords (L2, L3)
- Analyzing the role of HTTP Authentication (L4)

Unit- IV

Hacking with Perl:

The Perl Manual: Perl: The Basics, Scalars, Interacting with User by getting Input, Chomp() and Chop(), Operators, Binary Arithmetic Operators, The Exponentiation Operator(**), The Unary Arithmetic Operators, Other General Operators, Conditional Statements, Assignment Operators. The ?: Operator, Loops, The While Loop, The For Loop, Arrays, The For-Each Loop: Moving through an Array, Functions Associated with Arrays, Push() and Pop(), Unshift() and Shift(), Splice(), Default Variables, $_, @ARGV, Input Output, Opening Files for Reading, Another Special Variables.

At the end of the module the student shall be able to:

- Understanding the basic commands of Perl (L2)
- Practically examine the Perl commands (L4)
- Apply and differentiate various FILE operations (L3,L4)

Unit- V

Viruses:

Virus, Working principle of Virus, Boot Sector Viruses (MBR or Master Boot Record), File or Program Viruses, Multipartite Viruses, Stealth Viruses, Polymorphic Viruses, Macro Viruses, Blocking Direct Disk Access, Recognizing Master Boot Record (MBR) Modifications, Identifying Unknown Device Drivers, Making of own Virus, Macro Viruses, Using Assembly to Create your own Virus, Hiding the Virus from Scan, Create New Virus Strains, Simple Encryption Methods

At the end of the module the student shall be able to:

Understanding about Virus(L2)

Analyzing various types of viruses (L4)

Practically examine to create new viruses (L4

Text Books:

1.Patrick Engbreston,"The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy",1stEdition, Syngress publication,2011.

2.Ankit Fadia,"Unofficial Guide to Ethical Hacking", 3rd Edition, McMillan India Ltd,2006

References:

1. Simpson, backman, corley, "Hands-on Ethical Hacking & Network Defense", 2nd Edition, Cengage, 2011.

Subject Code	Subject Name	L	T	P	C
R19CS-PC4203.4	Big Data Analytics	3	0	0	3

Course Objectives:

1. Optimize business decisions and learn the advantage with Big Data analytics.
2. Introducing Java concepts required for developing map reduce programs.
3. Imparting the architectural concepts of Hadoop.
4. Introducing the use of map reduce paradigm.
5. To introduce programming tools PIG & HIVE in Hadoop echo system.

Course Outcomes:

1. Apply the data structures and serialization in Java.
2. Understand the Hadoop Distributed File System.
3. Apply the Map Reduce Paradigm on various case studies.
4. Apply the Pig Scripts and understand Pig architecture.
5. Apply the Hive Query Language

Unit 1:

Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization.

Learning Outcomes:

- After Completion of this unit, student will be able to
- Understand the concepts of data structures in JAVA.
- Understand the concepts of Generics.

Unit 2:

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

Learning Outcomes:

- After Completion of this unit, student will be able to
- Learn File systems in Hadoop.
- Understand Configurations of Hadoop clusters and XML Files.
- Understand HDFS file.

Unit 3:

Writing MapReduce Programs: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner. The Writable Interface, WritableComparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, BytesWritable, NullWritable, ObjectWritable and GenericWritable, Writable collections, Implementing a Custom Writable: Implementing a RawComparator for speed, Custom comparators

Learning Outcomes:

After Completion of this unit, student will be able to

- Work with large data sets.
- Structure Map reduce frameworks, and use them to solve complex problems, which require massive computation power.

Unit 4:

Pig: Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin

Learning Outcomes:

- After Completion of this unit, student will be able to
- Work with Pig Latin Command Interfaces.
- Work on the Big Data to solve complex problems.

Unit 5:

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

Learning Outcomes:

After Completion of this unit, student will be able to

The student will be able to use relational data in a Hadoop environment, using Hive and Hbase tools of the Hadoop Ecosystem.

Text Books

1.Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC

2.Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly

3.Hadoop in Action by Chuck Lam, MANNING Publ.

4.Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

References

1.Hadoop in Practice by Alex Holmes, MANNING Publ.

2.Hadoop MapReduce Cookbook,Srinath Perera, Thilina Gunarathne

Software Links:

Hadoop:http://hadoop.apache.org/

Hive: https://cwiki.apache.org/confluence/display/Hive/Home

Pig Latin: http://pig.apache.org/docs/r0.7.0/tutorial.html

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2		2							1	3	3	1
CO2	3	2	2	2	2				1			1	2	2	1
CO3	3	3	3	2	3				1			1	3	3	2
CO4	3	3	3	2	3				1				3	3	2
CO5	3	3	2		3				1				3	3	2
CO*	3	3	2	2	3				1			1	3	3	2

** For Entire Course, PO & PSO Mapping*

Subject	Subject Name	L	T	P	C

Code					
R19BSH-MC4201	**INTELLECTUAL PROPERTY RIGHTS AND PATENTS**	**3**	**0**	**0**	**0**

Course Objectives:

- Outline and impart knowledge of Intellectual property rights on trademarks, copyrights and patents and also agencies responsible for IPR(L2)
- Comprehend the awareness of copyright law and various rights acquired by the owner or original creators.(L2)
- Illustrate the patent law, registration process and grants, protects in India and abroad.(L3)
- Relate to significance of trademark and service mark in business Organisations and its infringement.(L2)
- Assess and maintain the protection of trade secret in the organisation and also emerging trends in cyber security and cybercrimes.(L3)

Course Outcomes:

1. Knowledge on Intellectual Property Law, Innovations andInventions of Trade related Intellectual
2. Property Rights.(L3)State the principles and rights afforded by Copyright. (L3)
3. Analyze Patent Requirements, Patent Law, Infringement and Litigation.(L3)
4. Outline the registration Processesof Trade Mark and Dilution of Ownership of Trade mark (L2)
5. State the main ideas of Employee Confidentiality Agreement and Trade Secret Litigation and also identify the legal procedures to prevent cybercrimes. (L2)

Unit I: Introduction to Intellectual Property Rights (IPR)

Introduction to IPRs, Basic concepts and need for Intellectual Property – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Agencies for IPR Registration – Emerging trends in IPR - Use and Misuse of Intellectual PropertyRights.

Learning Outcomes:

At the end of this unit student will be able to:

- Knowledge about the elements of IPR (L3)
- Learn International Instruments and emerging areas of IPR (L1)
- Assess Agencies responsible for Registration and laws related to IPR(L3)

Application: Applicability and relativity between elements of Intellectual property rights and creating innovative ideas.

Unit II: Copyrights and Neighboring Rights

Introduction to Copyrights – Principles of Copyright Protection – Law Relating to

Copyrights

- Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Semiconductor Chip ProtectionAct.

Learning Outcomes:

At the end of this unit student will be able to:

- Identify how one can generate economic wealth through copyrights(L3)
- Support the various concepts related to protection, promotion and enforcement of copy rights(L2)
- Knowledge of Limitations and Infringement of Copyrights. (L3)

Application: Practice of copyrights case and Identification of the infringement to the owner of the copy right.

Unit III: Patents

Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Patent Search - Patent Registration and Granting of Patent - Ownership and Transfer — Infringement of Patent – Compulsory Licensing – – Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations.

Learning Outcomes:

At the end of this unit student will be able to:

- Describe the registration process of Patents (L2)
- Gain knowledge of infringement of patents and their remedies(L3)
- Generalize on Patents, Software protection and Computer related Innovations.(L3)

Application: Checking the eligibility for several patents and suggest remedies for problems through case study.

Unit IV: Trademarks

Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies- Case study.

Learning Outcomes:

At the end of this unit student will be able to:

- Knowledge on registration and maintenance of trademarks (L3)
- Illustrate procedure for trademark claims (L2)
- Elaborate on transfer of rights in Trademarks (L3)

Application: Compare and contrast different trademarks and know how to register trademark

Unit V: Trade Secrets& Cyber Law

Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets - Maintaining Trade Secret – Physical Security – Employee Confidentiality Agreements – Breach of Contract – Trade Secret Litigation .

Cyber Law and Cyber Crime

Introduction to Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions - Cyber Crimes - Prevention and Punishment - Case study.

Learning Outcomes:

At the end of this unit student will be able to:

- Assess the level of physical security (L3)
- Outline Employee Confidentiality Agreements (L2)
- Gain knowledge of prevention and punishment of cybercrimes(L3)
- Understand the various levels of liability of network providers(L2)

Application: 1.Adapt how to protect trade secret physically and from the employees of the organization.

2. Choose and exhibit various securities to access like biometrics, login passwords, facial recognition, UID number, which protects the individual properties.

Text Books:

1. Fundamentals of IPR for Engineers- Kompal Bansal &Parishit Bansal, B. S. Publications,2013

2. Intellectual Property -Deborah E.Bouchoux ,Cengage Learning, New Delhi.,2012

3. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

References Books:

1. Intellectual property rights- PrabuddhaGanuli., Tata Mcgraw hill, 2012.

2. Intellectual property rights M.Ashokkumar and Mohd.Iqbal Ali:, Serials Publications, 2015

3. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi,
2015.

4. Intellectual Property- Richard Stim, Cengage Learning, New Delhi, 2012.

5.S. V. Satakar, ―Intellectual Property Rights and Copy Rights, EssEss Publications, New Delhi,2002

Web links:

1. http://www.ipindia.gov.in/patents.htm
2. http://www.ipindia.gov.in/trade-marks.htm
3. https://copyright.gov.in/
4. http://www.wipo.int/portal/en/index.html
5. https://indiankanoon.org/

COURSE OUTCOMES VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

SNO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO1 2	PS O1	PSO 2
CO1	-	-	-	-	-	2	1	-	-	-	-	1	-	1
CO2	-	-	-	-	-	2	1	1	-	-	-	1	-	1
CO3	-	-	-	-	-	2	2	2	-	-	-	1	-	1
CO4	-	-	-	-	-	2	2	1	-	-	-	1	-	1
CO5	-	-	-	-	-	2	1	2	-	-	-	1	-	1
CO*	-	-	-	-	-	2	2	2	-	-	-	1	-	1