Credit Distribution Pattern

	SEM-1	SEM-2	TOTAL
I	18	22	40
II	21	20.5	41.5
III	21	22	43
IV	21.5	14	35.5
TOTAL	81.5	78.5	160

I YEAR - I SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A1100101	Professional English-1	2	1	0	3	40	60	100	3
2	18A1100201	Engineering Mathematics-1	2	1	0	3	40	60	100	3
3	18A1100203	Applied Physics	2	1	0	3	40	60	100	3
4	18A1105301	Programming and Problem Solving with C	2	1	0	3	40	60	100	3
5	18A1103302	Engineering Graphics	1	0	2	3	40	60	100	2
6	18A1100191	English Communication Skills Lab-1	0	0	3	3	40	60	100	1.5
7	18A1100292	Applied Physics lab	0	0	2	2	40	60	100	1
8	18A1105392	Programming and Problem Solving with C Lab	0	0	3	3	40	60	100	1.5
9	18A1100801	Environmental Studies	2	1	0	3	40	60*	100	0
Total			**11**	**5**	**10**	**26**	**360**	**540**	**900**	**18**

I YEAR - II SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A1200101	Professional English-II	2	1	0	3	40	60	100	3
2	18A1200201	Engineering Mathematics-II	3	1	0	4	40	60	100	4
3	18A1200205	Applied Chemistry	2	1	0	3	40	60	100	3
4	18A1205401	OOPS through Java	2	1	0	3	40	60	100	3
5	18A1202301	Fundamentals of Electrical Engineering	3	0	0	3	40	60	100	3
6	18A1200191	English Communication Skills Lab-II	0	0	3	3	40	60	100	1.5
7	18A1200294	Applied Chemistry lab	0	0	2	2	40	60	100	1
8	18A1205391	Automation Tools and Professional Workshop	0	0	3	3	40	60	100	1.5
9	18A1205491	OOPS through Java Lab	0	0	4	4	40	60	100	2
Total			**12**	**4**	**12**	**28**	**360**	**540**	**900**	**22**

II YEAR I SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A2100203	Discrete Mathematical Structures	3	1	0	4	40	60	100	4
2	18A2105401	Data Structures	3	0	0	3	40	60	100	3
3	18A2105402	Data Base Management Systems	3	0	0	3	40	60	100	3
4	18A2105403	Digital Logic Design	2	0	2*	4	40	60	100	3
5	18A2105391	Internet of Things Lab	0	2	2	4	40	60	100	3
6	18A2105491	Data Structures Lab	0	0	2	2	40	60	100	1
7	18A2105492	Data Base Management System Lab	0	0	2	2	40	60	100	1
8	18A2105494	Python Programming Lab	0	1	2	3	40	60	100	2
9	HSS Elective	Humanities Elective-1	2	0	0	2	40	60	100	1
10	18A2100801	Professional Ethics and Human Values	2	0	0	2	40	60*	100	0
Total			**15**	**4**	**10**	**29**	**400**	**600**	**1000**	**21**

*** No External Evaluation**

List of Humanities Electives

A	18A2100601	Professional Communication Skills	D	18A2100604	Psychology
B	18A2100602	Visual Communication	E	18A2100605	Philosophy
C	18A2100603	Sanskrit			

II YEAR II SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A2200201	Probability and Statistics	3	1	0	4	40	60	100	4
2	18A2205401	Web Technologies and Advanced Java Programming	3	0	0	3	40	60	100	3
3	18A2205402	Software Engineering	3	0	2	5	40	60	100	4
4	18A2205403	Computer Organization	3	0	0	3	40	60	100	3
5	OE-1	Open Elective-1	3	0	0	3	40	60	100	3
6	18A2205491	Web Technologies and Advanced Java Programming Lab	0	0	3	3	40	60	100	1.5
7	18A2205492	Aptitude and Reasoning	0	0	2	2	40	60*	100	1
8	18A2205901	Mini project	0	0	2	2	40	60*	100	1
Total			**15**	**1**	**9**	**25**	**320**	**480**	**800**	**20.5**

* No External Evaluation

III CSE - I SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A3105401	Advanced Data Structures	2	1	0	3	40	60	100	3
2	18A3105402	Computer Networks	2	1	0	3	40	60	100	3
3	18A3105403	Formal Languages and Automata Theory	3	0	0	3	40	60	100	3
4	PE-I	**Professional Elective-1**	3	0	0	3	40	60	100	3
5	OE-II	**Open Elective-II**	3	0	0	3	40	60	100	3
6	18A3105492	Computer Networks lab	0	1	2	3	40	60	100	1.5
7	18A3105491	Advanced Data Structures Lab	0	0	3	2	40	60	100	1.5
8	18A3101301	Basics of Civil and Mechanical Engineering	0	2	0	2	40	60*	100	1
9	18A3105791	Competitive Coding	0	0	2	2	40	60*	100	1
10	18A3105792	Seminar	0	0	2	2	40	60*	100	1
11	18A3100801	Indian Constitution	0	1	2	2	40	60*	100	0
Total			**13**	**6**	**11**	**28**	**440**	**660**	**1100**	**21**

Code	Professional Elective – 1
18A3105511	1.1 Scripting Languages
18A3105512	1.2 Computer Graphics and Multimedia animation
18A3105513	1.3 Data Warehousing and Data Mining
18A3105514	1.4 Principles of Programming Languages

* No External Evaluation

III CSE - II SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A3205401	Operating Systems	2	1	0	3	40	60	100	3
2	18A3205402	Design and Analysis of Algorithms	3	0	0	3	40	60	100	3
3	18A3205403	Compiler Design	3	0	0	3	40	60	100	3
4	PE-2	**Professional Elective -2**	3	0	0	3	40	60	100	3
5	PE-3	**Professional Elective -3**	3	0	0	3	40	60	100	3
6	18A3205404	Artificial Intelligence	3	0	0	3	40	60	100	3
7	18A3205491	Operating Systems & Unix programming Lab	0	0	2	2	40	60	100	1
8	18A3205492	R Programming lab	0	0	2	2	40	60	100	1
9	18A3205991	Aptitude and Reasoning – 2	0	0	2	2	40	60*	100	1
10	18A3205791	Hackathon	0	0	2	2	40	60*	100	1
11	18A3200791	Biology for Engineers/ Enterprising and Startup/ NSS / YOGA / Social service/ sports /games	0	2	0	2	40	60*	100	0
Total			**17**	**3**	**8**	**28**	**440**	**660**	**1100**	**22**

Code	Professional Elective -2	Code	Professional Elective -3
18A3205511	2.1 Advanced Database Management Systems	18A3205521	3.1 Computer Vision
18A3205512	2.2 UML & Design Patterns	18A3205522	3.2 Data Analytics
18A3205513	2.3 Distributed Systems	18A3205523	3.3 Software Testing Methodologies
18A3205514	2.4 Adhoc and Sensor Networks	18A3205524	3.4 Cloud Computing and Application Development

* No External Evaluation

IV CSE - I SEMESTER

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	18A4105401	Managerial Economics and Financial Accounting	3	0	0	3	40	60	100	3
2	18A4105402	Cryptography and Network Security	3	0	0	3	40	60	100	3
3	PE-4	**Professional Elective - 4**	3	0	0	3	40	60	100	3
4	PE-5	**Professional Elective - 5**	3	0	0	3	40	60	100	3
5	OE-3	**Open Elective -3**	3	0	0	3	40	60	100	3
6	18A4105491	AI Application Development Lab	0	1	2	3	40	60	100	1.5
7	18A4105492	Predictive Analytics Lab	0	1	3	4	40	60	100	2
8	18A4105493	Full Stack Web Development Lab	0	0	2	2	40	60	100	1
9	18A4105791	Minor project	0	1	3	4	40	60*	100	2
10	18A4100804	Research Methodology	2	0	0	2	40	60*	100	-
Total			**17**	**3**	**10**	**30**	**400**	**600**	**1000**	**21.5**

Code	Professional Elective -4	Code	Professional Elective -5
18A4105511	4.1 Natural Language Processing		5.1 Real Time Systems
	4.2 AR & VR		5.2 Data Science
	4.3 Block chain Technology		5.3 High performance computing
	4.4 Intelligent Systems	18A4105524	5.4 Machine Learning

* No External Evaluation

IV CSE - II Semester

L - LECTURE T – TUTORIAL P – PRACTICAL CIA – Continuous Internal Assessment SEA – Semester End Assessment

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P/D	Total	CIA	SEA	Total	
1	PE-6	**Professional Elective-6**	3	0	0	3	40	60	100	3
2	OE-4	**Open Elective-4**	3	0	0	3	40	60	100	3
3		Major Project (Internal/Industry Internship) dissertation***	0	5	7	12	40	60	100	8
Total			**6**	**5**	**7**	**18**	**120**	**180**	**300**	**14**

Code	Professional Elective - 6
	6.1 Deep Learning
	6.2 System Modeling and Simulation
	6.3 Social Networking and Semantics
	6.4 Cyber Forensics

* Professional Elective- 6 and OE-4 is offered through blended learning method. Regular classes as well as online classes will be conducted as per the choice of the students (moocs). However, students will have to write their regular exam at the end semester.

** Internship or Professional certification courses may be opted as self-learning course. Students register and complete the opted course in approved technology platform on or before Last Instruction Day of VIII Semester. They have to submit the certificate before the last Instruction Day of VIII Semester.

Technical Writing/Paper publication in a reputed journal can be done on or before Last Instruction Day of VIII Semester.

List of Open Electives

Offering Department	OE-1	OE-2	OE-3	OE-4
CSE	Data Structures	OOPS through C++	Database Management Systems	AI
CSE	-	Java Programming	-	Data Science
IT	Software Engineering	Web Technology	R-programming	IOT
IT	-	-	Python Programing	Machine Learning
ECE	Microprocessors and applications	VLSI Design	Embedded Systems	Image processing
ECE	Basic Electronics	IC Applications	Principles of Communications	Electronic Measurements and Instruments
EEE	Electrical Materials	Renewable energy sources	Electrical and Hybrid vehicles	Electrical Power Utilization
EEE	Control Systems	Modeling & Simulation of Systems	MATLAB and Applications	Energy Audit
CE	Elements of Civil Engineering	Building Materials	Building construction	Project Management
CE	Basic Surveying	Air Pollution & Control	Green Buildings	Remote Sensing & GIS
ME	Basics of Mechanical Engineering	Introduction to Robotics	Mechatronics	Nano Technology
ME	Industrial Materials	Introduction to Material handling Equipment	Hydraulics and Pneumatic Systems	Additive Manufacturing
H&S	Organizational Behavior	Financial Management	Operations Research 3-0-0 (only for CSE & IT)	-
H&S	-	-	Transform Techniques & Special Functions 3-0-0 (only for CSE & IT)	-

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Lecture - Tutorial:	3 -0-0	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Course Objectives:

- To enhance the knowledge of the students regarding importance of management and Managerial problems with optimum solutions and demand r»recosfing methods.
- To develop the concepts viz., consumer behavior and demand concept.
- To provide the knowledge regarding production and cost and break even analysis.
- To share the concepts like market structures and business organization.
- To provide awareness regarding capital budgeting decisions & give an idea nf practicing technique of ratio analysis.
- To introduce the concepts- Financial Accounting.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Use the theory of managerial economics, demand, production analysis and forecasting theories.
CO2	Analyse of production markets and pricing strategies. Functions and cost-price functions to manage markets & break-even point.
CO3	Develop ability to identify, formulate and solve engineering problem by applying the knowledge of managerial economics.
CO4	Theorize about characteristics features and types of industrial organization, concept of changing business environment in post-liberalization scenario.
CO5	Enhance their capabilities in the interpretation of b/s that are followed in industries, organizational and industries.
CO6	Apply financial analysis, capital budgeting techniques in evaluating various investment opportunities.

Contribution of Course Outcomes towards achievement of Program Outcomes
(I- Low, 2- Medium, 3 — **High)**

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1											
CO2		1										
CO3	2	2	1									
CO4			1				1					
CO5	1		1			2						
CO6	1				1						1	

UNIT I

Introduction to Managerial Economics and Demand Analysis

Nature and scope of managerial economics & its relationship with other subjects concept of demand, Determinants of demand-law of demand &its limitations Elasticity of demand Types of measurements- De mand r»recasting and methods.

UNIT II

Cost Analysis & Introduction to Markets

Different cost concepts: Opportunity costs, Explicit & Implicit costs, Fixed & Variable costs Average & Marginal. Short run & Long run costs, Break Even Analysis(Simple Problems), market-nature and types-monopolistic competition and oligopoly

UNIT III

Types of Business Organization & Business Cycles

Features and Evaluation of sole Trader, Partnership, Joint Stock company & Co-operative Societies. Business Cycles: Meaning & features of Business cycles-Phases & control of Business cycles-concept of money and mnney supply, Functions of Commercial banks and RBI credit control methods

UNIT IV

Introduction to Accounting and **Financial** Analysis

Introduction to Double entry system, Journal, Ledger, Trial balance & fiinal Accounts

Financial Analysis

Ratio Analysis- Need & significance(Simple Problems) Cap ital budgeting Meaning & importance- Methods of Capital Budgetlng: payback period, ARR(Accounting Rate of Return), NPV(Net PresentValue)(Simple Problems)

TEXTBOOKS

- Dr. A.R. Aryasri-Managerial Economics and Financial Analysis TMH 201 1.
- Dr. N. Appo Rao, Dr. P. Vijay Kumar: Managerial Economics and Financial Analysis carigage publications, New Delhi-2011.
- Prof J.V. Prabhakara Rao, Pro(. P, Venkat Rao, Managerial Economics and Financial Analysis

REFERENCES

- V. Maheswari Managerial Economics Sultan fhand. 2014.
- Dr. B. Kuberudu and Dr. T. V. Ramana:managerial economits and Financial Analysis, Himalaya publishing House, 2014.
- Suma Damndaran: Managerial Economics, Oxford, 2011.
- Maheswari: Financial Accounting, Vikas Publications.
- Shailaja, Gajj;:la and Usha Munipnlle, Universities press, 2015
- Ranking Law and Practise, Gordan and Mithani, Himalaya Publications

E-RESOURCES

- http://nptel.ac.in/courses.php
- http://jntuk-coeerd.in/
- https://ocw.fnit.edu/courses/electrical-engineering- /

Course Code- Cryptography and Network Security

Lecture – Tutorial-Practical::		3	0	0	**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites:

Computer Networks, Arithmetic Calculations

Course Objectives:

- To present an overview of the main concepts of cryptography, understand the threats & attacks, understand ethical hacking
- To understand the difference between stream ciphers & block ciphers, present an overview of the Feistel Cipher and explain the encryption and decryption, present an overview of DES, Triple DES, Blowfish, IDEA
- To present the basic principles of public key cryptography, Distinct uses of public key cryptosystems
- To Present overview of the basic structure of cryptographic functions, Message Authentication Codes, Understand the operation of SHA-512, HMAC, Digital Signature
- To Provide an overview of Key distribution and management, Email security, IP Security, web security, concept of firewalls, virus and Malicious code

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the principles of cryptography and security, with enciphering Techniques and analyze a variety of threats and attacks.
CO2	Distinguish the black ciphers and stream ciphers and apply them on a various symmetric cryptographic techniques.
CO3	Understand the principle and mathematical models used in public-key cryptosystems by applying them on different (various) types of algorithms.
CO4	Analyze the message authentication functions with its types and digital certifications for secure communication.
CO5	Understand the user authentications principles and security approach at both the web and email.
CO6	Understand the concept of Email, IP, web Security with its services and dealing with the firewalls and Viruses

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 –

High)

	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	PS O3
CO1	3	2	-	-	-	2	-	-	-	-	-	-	3	-	2
CO2	3	3		2	-	2	-	-	-	-	-	-	3	-	2
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	2	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	2	2
CO5	3	2	-	2	-	-	-	-	-	-	-	-	3	2	2
CO6	3	2	-	2	-	-	-	-	-	-	-	-	3	2	2

UNIT I :

Introduction, Computer Security Concepts, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, **Classical Encryption Techniques**, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, **Symmetric Encryption**, Mathematics of Symmetric Key Cryptography, **Modern Symmetric Key Ciphers**, Data Encryption Standard, Advanced Encryption Standard, BlowFish, IDEA, CAST-128 algorithms

UNIT II:

Block Cipher Operations, Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode, **Asymmetric Encryption**, Mathematics of Asymmetric Key Cryptography, Number Theory, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms, Asymmetric Key Ciphers Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, ElGamal Cryptosystem, Elliptic Curve Cryptography

UNIT III:

CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS, Cryptographic Hash Functions, Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), **Message Authentication Codes,** Message Authentication Functions, Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC, MACs Based on Block Ciphers: DAA and CMAC

UNIT IV:

Digital Signatures, ElGamal Digital Signature Scheme, Schnorr, Digital Signature Scheme, Digital Signature

Standard (DSS), **Key Management and distribution**, **Electronic mail security**, PGP, S/MIME, IP Security, Web security, System Security, Intruders, Malicious Software, Viruses, Firewalls

TEXT BOOKS:

1. Cryptography And Network Security Principles And Practice 6th Edition, William Stallings, Pearson Education

2. Cryptography And Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay, 3E) Mc Gra Hill

3. Atul Kahate, Cryptography and Network Security, TMH. (2003)

REFERENCE BOOKS:

1. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
2. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.
3. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in Public World, 2 nd Edition,2011, Pearson Education. 95
4. Network Security and Cryptography, Bernard Meneges, Cengage Learning

E-RESOURCES:

1. http://users.abo.fi/ipetre/crypto/
2. https://www.vssut.ac.in/lecture_notes/lecture1428550736.pdf
3. https://analyticsindiamag.com/top-10-free-resources-to-learn-cybersecurity/
4. https://lecturenotes.in/subject/112/cryptography-and-network-security-cns
5. https://www.smartzworld.com/notes/cryptography-network-security-notes-pdf-cns-notes-pdf/
6. https://studentsfocus.com/cs6701-cns-notes-cryptography-network-security-lecture-handwritten-notes-cse-7th-sem-anna-university/
7. https://www.jntufastupdates.com/jntuk-r16-4-1-cns-material/

Course Code-NATURAL LANGUAGE PROCESSING

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites: :

Data structures, finite automata and probability theory

Course Objectives:

Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
CO2	Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
CO3	Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
CO4	Able to design, implement, and analyze NLP algorithms
CO5	Able to design different language modeling Techniques.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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**	**PSO 2**	**PSO 3**
CO1	2	2	3	-	2	-	-	-	-	-	-	-	3	3	2
CO2	2	3	3	-	2	-	-	-	-	-	-	-	2	-	3
CO3	-	2	2	2	3	-	-	-	-	-	-	-	2	-	2
CO4	2	3	3	3	3	-	-	-	-	-	-	-	2	2	2

CO5	-	2	2	3	3	-	-	-	-	-	-	-	2	2	2

UNIT I :

Introduction to Natural Language Processing: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background:An outline of English syntax

UNIT II:

Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Finite State Models and Morphological Processing, Grammars and Logic Programming., Augmented Transition Networks.

UNIT III:

Semantics and Logical Form: Word senses and Ambiguity, Encoding Ambiguity in the Logical Form, Verbs and States in Logical Form, Speech Acts and Embedded Sentences, Defining Semantic Structure: Model Theory

UNIT IV:

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems,

TEXT BOOKS:

1.James Allen, “Natural Language Understanding”, Pearson Education

2. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M.Bikel and ImedZitouni, Pearson Publication

3. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1. Speech and Natural Language Processing - Daniel Jurafsky& James H Martin, Pearson

Publications

2. Christopher D Manning and HinrichSchutze, “Foundations of Statistical Natural Language Processing” MIT Press, 1999.

3. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, “NLP: A Paninian Perspective”, Prentice

E-RESOURCES:

1. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1

2. . http://www.nptelvideos.in/2012/11/natural-language-processing.html

Course Code- Augmented Reality & Virtual Reality

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks: 40**	
Credits:	3				**External Marks: 60**	

Prerequisites: Computer Graphics

Course Objectives: This course provides students with an opportunity to explore the research issues in Augmented Reality and Virtual Reality (AR &VR). It also makes the students know the basic concept and framework of virtual reality.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand Basics of Augmented Reality and Interactions. Fundamentals of Augmented , Mixed Reality and its features
CO2	Understand Basics of Virtual Reality and Interactions. Fundamental Concepts and Components of Virtual Reality
CO3	Describe various input and output devices required for VR experience
CO4	Classify human factors that affect VR experience
CO5	Analyze the performance of various virtual reality applications.
CO6	Express the object position and orientation in virtual space.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	3	-	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	3	-	3	-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	3	-	-	-	-	-	-	3	-	-	3
CO6	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

UNIT I :

Introduction to Augmented Reality -Augmented Reality Interactions, Monitor Based Displays, Head-mounted Displays, AR Interaction, AR Tracking , Augmented and Mixed Reality, Technology and features of augmented reality, Typical AR Experiences, Difference between AR and VR, Challenges with AR, AR systems

UNIT II:

Introduction to Virtual Reality- Historical development of VR Fundamental Concept and Components of Virtual Reality, Primary Features and Present Development on Virtual Reality, The three l's of virtual reality, commercial VR technology and the five classic components of a VR system

UNIT III:

Input Devices: Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.
Output Devices: Graphics displays, sound displays & haptic feedback

UNIT IV:

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues.
Applications: Medical applications, military applications, robotics applications.
Virtual Space: Visual and object space, defining position and orientation in three dimensions

TEXT BOOKS:

1. Alan B. Craig, "Understanding Augmented Reality: Concepts and Applications", Newnes

2. William R. Sherman and Alan B. Craigm, "Understanding Virtual Reality " , Morgan Kaufmann Publishers

3. John Vince, “Virtual Reality Systems”, Pearson Education.

4. Steve Aukstakalnis, “Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR”, Addison-Wesley.

REFERENCE BOOKS:

1. Gregory C. Burdea & Philippe Coiffet, ”Virtual Reality Technology”, Second Edition, John Wiley & Sons, Inc.

2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", Springer-Verlag London 2005

E-RESOURCES:

1. http://www.vrac.iastate.edu/

2.http://www.hitl.washington.edu/projects/education/pf/whatvr1a.htm

3. https://learn.unity.com/course/create-with-code 4. https://www.wikitude.com/smart-augmented-reality/

4. https://www.coursera.org/learn/ar

5. https://www.coursera.org/learn/handheld-ar

Course Code- BLOCKCHAIN TECHNOLOGY

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites:

1. Knowledge in security and applied cryptography.

2. Knowledge in distributed databases.

Course Objectives:

- To Introduce block chain technology and Crypto currency
- Discuss the fundamental ideas of Bit coin MOOCs.
- Identify the different components of the block chain process.
- Recognize the differences between block chain and bit coin and other crypto currencies.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Learn about research advances related to one of the most popular technological areas today.
CO2	Demonstrate the block-chain services to develop a New Paradigm of Organizational activities
CO3	Learn the limitations of the block-chain mechanism to develop an efficient organizational structure
CO4	Applying Bit-Coin protocols and how to develop the digital currency in the websites

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	2	-	-	-	-	-	-	-	3	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3
CO3	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3

UNIT I :

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding

UNIT II:

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment

UNIT III:

Blockchain Science: Gridcoin, Foldingcoin, Blockchain Genomics, Bitcoin MOOCs.Currency, Token, Tokenizing, Campuscoin, Coin drop as a strategy for Public adoption.

UNIT IV:

Currency Multiplicity, Demurrage currency.
Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations

TEXT BOOKS:

1. Blockchain Blue print for Economy by Melanie Swan

REFERENCE BOOKS:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher

E-RESOURCES:

1. Blockchain | Tools, Publications & Resources (ala.org)
2. Blockchain Learning Hub | UNICEF Office of Innovation

Course Code- INTELLIGENT SYSTEMS

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites: NIL

Course Objectives:

This course is used to provide the description of agents and various types of agents and how they used to solve various AI problems. This gives a clear view of analyzing AI problems, types of problems techniques of solving problems. It gives a clear view of knowledge, representation of knowledge, types of logic and its algorithms. It provides a better understanding of uncertainty and certainty, its factors various theories of uncertainty and appropriate examples.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Explore various Artificial Intelligence problem solving techniques.
CO2	Identify and describe the different AI approaches such as Knowledge representation, Search strategies, learning techniques to solve uncertain imprecise, stochastic and nondeterministic nature in AI problems
CO3	Apply the AI techniques to solve various AI problems.
CO4	Analyze and compare the relative challenges pertaining to design of Intelligent Systems.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	-	2	-	-	2	2	-	-	3	-	-	2	2	-	2
CO2	2	-	-	-	-	-	-	3	-	3	-	-	2	-	-
CO3	-	3	3	-	-	3	-	-	-	-	-	-	3	-	3
CO4	-	-	-	3	-	-	3	-	-	-	3	-	-	3	-

UNIT I : Overview of Artificial Intelligence

Artificial Intelligence and its Application areas; Knowledge Representation and Search: The Predicate Calculus: The

Propositional Calculus, The Predicate Calculus, Using Inference Rules to Produce Predicate Calculus Expressions, Application: A Logic-Based Financial Advisor; Structures and strategies for state space search: Introduction, Structures for state space search ,Strategies for State Space Search, Using the State Space to Represent Reasoning with the Predicate Calculus; And/or Graphs

UNIT II: Searching

Heuristic Search: Introduction, Hill Climbing and Dynamic Programming, The Best-First Search Algorithm, Admissibility, Monotonicity and Informedness, Using Heuristics in Games, Complexity Issues. Control and Implementation of State Space Search: Introduction, Recursion-Based Search, Production Systems, The Blackboard Architecture for Problem Solving.

UNIT III: Other Knowledge Representation Techniques

Semantic Networks, Conceptual Dependencies, Scripts and Frames, Conceptual Graphs. Knowledge Intensive Problem Solving: Overview of Expert System Technology, Rule-Based Expert Systems, Model-Based, Case Based, and Hybrid Systems Planning: Introduction to Planning, Algorithms as State-Space Search, Planning graphs

UNIT IV: Automated Reasoning

Introduction to Weak Methods in Theorem Proving, The General Problem Solver and Difference Tables, Resolution Theorem Proving; Uncertain Knowledge and Reasoning: Introduction to Uncertainty, Inference using Full-Joint Distribution, Independence, Bayes' Rule and its use. Representing Knowledge in Uncertain Domain: Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Network, Approximate Inference in Bayesian Network

TEXT BOOKS:

1. Elaine Rich, Kevin Knight and ShivashankarB.Nair, ―Artificial Intelligence‖, TMH, Third edition, 2009.
2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, Second edition, 2003.
3. N. P. Padhy, ―Artificial Intelligence and Intelligent System, Oxford University Press, Second edition, 2005.

REFERENCE BOOKS:

1. Artificial Intelligence A Modern Approach, Stuart Russel, Peter Norvig, 3rd Edition, Pearson Publication, 2015, ISBN-13:
   978-93-325-4351-5
2. Artificial Intelligence, Elaine Rich, Kevin Knight, 3 rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709, ISBN-
   13: 978-0070087705
3 Artificial Intelligence – Structures and Strategies for Complex problem Solving, George F Luger, 6th Edition, Pearson
   Publication, 2009, ISBN-10: 0-321-54589-3, ISBN-13: 978-0-321-54589-3
4. Intelligent Systems-A Modern Approach, Grosan, Crina, Abraham, Ajith, Springer-Verlag Berlin Heidelberg 2011, ISBN 9783642269394, 2011.

E-RESOURCES:

1. www.nptel.ac.in

2. https://www.britannica.com/technology/artificial-intelligence

3. https://www.tutorialspoint.com / Artificial Intelligence / AI – Overview

Course Code-Real Time Systems

Lecture – Tutorial-Practical::	3-0-0					**Internal Marks:**	40
Credits:	3					**External Marks:**	60

Prerequisites:

Computer Organization and Operating System, Microprocessor& Microcontroller

Course Objectives:

To provide broad understanding of the requirements of Real Time Operating Systems.

To make the student understand, applications of these Real Time features

Course Outcomes:

CO1	Understand concepts of Real time Systems and commands
CO2	Be able to explain real-time concepts such as preemptive multitasking, task priorities, priority inversions, mutual exclusion, context switching, and synchronization, interrupt,latency and response time, and semaphores.
CO3	Discuss how tasks can communicate using semaphores, mailboxes, and queues.
CO4	Be able to explain how the real-time operating system implements time management.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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**	**PSO3**
CO1	2	2	2	--	2	--	--	--	--	--	--	--	2	2	2
CO2	3	2	2	--	2	--	--	--	--	--	--	--	--	2	--
CO3	3	2	3	--	--	--	--	--	--	--	--	--	2	2	2
CO4	2	2	2	--	2	--	--	--	--	--	--	--	2	2	2

UNIT I :

Introduction

Introduction to UNIX/LINUX, Overview of Commands, File I/O, (open, create, close, lseek, read, write),

	Process Control (fork, vfork, exit, wait, waitpid, exec).
	UNIT II:
	Real Time Operating Systems Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, defining a Task, asks States and Scheduling, Task Operations, Structure,Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use
	UNIT III:
	Objects, Services and I/O Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem
	UNIT IV:
	Exceptions, Interrupts and Timers Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers.
	TEXT BOOKS:
	1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011
	REFERENCE BOOKS:
	1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH. 2. Advanced UNIX Programming, Richard Stevens 3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh
	E-RESOURCES:
	1. https://www.guru99.com/real-time-operating-system.html 2. https://www.tutorialspoint.com/Real-Time-Embedded-Systems 3. https://nptel.ac.in/courses/106/105/106105036/

COURSE CODE- DATA SCIENCE

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites: Linear Algebra, Descriptive Statistics, Data Mining, Python, R

Course Objectives: To learn the fundamentals of Data Science, Data Extraction and Pre-Processing Methods, Model Development, and Evaluation with Descriptive Statistics.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Able to learn fundamentals of Data Science.
CO2	Understanding different Data collection and Pre-Processing methods.
CO3	Understanding the use of various Descriptive Statistics.
CO4	Analyzing various Data analytics techniques.
CO5	Use of Regression Techniques.
CO6	Evaluation of Various Models.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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**	**PSO2**	**PSO 3**
CO1	3	2	2	2	2	2	--	--	--	--	--	--	2	2	3
CO2	2	2	3	2	2	--	--	--	--	--	--	--	2	2	2
CO3	2	2	3	2	2	--	--	--	--	--	--	--	3	3	2
CO4	3	3	2	3	3	3	--	--	--	--	--	--	2	3	2
CO5	3	3	2	3	3	3	--	--	--	--	--	--	2	3	2
CO6	2	2	2	3	3	3	--	--	--	--	--	--	2	3	3

UNIT I: INTRODUCTION TO DATA SCIENCE

Introduction to Data Science: Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

UNIT II: Data Collection and Data Pre-Processing

Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

UNIT III: Descriptive Statistics and Exploratory Data Analytics

Mean, Standard Deviation, Skewness, Kurtosis, Correlation, ANOVA, Box Plot, Histogram, Scatter Plot, Multi-vary chart, Pivot Table, Heat Map.

UNIT IV: Model Development and Evaluation

Regression Techniques: Linear, Multiple, K-Means.Evaluation Techniques: Precision, Recall, F1-Score, R-Square, MAE, MSE, RMS, Residual Plots, Distribution Plots, Cross-Validation, Prediction.

TEXTBOOKS:

1. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science," PACKT, 2016.

2. Cathy O'Neil and Rachel Schutt, "Doing Data Science," O'Reilly, 2015.

3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics," IGI Global

REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

2. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics," IGI Global

E-RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106179/
2. https://www.coursera.org/browse/data-science
3. https://swayam.gov.in/explorer

COURSE CODE- HIGH PERFORMANCE COMPUTING

Lecture – Tutorial- Practical::		**3**	**0**	**0**	**Internal Marks:**	40
Credits:3		**03**			**External Marks:**	60

Prerequisites:

Course Objectives:

The main objective of this course is to make the students familiar with High Performance Computing Principles and its environment.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Analyze the functionality of Modern Processor.
CO2	Comprehend and implement various optimization techniques for serial code.
CO3	Design the concept of parallel computing and Programming.
CO4	To study about memory parallel programming using open MP and MPI

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

	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	2	--	--	2	--	--	--	2	--	--	--	--	2	--	--
CO2	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--
CO3	2	--	--	--	--	2	--	--	--	2	--	-	2	--	--
CO4	--	2	--	--	3	--	--	2	--	--	--	--	--	--	2

UNIT I : Modern Processors: Stored Program Computer Architecture, Architecture of microprocessor based on cache- Performance based metrics and benchmarks, Moore's Law, Pipelining, Super scalarity, SIMD, Different classes of Memory- cache, mapping, pre-fetch ,Introduction to different types of processor such as Multicore processors, Multithreaded processors, Vector Processors

UNIT II: Requirements and General Issues: Scalable parallel computer Architectures, A cluster computer and its Architecture, clusters classifications, Commodity components for clusters, Network services/Communication SW, Cluster middleware and single system Image(SSI),Resource Management and Scheduling(RMS),Programming environments and Tools, Representative cluster Systems. High speed Networks: Design issues, Fast Ethernet, High Performance parallel interface (HPPI), Asynchronous transfer mode (ATM), Myrinet.

UNIT III: Parallel Computers: Taxonomy of parallel computing paradigm, Different types of memory computers such as Shared memory computers, Distributed memory computers, Hierarchical systems, Basics of parallelization.

Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws- parallel efficiency - serial performance Vs Strong scalability- Refined performance models- Choosing the right scaling baseline- Case Study: Can slow processors compute faster- Load balance

UNIT IV: Distributed memory parallel programming with MPI: Brief introduction to MPI such as messages and point-to-point communication - collective communication – Non blocking point-to-point communication-virtual topologies, MPI parallelization of Jacobi solver- MPI implementation - performance properties .MPI performance tools, communication parameters, Synchronization, serialization.

TEXT BOOKS:

1.Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall / CRC Computational Science series

2. Gene Wagenbreth and John Levesque, High performance Computing: Programming and Application, CRC press, Taylor and francis group

3.MaciejBrodowicz, Matthew Anderson, and Thomas Sterling, High Performance Computing: Modern Systems and Practices,Morgankaufmann publishers

REFERENCE BOOKS:

1. Charles Severance, Kevin Dowd, "High Performance Computing", O'Reilly Media, 2nd Edition, 1998.

2. Kai Hwang, Faye Alaye Briggs, "Computer Architecture and Parallel Processing", McGraw Hill, 1984.

E-RESOURCES:NPTL Videos And IEEE Journals,

1.https://www.intel.com/content/www/us/en/high-performance-computing/processors.html

2.https://www.usgs.gov/core-science-systems/sas/arc/about/what-high-performance-computing

3. https://en.m.wikipedia.org/wiki/Parallel_computing

4. https://www.open-mpi.org/

Course Code- MACHINE LEARNING

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites: linear algebra, probability and statistics

Course Objectives:

To provide knowledge about data preprocessing and its uses in prediction
How linear models are learning from the data.
Improving efficiency of the models using nonlinearity and ensembles
How neural networks help in increasing efficiency

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understanding the machine learning basics and how data is preprocessed
CO2	How linear models help in prediction
CO3	Distance based models complexity
CO4	Probabilistic models understanding
CO5	Nonlinear models and ensembles improve efficiency
CO6	How neural network provide nonlinearity

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	2	--	2	3	3	--	--	--	--	--	--	--	2	2	--
CO2	--	--	2	2	2	--	--	--	--	--	--	--	--	2	3
CO3	--	--	2	3	2	--	--	--	--	--	--	--	--	2	2
CO4	2	--	3	2	2	--	--	--	--	--	--	--	--	3	--
CO5	2	--	2	2	2	--	--	--	--	--	--	--	2	--	--
CO6	2	--	2	--	2	--	--	--	--	--	--	--	--	2	2

UNIT I :The Ingredients of Machine Learning: Introduction to Machine Learning, Types of Machine Learning, Models - The output of Machine Learning

Binary Classification and related tasks: Classification, Calculating accuracy in classification.

Natural Language Processing (NLP): Text data preprocessing, Bag of words, Plane and Hyper-plane for machine learning, Data Cleaning, Data Preprocessing (Min – Max Scaling), One Hot Encoding

UNIT II:

Beyond Binary Classification: Handling more than two classes, finding minimum and maximum of a function, Gradient Descent, Linear Regression, Multiple Regression, Calculating accuracy in regression (RMSE), Effect of outliers and noisy data, overfitting and underfitting models, K-fold cross validation

Logistic Regression and SVM: Sigmoid function in logistic regression, loss functions in logistic regression.SVM.

UNIT III:

Tree Model: Decision Trees, Ranking and Probability estimation trees,

Distance Based Models: Distance Measures (Euclidean, Manhattan and Minkowski), Neighbors, KNN, Distance based clustering: Hierarchical Clustering, Agglomerative Clustering

Probabilistic model: Naive Bayes algorithm for classification, Laplace, smoothing

Model Ensembles: Random Forest.

UNIT IV:

Dimensionality Reduction: Principal Component Analysis (PCA), Implementation and demonstration.

Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation algorithm.

TEXT BOOKS:

1. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.

2. Machine Learning, Tom M. Mitchell, MGH.

REFERENCE BOOKS:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben- David, Cambridge.

2. Machine Learning in Action, Peter Harington, 2012, Cengage.

AI APPLICATION DEVELOPMENT LAB

Lecture – Tutorial- Practical::	0-1-2	**Internal Marks:**	40
Credits:	1.5	**External Marks:**	60

Prerequisites:

Artificial intelligence concepts, Data mining, programming language

Course Objectives:

1 Able to demonstrate proficiency in modern AI and machine learning techniques
2 Able to design and implement effective AI solutions to various applications, conduct proper evaluations, and refine the AI solutions.
3 Able to effectively train various machine learning models with modern hardware and software platforms
4 Able to effectively deploy various machine learning models for different user platforms
5 Able to demonstrate good mastery of modern AI and machine learning techniques

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Describe various machine learning algorithms for AI applications
CO2	Describe the development lifecycle of AI applications
CO3	Describe the principles of AI for IoT applications
CO4	Collect data from Internet and perform data preprocessing
CO5	Identify suitable machine learning models for AI applications
CO6	Develop software programs to effectively train machine learning models for AI applications

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	3	3	2	-	-	-	2	-	-	2
CO2	3	3	3	3	3	-	-	2	2	-	-	2
CO3	3	3	3	3	3	-	-	2	2	-	-	2
CO4	3	3	3	3	2	-	-	-	2	-	-	2
CO5	3	3	3	3	3	-	-	-	2	-	-	2
CO6	3	3	3	3	2	-	-	-	2	-	-	2

I. Programming for AI Applications
A. Data Collection and Preprocessing
B. Training of Machine Learning Models
C. Evaluation of Machine Learning Models
D. Deployment of Machine Learning Models
E. Distributed Computing for AI

II. AI Software Engineering
A. AI Software Development Lifecycle
B. Data Management for AI
C. Cloud and Edge Computing for AI

III. AI for IoT
A. Foundations of IoT
B. AI for Industrial IoT

C. AI for Smart Cities IoT

IV. AI Group Project with one or more of the following selected topics:
A. Computer Vision
B. Natural Language Processing
C. AI in Healthcare

TEXT BOOKS:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, 2019
2. Eli Stevens, Luca Antiga, and Thomas Viehmann, Deep Learning with PyTorch, Manning Publications, 2020
3. Amita Kapoor, Hands-on Artificial Intelligence for IoT: Expert Machine Learning and Deep Learning Techniques for Developing Smarter IoT Systems, Packt Publishing, 2019

REFERENCE BOOKS:

1. V Kishore Ayyadevara, Yeshwanth Reddy, Modern Computer Vision with PyTorch, Packt Publishing, 2020
2. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, Practical Natural Language Processing, O'Reilly, 2020
3. Arjun Panesar, Machine Learning and AI for Healthcare, 2nd Edition, Apress, 2020

E-RESOURCES:

1. https://www.coursera.org/learn/ai-programming
2. https://www.ai-project.org/

Course Code- Predictive Analytics

Lecture – Tutorial-Practical::	0 -1-2				**Internal Marks:**	40
Credits:	2				**External Marks:**	60

Prerequisites: Linear Algebra, Descriptive Statistics, Data Mining, 'R'

Course Objectives: To learn various Data Analytics Approaches with Classification and Regression Techniques and Predict the given outcomes.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Able to Implement Linear and Multiple Regressions.
CO2	Able to Estimating Probabilities using a logistic function and the prediction of Categorical placement.
CO3	Able to build Various Time-series models.
CO4	Able to implement the applications single and multiple decision trees.
CO5	Able to build multiple Linear regression models across the range of predictor values.
CO6	Able to know outcome variable's values.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2	PSO 3
CO1	3	2	2	2	2	2	--	--	--	--	2	--	2	2	3
CO2	2	2	3	2	2	--	--	--	--	--	2	--	2	2	2
CO3	2	2	3	2	2	--	--	--	--	--	2	--	3	3	2
CO4	3	3	2	3	3	3	--	--	--	--	2	--	2	3	2
CO5	3	3	2	3	3	3	--	--	--	--	2	--	2	3	2
CO6	2	2	2	3	3	3	--	--	--	--	2	--	2	3	3

List of Experiments

1. Implementation of Linear Regression.

2. Implementation of Multiple Regression.
3. Implementation of Logistic Regression.
4. Implementation of Multinomial Logistic Regression.
5. Implementation of Probit Regression.
6. Implementation of Auto-Regressive Time-Series Model.
7. Implementation Moving-Average Time-Series Model.
8. Implementation of Decision Tree Regression.
9. Implementation of Random Forests.
10. Implementation of the Overfitting Regression Model.
11. Implementation of Multivariate adaptive regression splines.
12. Implementation of CART Classification Model.

TEXT BOOKS:

1. Predictive Analytics by Jeffery S.Strickland.

2. R: Predictive Analysis by Tony Fischetti, Eric Mayor, Rui Miguel Forte, Packet Publishing.

REFERENCE BOOKS

1.Data Science and Predictive Analytics, Biomedical and Health Applications using R by Ivo D. Dinov

E-RESOURCES

1. www. onlinecourses.nptel.ac.in/noc20_mg24/preview.
2. www.coursera.org/learn/predictive-modeling-analytics.
3. https://onlinecourses.swayam2.ac.in/imb21_mg20/preview.

Course Code- Full Stack Web Development - LAB

Practical::	0-0-2				**Internal Marks:**	40
Credits:	1				**External Marks:**	60

Prerequisites: Basic Knowledge of Programming, HTML , CSS.

Course Objectives:

- To implement Forms, inputs and Services using Angular JS
- To develop a simple web application using Nodejs; Angular JS and Express
- To implement data models using Mongo DB

Upon completion of this course; the student should be able to:

- Design and Implement Forms, inputs and Services using Angular JS.
- Develop a simple web application using Nodejs; Angular JS and Express.
- Implement data models using Mongo DB.
- Used for Server side web applications: Node.js with Express.js can be used to create classic web applications on the server-side.
- Easily scale application in every way by adding nodes and adding additional resources to it.
- Same language can be used for both backend and frontend: You can do both frontend and backend coding.
- Requires less development and maintenance cost:
- Privileged to have a wide and active group of developers who continue to contribute to its ongoing growth and progress on a regular basis.
- Node and Express.js is used by popular companies like PayPal, Walmart, GoDaddy, Flickr, Storylens, and IBM.

Upon successful completion of the course, the student will be able to:

CO1	Analyze existing problems with the team, development process and wider organization
CO2	Apply a thorough understanding of Mongo Db principles and specific practices
CO3	Select the most appropriate way to improve results for a specific circumstance or need
CO4	Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical

	problems
CO5	Evaluate likely successes and formulate plans to manage likely risks or problems
CO6	Create high quality applications

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	2	--	2	--	--	2	--	--	--	--	3	2	2
CO2	3	2	2	--	--	--	2	--	--	--	--	2	3	2	2
CO3	2	2	2	--	--	--	--	--	--	--	--	--	2	2	2
CO4	2	2	3	--	--	--	--	--	2	--	--	--	2	2	3
CO5	2	2	2	--	--	--	--	--	--	2	--	--	2	2	2
CO6	2	2	2	--	--	--	--	--	--	--	--	--	2	2	2

LIST OF EXPERIMENTS:

1. Basic JavaScript Concepts : Getting Started with JavaScript Variables, Arrays & Objects - Project using Arrays and Objects Loops, Conditionals & Switches - Project on Iterations Functions & Events - Project on Functions JavaScript Form Validation - Form Project Learning Ajax - Basic Ajax Project Project - Github AJAX
2. jQuery Programming Techniques : Getting Started With jQuery Selectors & Mouse Events - Project on Selectors Form Events - Project Form Events DOM Manipulation - Project on DOM Effects & Animation - Project on Effect and Animation Traversing & Filtering - Project on Filtering Project - jQuery Image Slider.
3. Backend Programming with Node.js :Getting Started With Node Installation and Simple Server Express Setup and Routing Template Engines - Project using template Engine Node MongoDB Driver - Part 1 Node MongoDB Driver - Part 2 Setup, Middleware & Routes - Starting the Project Creating the UI Form Validation and User Register Password Encryption Login Functionality Access Control & Logout.
4. Develop a Form and validate using Angular JS , 2. Create and implement modules and controllers in Angular JS,. Implement Error Handling in Angular JS, . Create and implement Custom directives, Create a simple web application using Express, Node JS and Angular JS, Implement CRUD operations Implement MongoDB data models .
5. Getting Started With MySQL : An Overview of SQL , XAMPP and MySQL Setup , Create Tables, Columns and Insert Data , Part 1 - Selecting Data , Part 2 - Distinct, Aliases & Concat , Update, Delete & Alter , Part 1 - Foreign Keys , Part 2 - Table Joins , Project - CD Collection Database.

Reference Books

1. Best Book for Hands-on Learners: Web Development with Node and Express: Leveraging the JavaScript Stack - by Ethan Brown
2. Beginning Node.js, Express & MongoDB Development by Greg Lim
3. Node.js Web Development by David Herron helps you to build scalable web applications using Node.js, Express.js, and the latest
4. Murach's MySQL 3rd Edition
5. Eloquent JavaScript: A Modern Introduction to Programming , Eloquent JavaScript - by – Marjin Haverbeke , Latest Edition – 3rd Edition , Publisher – No Starch Press
6. JavaScript and JQuery: Interactive Front-End Web Development Paperback – 18 July 2014 by Jon Duckett (Author)

SUBJECT CODE: RESEARCH METHODOLOGY

Lecture – Tutorial:	**2-0-0**	**Internal Marks:**	**40**
Credits:	**0**	**External Marks:**	**60**

COURSE OBJECTIVES

1. To expose students to various perspectives and concepts in the field of strategic management.
2. To understand Strategy formulation process and frameworks, tools and techniques of strategic analysis and its application.
3. To identify the Conceptual, diagnostic and analytical and conceptual skills in strategy formulation and execution. 4. Enable the students to understand the principles of strategy implementation in the organisation.
5. To learn about strategy evaluation and control by using quality and quantity benchmarking.

COURSE OUTCOMES:

CO1	Have basic awareness of social research, research process and testing of hypothesis.
CO2	Have adequate knowledge on research designs and measurement scaling techniques as well as quantitative data analysis.
CO3	Apply various methodologies including sampling questioning, empirical techniques in their research work reports.
CO4	Construct the data for hypothesis testing and statistical quality control charts
CO5	Construct the data using various multi-variate and bi-variate techniques and ANOVA for complex experimental design

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

UNIT-I

Introduction :

Nature and Importance of research, The role of business research, aims of social research. Research Process – Types of Research – Defining Research Problem – Formulation of Hypothesis – Testing of Hypothesis.

UNIT-II

Data Base:

Discussion on primary data and secondary data, tools and techniques of collecting data. Methods of collecting data. Sampling design and sampling procedures. Random Vs. Non-random sampling techniques, Designing of Questionnaire –Measurement and Scaling – Nominal Scale – Ordinal Scale–Interval Scale–Ratio Scale–Guttman Scale– Likert Scale–Schematic Differential Scale.

UNIT-III

Survey Research and data analysis:

media used to communicate with respondents, personal interviews, tele phone interviews, self-administered questionnaires, selection of an appropriate Survey research design, the nature of field work, principles of good interviews and fieldwork management. Editing–Coding–Classification of Data– Tables and Graphic Presentation– Preparation and Presentation of Research Report.

UNIT-IV

Statistical Inference & quality control:

Tests of Hypothesis, Introduction to Null hypothesis vs alternative hypothesis, parametric vs. non-parametric tests, procedure for testing of hypothesis, tests of significance for small samples, application, t-test.

Text Books:

1. Navdeep and Guptha:"**Statistical Techniques & Research Methodology**", Kalyani Publishers
2. C.R.Kothari, Gaurav Garg,"**Research Methodology Methods And Techniques**" New Age International Publishers,2018
3. Willam G.Zikmund, Adhkari: "***Business Research Methods***", Cengage Learning, New Delhi,2013.
4. S.Shajahan: "***Research Methods for management***", JAICO Publishing House, New Delhi,2009.

References:

1. UWEFLICK:"**Introducing*ResearchMethodology***",SAGE,New Delhi,2012.
2.CooperR.DonaldandSchindlerS.Pamela:"***BusinessResearchMethods***",9/e,Tata MCGraw Hill, NewDelhi.
3. M.V.Kulkarni: "**Research Methodology**", Everest Publishing House, New Delhi, 2010.

IV YEAR II SEMESTER

Course Code-DEEP LEARNING

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites:

Statistics, Calculus, Linear Algebra and Probability

Programming Knowledge

Data Modeling

Course Objectives:

- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Convolutional Networks,Autoencoders.
- To gain knowledge to apply optimization strategies

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the basic concepts of neural network, its applications and various learning models
CO2	Acquire the knowledge on Recurrent, Recursive Nets and Auto-encoder models
CO3	Analyze different Network Architectures, learning tasks, Convolutional networks
CO4	Use an efficient algorithm for Deep Models
CO5	Apply optimization strategies for large scale applications

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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**	**PSO 2**	**PSO 3**
CO1	3	2	3	3	2	2	--	--	--	--	--	--	3	2	2
CO2	2	3	3	2	2	2	--	--	--	--	--	--	2	2	2
CO3	3	3	2	2	2	3	--	--	--	--	--	--	2	2	3
CO4	3	3	3	2	3	3	--	--	--	--	--	--	3	2	3

CO5	3	3	2	3	2	3	--	--	--	--	--	--	3	2	2

UNIT I :

Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Multilayer Perceptron, Example: Learning XOR ,Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and OtherDifferentiation Algorithms

UNIT II:

Convolutional Networks: Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the basic convolution function, Structured Outputs, Data types, Efficient Convolution Algorithms, Random or Unsupervised features, The Neuroscientific basis for convolutional networks

UNIT III:

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, The Long Short-Term Memory and Other Gated RNNs

UNIT IV:

Autoencoders: Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Auto encoders, Applications of Autoencoders

Optimization for Train Deep Models: Challenges in Neural Network Optimization, Basic Algorithms,Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language

Processing

TEXT BOOKS:

1. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville

2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

3. Deep Learning (Adaptive Computation and Machine Learning Series), Ian Good Fellow, Yoshua Bengio and Aaron Courville, MIT Press (3 January 2017), ISBN-13: 978-0262035613.

4. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, Nikhil Buduma, by O'Reilly Publications, 2016 Edition, ISBN-13: 978-1491925614.

REFERENCE BOOKS:

1. Introduction to Artificial Neural Networks, Gunjan Goswami, S.K. Kataria & Sons; 2012 Edition, ISBN-13: 978-9350142967

Course Code-SYSTEM MODELLING AND SIMULATION

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	3				**External Marks:**	60

Prerequisites:

Course Objectives:

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Explain the basic system concept and definitions of system
CO2	Discuss techniques to model and to simulate various systems
CO3	Analyze a system and to make use of the information to improve the performance
CO4	Illustrate the operation of a dynamic system and make improvement according to the simulation results.
CO5	Describe the behavior of a dynamic system and create an analogous model for a dynamic system
CO6	Explain the system concept and apply functional modeling method to model the activities of a static system

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	-	-	-	2	-	-	2	2	-	3
CO2	2	-	-	-	-	-	-	2	2	-	-	2	3	-	-
CO3	3	-	-	-	-	-	-	2		-	-	-	-	2	-
CO4	-	2		3	-	-	-	-		-	-	2	-	-	2
CO5	3	-	3	-	--	-	-	-	2	-	-	-	3	2	-
CO6	2	-	--	-		-	-	-	2	-	-	2	-	2	3

UNIT I :

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet.

General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The EventScheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing. Simulation in Java; Simulation in GPSS

UNIT II:

Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; discrete distributions; Continuous distributions; Poisson process; Empirical distributions

Queuing Models: Characteristics of queuing systems, Queuingnotation, Long-run measures of performance of queuing systems, Long-run measures of performance of queuing systems cont…., Steady-state behavior of M/G/1 queue, Networks of queues

UNIT III:

Random-Number Generation:Properties of random numbers; Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers

Randon Variate Generation**:**Inverse transform technique Acceptance-Rejection technique.

Verification, Calibration and Validation: Optimization: Model building, verification and validation, Verification of simulation models, Verification of simulation models, Calibration

UNIT IV:

Input Modeling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.

Estimation of Absolute Performance: Types of simulations with respect to output analysis, Stochastic nature of output data, Measures of performance and their estimation, ; Output analysis for terminating simulations; Output analysis for steady-state simulations.

TEXT BOOKS:

Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5 th Edition, Pearson Education, 2010.

REFERENCE BOOKS:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.

2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007

Course Code- Social Networking and Semantics

Lecture – Tutorial-	3-0-0				**Internal Marks:**	40

Practical::						
Credits:	3				**External Marks:**	60

Prerequisites:

1. Knowledge in Networks

2. Knowledge in distributed databases.

Course Objectives:

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Ability to understand and knowledge representation for the semantic web.
CO2	Learn the various semantic web applications.
CO3	Ability to create ontology.
CO4	Ability to build a blogs and social networks.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	2	-	-	-	-	-	-	-	3	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3
CO3	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3

UNIT I :

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 semantic Web.

UNIT II:

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL),UML,XML/XML Schema. Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping.

UNIT III:

Logic, Rule and Inference Engines. 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.

UNIT IV:

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 network features

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley interscience,2008.
2. Social Networks and the Semantic Web, Peter Mika,Springer,2007

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, Rudi Studer, Paul Warren, John Wiley & Sons.

2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)

3. Information Sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.

4. Programming the Semantic W eb, T.Segaran, C.Evans, J.Taylor,O'Reilly, SPD.

E-RESOURCES:

1. https://www.semanticscholar.org/
2. https://info.sice.indiana.edu/

Course Code- CYBER FORENSICS

Lecture – Tutorial-Practical::	3-0-0				**Internal Marks:**	40
Credits:	4				**External Marks:**	60

Prerequisites:

Network Security

Course Objectives:

- A brief explanation of the objective is to provide digital evidences which are obtained from digital media.
- In order to understand the objectives of computer forensics, first of all, people have to recognize the different roles computer plays in a certain crime.
- According to a snippet from the United States Security Service, the functions computer has in different kinds of crimes.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Students will understand the usage of computers in forensic
CO2	How to use various forensic tools for a wide variety of investigations
CO3	Understanding of the cyber security needs of an organization.
CO4	It gives an opportunity to students to continue their zeal in research in computer forensics

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	2	-	-	-	-	-	-	-	3	3	3	2
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	2	3

CO3	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3
CO4	3	-	3	2	-	-	-	-	-	-	-	-	3	2	3

UNIT I :

Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident

UNIT II:

Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system -Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive.

UNIT III:

Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions

Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honeynet project.

UNIT IV:

Current Forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

TEXT BOOKS:

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006

2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.

3. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning

REFERENCE BOOKS:

1. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison- Wesley Pearson Education

2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition

E-RESOURCES:

1. www.ComputerForensicsWorld.com – Prevention. Protection. Safety.
2. http://www.cyberforensics.in/

3. http://www.forensicfocus.com