SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF COMPUTER ENGINEERING

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

COURSE STRUCTURE - 2019 PATTERN

THIRD YEAR B. TECH.

Semester I

SRES's Sanjivani College of Engineering

Kopargaon

(An Autonomous Institute Affiliated to SPPU Pune)

COURSE STRUCTURE- 2019 PATTERN

THIRD YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER I

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme-Marks						
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PRJ	CO301	**Second Year Internship**	-	-	-	2	-	-	-	50	-	-	50
PCC	CO302	Design and Analysis of Algorithms (DAA)	4	-	-	4	30	50	20	-	-	-	100
PCC	CO303	Computer Network (CN)	3	-	-	3	30	50	20	-	-	-	100
PCC	CO304	Theory of Computation (TOC)	3	-	-	3	30	50	20	-	-	-	100
PCC	CO305	Data Base Management System (DBMS)	3	-	-	3	30	50	20	-	-	-	100
PEC	CO306	Professional Elective - I	3	-	-	3	30	50	20	-	-	-	100
PC	CO307	DAA Lab	-	-	2	1	-	-	-			25	25
PC	CO308	CN Lab	-	-	2	1	-	-	-	25	-	-	25
PC	CO309	DBMS Lab	-	-	2	1	-	-	-	-	50		50
PRJ	CO310	Skill based Credit Course	1	-		1	-	-	50	-	-		50
MC	MC311	Mandatory Course-V	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			18	-	06	22	150	250	150	75	50	25	**700**

Mandatory Course-V :Learning an Art Form (Music: vocal or instrumental, dance, painting, clay modeling, etc.):

Code	Professional Elective-1
CO306 A	Web Technology (WT)
CO306 B	Software Engineering and Design(SED)
CO306 C	Microcontroller and Robotics (MR)

Dean Academics ***Director***

COURSE STRUCTURE- 2019 PATTERN
THIRD YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER II

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme-Marks						
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PCC	CO312	Internet Of Things (IOT)	3	-	-	3	30	50	20	-	-	-	100
PCC	CO313	System Programming and Operating System (SPOS)	3	-	-	3	30	50	20	-	-	-	100
PEC	CO314	Professional Elective-2	3	-	-	3	30	50	20	-	-	-	100
OE	CO315	Open Elective-1	4	-	-	4	30	50	20	-	-	-	100
HSMC	CO316	Employability Skill Development (ESD)	1	-	2	2	-	-	-	-	-	50	50
PRJ	CO317	IPR and EDP	2	-	-	2	15	25	10	-	-		50
PC	CO318	IOT Lab	-	-	2	1	-	-	-	75	-	-	75
PC	CO319	SPOS Lab	-	-	2	1	-	-	-		75	-	75
PRJ	CO320	IPR and EDP Lab	-	-	2	1	-	-	-	-	-	50	50
MC	MC321	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			17	-	08	20	135	225	90	75	75	100	**700**

Mandatory Course-VI: Behavioral and Interpersonal skills (non-verbal skills / behaviors, nonaggression)

Code	Professional Elective-II
CO314 A	Software Testing and Quality Assurance (STQA)
CO314 B	Advanced Database Management System (ADBMS)
CO314 C	Wireless Sensor Network (WSN)

Code	Open Elective-1
CO315 A	IOT Basics

COURSE STRUCTURE- 2019 PATTERN

B.Tech Honors Specialization

Artificial Intelligence and Machine Learning

Year /Sem	Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks						
								Theory			OR	PR	TW	Total
				L	T	P		ISE	ESE	CIA				
T Y Sem-I	PC	CO1801	Mathematical Foundations of Artificial Intelligence and Machine Learning	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO1802	Python for Artificial Intelligence and Machine Learning	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO1803	Python for Artificial Intelligence and Machine Learning Lab	-	-	2	1	-	-	-	-	-	25	25
Final Sem-I	PC	CO1901	Practical Machine Learning With Tensorflow	4	-	-	4	30	50	20	-	-	-	100
Final Sem-II	PC	CO1902	Practical Machine Learning With Tensorflow	-	-	2	1	-	-	-	-	-	25	25
Final Sem-II	PC	CO1903	Artificial Intelligence and Machine Learning: In Practice	4	-	-	4	30	50	20	-	-	-	100
			Total	16	-	04	18	120	200	80	-	-	50	450

Data Science

Year /Sem	Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks						
								Theory			OR	PR	TW	Total
				L	T	P		ISE	ESE	CIA				
T Y Sem-I	PC	CO2 801	Mathematical Foundation and SQL Basic for Data Science	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO2802	Big Data Engineering	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO2803	Big Data Engineering Lab	-	-	2	1	-	-	-	-	-	25	25
Final Sem-I	PC	CO2901	Data Science with Python	4	-	-	4	30	50	20	-	-	-	100
Final Sem-II	PC	CO2 902	Data Science with Python.	-	-	2	1	-	-	-	-	-	25	25
Final Sem-II	PC	CO2903	Data Science : Visualization.	4	-	-	4	30	50	20	-	-	-	100
			Total	16	-	04	18	120	200	80	-	-	50	450

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

Program Specific Outcomes (PSOs)

1. **Professional Skills:** The ability to apply knowledge of problem solving, algorithmic analysis, software Engineering, Data Structures, Networking, Database with modern recent trends to provide the effective solutions for Computer Engineering Problems.

2. **Problem-Solving Skills:** The ability to inculcate best practices of software and hardware design for delivering quality products useful for the society.

3. **Successful Career:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths.

SEMESTER I

CO302: Design and Analysis of Algorithms			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	4	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Structures-I, Data Structures-II, Discrete Mathematics

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Course Objectives:

1. To study and perform analysis of algorithms
2. To study how to solve problems using greedy strategy
3. To study how to solve problems using dynamic programming.
4. To study how to solve problems using backtracking and branch-n-bound strategies
5. To understand computational complexity theory.
6. To study parallel algorithm and distribute algorithms

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Students will be able to design and analyse algorithms	4	Analyse
2. Students will be able solve problems using greedy strategy	3	Apply
3.Students will be able to solve problems using dynamic programming strategy	3	Apply
4. Students will be able to solve problems using backtracking and branch-n-bound strategies	3	Apply
5.Students will be able to apply computational complexity theory	3	Apply
6. Students will be able to develop parallel algorithms and distribute algorithm.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	-	1	2	1	-	-	-	1	3		-

CO2	2	-	1	3	-	1	1	1	-	-	-	1	3	2	-
CO3	2	-	1	3	-	1	1	1	-	-	-	1	3	2	2
CO4	2	-	1	3	-	1	1	1	-	-	-	1	3	2	2
CO5	-	2	2	3	-	1	1	1	-	-	-	1	3		2
CO6	1	-	2	3	-	1	1	1	-	-	-	1	2	1	-

COURSE CONTENTS

Unit I	**Problem Solving and Basics of Algorithmic Analysis**	**No. of Hours**	**Cos**
	Problem solving principles: Classification of problem, problem solving strategies, What are algorithms, classification of time complexities (linear, logarithmic etc) ,Divide and Conquer strategy. Asymptotic notations, Best case, worst case, average case analysis, lower bound and upper bound, amortized analysis. Recurrences: Formulation and solving recurrence equations using Master Theorem.	8	CO1
Unit II	**Greedy Strategy**	**No. of Hours**	**Cos**
	Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms-Job scheduling and activity selection problems	8	CO2
Unit III	**Dynamic Programming**	**No. of Hours**	**Cos**
	Principle, control abstraction, time analysis of control abstraction, binomial coefficients, OBST, 0/1 knapsack, Chain Matrix Matrix Multiplication.	8	CO3
Unit IV	**Backtracking and Branch -and-Bound**	**No. of Hours**	**Cos**
	Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem, graph coloring problem, sum of subsets problem. Branch-and-Bound: Principle, control abstraction, time analysis of control abstraction, strategies: FIFO, LIFO and LC approaches. TSP, knapsack problem.	8	CO4
Unit V	**Complexity Theory**	**No. of Hours**	**Cos**

	Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P class, NP class &NP complete problems- vertex cover and 3-SAT and NP-Hard Problems: Hamiltonian cycle problem, Clique problem	8	CO5
Unit VI	**Parallel Algorithms**	**No. of Hours**	**Cos**
	Sequential and parallel computing, RAM & PRAM models, Amdahl's Law, Brent's theorem, parallel algorithm analysis and optimal parallel algorithms. Distributed Algorithms: Embedded Algorithms	8	CO6
Books:			
Text Books(T):			
T1. Horowitz and Sahani, Fundamentals of Computer Algorithms, 2nd edition, University Press, ISBN:97 881 73716126,817371 61262 T2.Gills Brassard and Paul Bartly, Fundamentals of Algorithmic, PHI New Delhi. T3.The Design and Analysis of Computer Algorithms, Aho,Hopcroft,Ullman.			
Reference Books(R):			
R1. Algorithms and Parallel Computing, Fayez Gebali, Willy, ISBN 978-0-470-90210-3 R2. Thomas H. Coreman and Charles R. L. Leiserson, Introduction to Algorithm, PHI			

CO303: Computer Network			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Computer Organization and Architecture, Digital Electronics and Data Communication

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Course Objectives:

1. To learn and understand the fundamental concepts of computer network.
2. To learn and understand different techniques for framing, error control and flow control.
3. To learn and understand different techniques for channel allocation and IEEE standards.
4. To learn and understand switching and routing techniques used in internet layer.
5. To learn and understand TCP and UDP protocols used in transport layer.
6. To learn and understand application layer protocol.

Course Outcomes (COs):

On successful completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Design** and implement different computer networks using network technologies.	3	Apply
2. **Design** and implement different error and flow control algorithms.	2	Understand
3. **Demonstrate** basic concepts of channel allocation.	2	Understand
4. **Demonstrate** different switching and routing techniques.	2	Understand
5. **Design** and implement client server architecture using transport layer protocol.	4	Analysis
6. **Develop** different network applications.	5	Evaluate

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3				1		2		1	1	2	1	1
CO2		3	1										1	1	1
CO3													2		
CO4		3	1		1							1	3	1	1
CO5	1	3	3									1	3		1
CO6	2	3	3	2	2	2	1	1	2		1	2	3	2	3

Course Contents

Unit-I	**Introduction to Computer Network**	**No. of Hours**	**COs**
	Communication System, Introduction of LAN, MAN, WAN,WAN Acceleration, PAN, Ad-hoc Network, Network Architectures: Client-Server Peer To Peer, Topologies: Star and Hierarchical, OSI Model, TCP/IP Model, Design issues for Layers, Network Devices: Bridge, Switch, Router and Access Point,Smart NIC	7 Hrs.	1
Unit-II	**Logical Link Control Layer**	**No. of Hours**	**COs**
	Design issues: Services to Network Layer, Framing, Error Control and Flow Control, Error Control: Parity Bits, Hamming Codes (7/8-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol.	7 Hrs.	2

Unit-III	Medium Access Control Layer	No.of Hours	COs
	Channel allocation: Static and Dynamic, Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD, Binary Exponential Back off algorithm, Fast Ethernet, Gigabit Ethernet, IEEE 802.11a/b/g/n and IEEE 802.15 and IEEE 802.16 Standards, Frame formats, CSMA/CA.	7 Hrs.	3
Unit-IV	**Internet Layer**	**No.of Hours**	**COs**
	Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols: Distance Vector, Link State, Path Vector, Routing in Internet: RIP, OSPF, BGP, Congestion control and QoS, MPLS, Routing in MANET : AODV, DSR.	7 Hrs.	4
Unit-V	**Transport Layer**	**No.of Hours**	**COs**
	Services, Berkley Sockets, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP Congestion Control, Quality of Service (QoS), Differentiated services, Protocols: TCP and UDP.	7 Hrs.	5
Unit-VI	**Application Layer**	**No.of Hours**	**COs**
	Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP). Case Study: Network Performance:Throughput,Latency, Packet loss, Re-transmission.	7 Hrs.	6
Books:			
Textbooks:			

T1. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8.

T2. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill, Publications, ISBN: 0 – 07 – 058408 – 7.

Reference Books:

R1. Kurose, Ross “Computer Networking a Top Down Approach Featuring the Internet”,Pearson, ISBN-10: 0132856204.

R2.Matthew S. G, “802.11 Wireless Networks”, O’Reilly publications, ISBN: 81-7656-992-5

R3.C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols” Prentice Hall, ISBN-10: 8131706885; ISBN-13: 978-8131706886.

R4.Holger Karl and Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks”, Wiley India , ISBN: 9788126533695.

R5.Eldad Perahia, Robert Stacey, “Next Generation Wireless LANs”, Cambridge, ISBN-10:1107016762; ISBN-13: 978-1107016767.

R6.Efraim Turban, Linda Volonino, Gregory R. Wood “Computer Networking a Top Down.

R7. Approach Featuring the Internet”, 10th Edition, Wiley; ISBN13: 978-1-118-96126-1.

CO304: Theory of Computation			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Discrete Mathematics, Data Structures

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Course Objectives:

1. To study Finite State Machine, Finite Automata and its language
2. To learn Regular Expressions and Regular Languages
3. To understand Context Free Grammars and Context Free Languages
4. To study Pushdown Automata and its language
5. To learn and understand Turing Machine and its language
6. To be familiar with the theory of computability and complexity .

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Analyse** and design Finite Automata for regular languages	4	Analyse
2. **Build** regular expressions for a regular language and to prove theorems and properties of regular languages	3	Apply
3**. Write** context free grammar for context free languages and to prove properties of CFL	3	Apply
4. **Analyse** and design Pushdown Automata for context free language	4	Analyse
5. **Analyse** and design Turing Machines for unrestricted languages	4	Analyse
6. **Demonstrate** the understanding of key terms, such as algorithm, computability, decidability, and complexity through problem solving.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	-	-	-	-	1	-	-	1	3	2	-

CO2	2	2	2	2	-	-	-	-	1	-	-	1	3	2	-
CO3	2	2	2	2	-	-	-	-	1	-	-	1	3	2	-
CO4	2	2	3	1	-	-	-	-	1	-	-	1	3	2	-
CO5	2	2	3	1	-	-	-	-	1	-	-	1	3	2	-
CO6	2	1	2	2	-	-	-	-	1	-	-	1	3	2	-

COURSE CONTENTS

Unit I	FORMAL LANGUAGE THEORY AND FINITE AUTOMATA	No. of Hours	Cos
	Basic Mathematical Objects: Sets, Logic, Functions, Relations Introduction to Formal language, Alphabets and languages, Finite representation of language, Finite Automata (FA): An Informal Picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA, FA with output: Moore and Mealy machines -Definition, models, inter-conversion. Application of FA: Text Search. Case Study: FSM for Traffic Signal Controller, Vending Machine	7	1
Unit II	**REGULAR EXPRESSIONS (RE) AND LANGUAGES**	**No. of Hours**	**Cos**
	Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Conversions: NFA to DFA, RE to DFA, DFA to RE, State/loop elimination, Arden‘s theorem, Properties of Regular Languages: Pumping Lemma for Regular languages, Closure and Decision properties, Applications of RE: Regular Expressions in UNIX, Lexical analysis, Finding patterns in text Case Study : RE in Text Search and Replace	7	2
Unit III	**CONTEXT FREE GRAMMARS (CFG) AND LANGUAGES**	**No. of Hours**	**Cos**
	Introduction, Regular Grammar, Context Free Grammar-Definition, Derivations, Language of a grammar, sentential forms, Parse trees- inference, derivations, parse trees, Ambiguity in grammar and Languages- ambiguous Grammar, Simplification of CFG, Normal Forms- Chomsky normal form, Greibach normal form, Closure properties of CFL, Decision properties of CFL's, Chomsky Hierarchy, Application of CFG: Parsers, The YACC Parser-Generator, Markup languages, XML and Document Type Definitions. Case Study: CFG for Parenthesis Match, Palindrome Strings	7	3
Unit IV	**PUSHDOWN AUTOMATA (PDA) & LINEAR BOUNDED AUTOMATA (LBA)**	**No. of Hours**	**Cos**

	Definition of the PDA, Languages of a PDA, Equivalence of Acceptance by Final State & Empty stack, Equivalence of PDA's and CFG's, Deterministic PDA, PDA and Context Free Language, Definition of Linear Bounded Automata, Language of LBA, LBA and Context Sensitive Language.	7	4
Unit V	**TURING MACHINES (TM)**	**No. of Hours**	**Cos**
	Problems that computers cannot solve, Turing Machine: Notation for the TM, Instantaneous description for TM, Transition diagrams for TM, The Language of Turing Machine, TM and Halting, Programming techniques for TM's, Extensions to the basic TM, Turing Machines and Computers, Church-Turing Thesis, Universal Turing Machines.	7	5
Unit VI	**UNDECIDABILITY & INTRACTABLE PROBLEMS**	**No. of Hours**	**Cos**
	A Language that is not recursively enumerable, An un-decidable problem that is RE, Post's Correspondence Problem, The Classes P and NP, An NP-Complete Problem, A Restricted Satisfiability Problem: Normal Forms for Boolean Expressions, Converting Expressions to CNF, The Problem of Independent Sets, The Node-Cover Problem	7	6

Books:

Text Books(T):

T1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, “Introduction to Automata Theory Languages and Computation”, Addison-Wesley, ISBN 0-201-44124-1.

T2. H.L. Lewis, Christos H. Papadimitriou, “Elements of the Theory of Computation”, Prentice Hall, ISBN-10: 0132624788; ISBN-13: 978-0132624787

Reference Books(R):

R1. John Martin, “Introduction to Languages of The Theory of Computation”, 2nd Edition, Mc Graw Hill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5

R2. Sanjeev Arora and Boaz Barak, “Computational Complexity: A Modern Approach”, Cambridge University Pre ss, ISBN:0521424267 9780521424264

R3. Daniel Cohen, “Introduction to Computer Theory”, Wiley & Sons, ISBN 97881265133454.

R4. J. Carroll & D Long, “Theory of Finite Automata”, Prentice Hall, ISBN 0-13-913708-4

R5. Kavi Mahesh, “Theory of Computation: A Problem-Solving Approach”, Wiley India, ISBN10 8126533110

R6. Michael Sipser, “Introduction to the Theory of Computation”, Cengage Learning, ISBN-13: 9781133187813

R7. Vivek Kulkarni, “Theory of Computation”, Oxford University Press, ISBN 0-19-808458

CO305: Database Management System			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: (if any) Discrete Mathematics, Data Structures

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Course Objectives:

1. To understand the fundamental concepts of database management (Database design, database languages, and database-system implementation).
2. To provide a strong formal foundation in database concepts, technology and practice.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. Be familiar with the basic issues of transaction processing and concurrency control.
5. To learn and understand various Database Architectures and Applications.
6. To learn a powerful, flexible and scalable general purpose database to handle big data.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. **Create** E-R diagram for given requirements and convert the same into database tables..	4	Analyse
2. **Use** database techniques such as SQL & PL/SQL.	3	Apply
3. **Implement** good database design using normalization.	3	Apply
4. **Use** transaction Management and query processing in relational database System.	3	Apply
5. **Compare** different database architecture and use of appropriate architecture in real time application.	4	Analyse
6. **Use** advanced NoSQL databases and programming concepts.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	2	--	--	--	--	--	2	3	2	3	2	1
CO2	2	--	--	2	--	--	--	--	--	2	2	2	2	2	--
CO3	1	--	--		--	--	--	--	--	3	2	2	2	3	--

CO4	2	--	--	2	--	--	--	--	--	3	2	2	1	2	--
CO5	2	--	--	2	--	--	--	--	--	3	2	2	2	3	--
CO6	2	--	--	2	--	--	--	--	--	3	2	3	2	2	1

Course Contents

Unit-I	**Introduction to DBMS**	**No.of Hours**	**COs**
	Introduction to Database Management Systems, File system verses database system, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database users, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.	07 Hrs.	CO1
Unit-II	**SQL and PL/SQL**	**No.of Hours**	**COs**
	SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges , Embedded SQL, Dynamic SQL.	07 Hrs.	CO2
Unit-III	**Relational Database Design**	**No.of Hours**	**COs**
	Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF,	08 Hrs.	CO3
Unit-IV	**Database Transactions and Query Processing**	**No.of Hours**	**COs**
	Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, Recovery methods : Shadow-Paging and Log-Based Recovery, Checkpoints, Query Processing, Query Optimization, Performance Tuning.	08 Hrs.	CO4

Unit-V	Database System Architectures	No.of Hours	COs
	Introduction to Database Architectures: Multi-user DBMS Architectures, Case study- Oracle Architecture. Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases, Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database. Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	07 Hrs.	CO5
Unit-VI	**NoSQL Database**	**No.of Hours**	**COs**
	Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, MongoDB- Introduction, CRUD operation, aggregation, indexing, sharding, Case Study-unstructured data from social media. Introduction to Big Data.	08 Hrs.	CO6

Books:

Text Books:

T1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
T2**.** Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4

Reference Books:

R1. C J Date, “An Introduction to Database Systems”, Addison-Wesley, ISBN: 0201144719
R2**.** S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education, ISBN 978-81-317-6092-5
R3. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626.
R4. Kristina Chodorow, Michael Dirolf, “MongoDB: The Definitive Guide”, O’Reilly Publications, ISBN: 978-1-449-34468-9.

CO306: Web Technology			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Basic knowledge of Programming and Computer Systems

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Course Objectives:

1. To learn the concepts of World Wide Web and internet.
2. To learn the web application development process and elements of web page.
3. To understand current client side and server side web technologies.
4. To learn current client side and server side frameworks.
5. To understand MVC architecture .
6. To learn XML , AJAX concept and its usage.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Understand** Internet and World Wide Web.	2	**Understand**
2. **Understand** the process of web development and various elements of web pages.	2	**Understand**
3**. Apply** client side and server side technologies to implement web application.	3	**Apply**
4. **Apply** client side and server side frameworks to enhance the web application functionality.	3	**Apply**
5. **Apply** MVC architecture to implement complex web application.	3	**Apply**
6. **Apply** XML and Ajax Concepts to implement web application.	3	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO6	-	-	3	-	-	-	3	-	-	1	-	2	1	1	-

COURSE CONTENTS

Unit I	Introduction to Web Technologies	No. of Hours	Cos
	Internet, WWW, Webpage, Website, Types of Web Applications, Web Application Architecture, Web Servers, Roles and responsibilities of Web Developer, Challenges in Web App Development. **HTML:** Structure of Web Page, Text Formatting tags, Image, tables, links, frames, forms and HTML 5.	6	CO1 CO2
Unit II	**Client Side Technologies**	**No. of Hours**	**Cos**
	CSS: Need of CSS, Types of CSS, CSS Selectors, CSS for basic HTML tags, responsive CSS framework: Bulma **XML:** Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON. **AJAX:** Introduction, Working of AJAX, AJAX processing steps, coding AJAX script.	7	CO2 CO3 CO6
Unit III	**Client Side Technologies and JS Library**	**No. of Hours**	**Cos**
	Java Script: JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS. **DOM:** DOM levels, DOM Objects and their properties and methods, Manipulating DOM **JQuery:** Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events. Bootstrap framework.	7	CO3 CO4
Unit IV	**Server side Technologies**	**No. of Hours**	**Cos**
	Introduction to CGI **Servlet:** lntroduction, life cycle of servlet, servlet directory structure, servlet example, form handling, cookies and session tracking. **JSP :** life cycle, JSP tags, built in objects, Directives, File uploading and page redirecting. Database connectivity using servlet and JSP	8	CO3 CO4
Unit V	**Server side Technologies and Framework**	**No. of Hours**	**Cos**

	PHP : Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using PostgreSQL/MySQL with PHP. Introduction to **Laravel framework**	8	CO3 CO4 CO6
Unit VI	**MVC and CMS**	**No.of Hours**	**Cos**
	MVC **AngularJS:** Overview, directives, expression, controllers, filters, tables, modules, forms, includes, views, scopes, services, dependency injection, custom directives, Internationalization, **Java Struts:** Overview, architecture, configuration, sample code. Web Hosting example. **CMS:** Joomla/wordpress	6	CO4 CO5
Books:			
Text Books(T):			
T1. Achyut Godbole & AtulKahate, "WebTechnologies: TCP/IP to Internet Application Architectures",McGraw Hill Education publications T2. Robin Nixon," Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5", O'REILLY			
Reference Books(R):			
R1. Adam Bretz &Colin J Ihri,"Full Stack Javascript Development with MEAN",SPD R2. McGraw Hill Education publications," Developing Web Applications". R3. AllanCole," Build Your Own Wicked Wordpress Themes",SPD			

CO306: Micro Controller and Robotics			
Teaching Scheme		**Examination Scheme**	
Lectures:	**03 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**03**	**End-Sem Exam:**	**50 Marks**
		Continuous Internal Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Structure, Microprocessor Systems

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Course Objectives:

1. To understand architecture and features of typical Microcontroller
2. To understand the need of microcontrollers in real life applications.
3. To learn interfacing of real world peripheral devices
4. To study various hardware and software tools for developing embedded applications
5. To acquaint with the fundamentals of mobile robotics
6. To solve real world problems with the help of robotics

Course Outcome (COs): On successful completion of the course, student will be able to-

Course Outcomes	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. 1.**Understand** the importance of microcontroller in designing embedded application.	2	**Understand**
2. 2.**Apply** knowledge to write program for embedded applications	3	**Apply**
3**. 3.Understand** the interfacing to real world devices.	2	**Understand**
4. 4.**Design** and develop embedded processor based applications	3	**Apply**
5. 5**.Explore** the fundamentals of Robotics	2	**Understand**
6. 6.**Apply** knowledge to develop real-world problems solutions with robotics.	4	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO4	3	2	3	2	3	2	-	-	2	-	2	2	2	2	1
CO5	3	2	1	1	2	1	-	-	-	-	-	-	3	2	1
CO6	3	3	3	2	3	2	-	-	2	-	2	2	3	3	2

COURSE CONTENTS

Unit-I	**INTRODUCTION TO MICROCONTROLLER**	**No.of Hours**	**COs**
	Introduction, MCS51 Microcontroller: internal architecture, pin description, addressing modes. Difference between microcontroller and microprocessor, criteria for choosing a microcontroller	08 Hrs.	CO1
Unit-II	**PROGRAMMING MICROCONTROLLER**	**No.of Hours**	**COs**
	Instruction set-arithmetic, logical, data transfer, branching and Flag manipulation Instructions. 8051 assembly language programming- Timers, Interrupts, I/O ports, Interfacing I/O Devices, Serial Communication, Introduction to C programming in 8051,introduction to RTOS.	08 Hrs.	CO2
Unit-III	**PERIPHERAL INTERFACING**	**No.of Hours**	**COs**
	Real world interfacing- Analog to Digital converter, Digital to Analog converter, Mechanical switches, LEDs, seven segment display, keypads, LCDs, DC motor, stepper motor, PWM, External Memory Interface.	08 Hrs.	CO3
Unit-IV	**EMBEDDED PROCESSOR**	**No.of Hours**	**COs**
	Embedded Systems: Application Domain and Characteristic of Embedded System, Real time systems and Real time scheduling, Processor basics and System-On-Chip, Case Study: ARM, Arduino, Raspberry PI	08 Hrs.	CO1 CO4
Unit-V	**ROBOTICS**	**No.of Hours**	**COs**
	Robotics: Fundamentals, path Planning for Point Robot, Mobile Robot Hardware, Non Visual Sensors : Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, . Robot System Control: Horizontal and Vertical Decomposition	08 Hrs.	CO5
Unit-VI	**ROBOTS IN PRACTICE**	**No.of Hours**	**COs**

	Robot Pose Maintenance and Localization: Simple Landmark Measurement, Servo Control, Robots in Practice: Delivery Robots, Intelligent Vehicles, Mining Automation, Space Robotics, Autonomous Aircrafts, Agriculture, Forestry, Domestic Robots.	08 Hrs.	CO6

Books:

Text Books:

T1. Muhammed Ali Mazidi, “The 8051 Microcontroller and Embedded systems”, Prentice Hall, 2007
T2. John B. Peatman, “Design with PIC microcontroller”, McGraw Hill International Ltd., 1997
T3. Michael Jenkin, Gregory, “Computational Principles of Mobile Robotics”, Cambridge University Press, 2010, ISBN : 978-0-52-187157-0

Reference Books:

R1. Scott Mackenzie, Raphael C. W. Phan, “The 8051 Microcontroller”, Prentice Hall, 2007
R2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
R3. B.P. Singh, Advanced Microprocessors and Microcontrollers, NewAge International Publishers, 8122422853

CO306: Software Engineering and Design			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Computer Fundamentals and Programming

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Course Objectives:

1. To learn and understand the principles of software engineering
2. To be acquainted with methods of capturing,specifying,visualizing and analysing s/w requirements.
3. To apply project planning and managemen to software project developmentl
4. To apply design principles to software project development.
5. To understand and apply Object Oriented concept for designing OO based model/application.
6. To choose and use modern design tools for software project development .

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Decide process model for developing a software project	2	Understand
2. Analyze the problem statement (SRS) and choose proper design technique for designing web- based/ desktop application	4	Analyze
3. Apply Project Planning and Management to s/w project development	3	Apply
4. Design and analyze an application using UML modeling as fundamental tool	4	Analyze
5. Apply Object Oriented design for s/w project development	3	Apply
6. Decide and apply appropriate modern tool for designing and modeling	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	1	1	1	1	1	3	2	2	-

CO2	-	2	2	-	-	-	1	-	1	1	-	3	2	2	-
CO3	-	-	1	-	2	-	1	1	1	1	3	3	2	3	2
CO4	-	-	2	1	3	-	1	1	1	1	-	3	2	2	2
CO5	-	1	2	-	-	-	1	1	1	1	1	3	2	2	2
CO6	-	-	-	1	3	1	1	1	1	1	1	3	2	2	-

COURSE CONTENTS

Unit I	**Introduction to Software Engineering**	**No. of Hours**	**Cos**
	Nature of Software,Software engineering,The Software Process,Software Myths,A Generic Process Model,Prescriptive Process Models:The Waterfall Model,Incremental Process Models,Evolutionary Process Models,Concurrent Models,Specialized Process Models,The formal Methods Models,The Unified Process ,Personal ,Agility Principles,Extreme Programming,(XP),SCRUM,Introduction to Clean Room Software Engineering.	6	CO1
Unit II	**Requirements Engineering and Analysis**	**No. of Hours**	**Cos**
	Requirements Engineering:User and System requirements, functional and non-functional requirements, A spiral view of requirements engineering process, Software requirements specifications (SRS): SRS document, The structure of SRS, Ways of writing SRS, Structured and Tabular SRS for insulin pump, Requirements Elicitation and Analysis:Process, requirements validation, requirements management. Case study:Mental health care patient management system (MHC-PMS)	6	CO2
Unit III	**Project Planning and Management**	**No. of Hours**	**Cos**
	The Management Spectrum Software Scope, Problem Decomposition, Process Decomposition Process and project metrics, Size-Oriented Metrics, Function-Oriented Metrics Software Process Reconciling LOC and FP Metrics, Object-Oriented Metrics ,Integrating Metrics within the Software Project Estimation,Decomposition , Process-Based Estimation,Estimation with Use Cases Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Model ,Agile estimation Model, Project scheduling: Basic	6	CO3

	Concepts Defining a Task Set for the Software Project , Scheduling : Tracking the Schedule, Earned Value Analysis, Risk Management,Project plan.		
Unit IV	**Introduction to Software Design**	**No. of Hours**	**Cos**
	Introduction to software design, design methods- procedural / structural and object oriented, Requirement Vs Analysis Vs Architecture Vs Design Vs Development 4+1 Architecture, case study of transferring requirement to design, UP, COMET use case based software life cycle, Introduction to UML -Basic building blocks, Reusability, Use case modeling, use case template	6	CO4
Unit V	**Static Modeling**	**No. of Hours**	**Cos**
	Analysis Vs Design, Class diagram- Analysis - Object & classes, finding analysis & design classes, refining analysis relationships, Inheritance & polymorphism, Object diagram, Component diagram- Interfaces & components, deployment diagram, package diagram.	6	CO5
Unit VI	**Dynamic Modeling**	**No. of Hours**	**Cos**
	Interaction & Interaction overview diagram, sequence diagram, Timing diagram, Communication diagram, Advanced state machine diagram, activity diagram	6	CO6

Books:

Text Books(T):

T1. Roger S Pressman "Software Engineering : A Practitioner's Approach " 7th Edition Mcgraw-Hill ISBN:0073375977

T2. Ian Sommerville " Software Engineering" 9th edition Pearson Education SBN-13: 978-0-13-703515-1, ISBN-10: 0-13-703515-2 , pdf downloadable.

T3. Jim Arlow, Ila Neustadt, "UML 2 and the unified process –practical object-oriented analysis and design" Addison Wesley, Second edition, ISBN 978-0201770605

Reference Books(R)

R1. Pankaj Jalote " An Integrated Approach to Software Engineering" 3rd Edition Narosa Publication ISBN: 81-7319-702-4 pdf down loadable.

R2. Rajib Mall " Fundamentals of Software Engineering" 3rd edition PHI

R3. Gardy Booch, James Rambaugh, Ivar Jacobson, "The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8

CO307: Design and Analysis of Algorithms Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Term Work:**	**25 Marks**
Credits:	1	**Total:**	25 Marks

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Prerequisite Course: Data Structures-I, Data Structures-II, Discrete Mathematics.

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Course Objectives:Liberation Serif;Times New Roman

1. To develop problem solving abilities using mathematical modelling
2. To apply algorithmic strategies and testing while solving problems
3. To develop time and space efficient algorithms
4. To design algorithmic assignments using backtracking and branch-n-bound strategies
5. To develop parallel algorithms
6. To develop String Matching algorithms

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Students will be to Demonstrate efficient design, analysis and testing of algorithmic assignments	4	Analyse
2. Students will be to Debug and Demonstrate the Testing of functioning using Software Engineering for OO Programming	2	Understand
3**.** Students will be to develop efficient Algorithms	4	Analyse
4. Students will be to Apply Backtracking and Branch-n-Bound strategy	3	Apply
5. Students will be able to use Parallel Environments	2	Understand
6. Students will be to develop String Matching algorithms	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	2	2	1	1	2	-	-	-	1	3	2	-
CO2	1	1	3	-	2	1	1	2	-	-	-	2	1	1	-
CO3	1	1	1	2	-	1	1	2	-	-	-	1	3	2	2

CO4	2	1	2	3	-	1	1	2	-	-	-	1	3	2	2
CO5	2	1	2	3	-	1	1	2	-	-	-	1	3	2	2
CO6	2	1	2	2	-	1	1	2	-	-	-	1	2	2	-

Suggested List of Assignments

For each assignment program code with sample output is to be submitted as a soft copy. Handwritten write up (Title, Objectives, Problem Statement, Outcomes, Relevant Theory-Concept in brief, Algorithm, Flowchart, Test cases, Conclusion) of each assignment is to be submitted by students.

Perform any 8 Experiments

1. Using Divide and Conquer Strategies, design a function for Binary Search using C Also compute it's time complexity.
2. Using Divide and Conquer Strategies design a class for Concurrent Quick Sort using C++.Also Compute it's time complexity.
3. 8-Queen matrix is stored having first queen placed, use backtracking to place remaining queens to generate the final 8-queen matrix using python.
4. Concurrent Implementation of travelling salesman problem Given a Graph G=(V, E), where V is a set of cities, E=set of edges assigned with different costs. Salesman starts from the source city and wants to visit the destination city. Find out the shortest possible distance.
5. Implementation of 0-1 knapsack problem using branch and bound approach. Consider the number of objects N, Weights as w1. w2..... wn, profits as p1, p2.... pn and Knapsack or bag capacity as m. Find an optimal solution.
6. Implementation of Optimal Merge Pattern Problem For a set of sorted files of different lengths, merge all the files into a single sorted file in minimum time.
7. Implementation of Sum of Subsets Problem using Backtracking.Given a set S of n objects with weight (w1, w2... wn) and a value M. Find subsets of elements of S whose total weight equals to M.
8. Implementation of Parallel Merge sort. Given list of N elements is divided into sublists and then they are merged by comparing elements with adjacent lists to get a final sorted output.
9. Write a Program to implement the Rabin-Karp String Matching algorithm.
10. Write a Program to implement KMP String Matching algorithm.

CO308: Computer Network Laboratory			
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs. / Week**	**Oral :**	**25 Marks**
Credits:	**1**		
		Total:	**25 Marks**

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Prerequisite Course: Computer Organization and Architecture, Digital Electronics and Data Communication

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Course Objectives:

1. To learn and understand the fundamental LAN and WAN .
2. To learn and understand the error detection and correction.
3. To learn and understand subnetting.
4. To learn and understand Client-Server architectures and prototypes by the means of netwok standards and technology.
5. To learn and understand DHCP protocol.
6. To learn and understand different network simulation tools.

Course Outcomes (COs) :

On successful completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Design and develop Local Area Network.	3	Apply
2. Implementation of error detection and correction techniques.	3	Apply
3. Design and implementation of subnetting.	2	Understand
4. Implementation of Client-Server program using different protocols.	3	Apply
5. Installation and configuration of DHCP client and server.	3	Apply
6. Use the different network simulation tools.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3		2						2		2	2	
CO2	1	2	3		1								2	2	
CO3	1	2											3		
CO4	2	3										1	3	1	
CO5	1												3		
CO6	1		3		2							2	2		

Course Contents

1. **Part A:** Setup a wired LAN using Switch. It includes preparation of cable, testing of cable using LAN tester, configure machines using IP addresses, testing using PING utility.
   Part B: Extend the same Assignment for Wireless using Access Point.
2. Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes.
3. Write a program to demonstrate subnetting and find the subnet masks.
4. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window protocol.
5. Write a program using TCP socket for wired network for following:
   a. Say Hello to Each other b. File transfer c. Calculator (Arithmetic)
6. Write a program using UDP socket for wired network for following:
   a. Say Hello to Each other b. File transfer c. Calculator (Arithmetic)
7. Install and configure DHCP server.
8. Study of any network simulation tools - To create a network with three nodes and establish a TCP connection between node 0 and node 1 such that node 0 will send TCP packet to node

2 via node 1.

9. Use network simulator NS2 to implement:

   a. Analysis of CSMA and Ethernet protocols

   b. Network Routing: Shortest path routing, AODV.

10. Configure RIP/OSPF/BGP routing algorithms using packet Tracer.

CO309: Database Management System Laboratory			
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs. / Week**	**Term Work:**	
Credits:	**1**	**Practical Exam:**	**50 Marks**
		Total:	**50 Marks**

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Prerequisite Course: (if any) Database Management System

Course Objectives:

1. To develop basic, intermediate and advanced Database programming skills.
2. To develop basic Database administration skills.
3. To apply advance database programming concept for database application.
4. To provide a strong formal foundation in database concepts, technology and practice.
5. To learn a powerful, flexible and scalable general purpose database to handle big data.
6. To learn and understand various Database Architectures and Applications.

Course Outcomes (COs) :

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

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Demonstrate the ability to handle databases of varying complexities	3	Apply
2. Use advanced database Programming concepts	3	Apply
3. Implement program for database connectivity using java/PHP/Python.	3	Apply
4. Use and handle NoSQL databases like mongoDB, Cassandra.	3	Apply
5. Implement database triggers, procedures and cursor for database application	3	Apply
6. Develop mini project using concept of database as backend.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	2	--	--	--	--	--	2	3	2	3	2	1
CO2	2	--	--	2	--	--	--	--	--	2	2	2	2	2	--
CO3	1	--	--		--	--	--	--	--	3	2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--	3	2	2	1	2	--
CO5	2	--	--	2	--	--	--	--	--	3	2	2	2	3	--
CO6	2	--	--	2	--	--	--	--	--	3	2	3	2	2	1

Course Contents

Sr. No.	Title of Assignment
Group A- Database Programming Languages – SQL, PL/SQL	
1	Study of Open Source Relational Databases: MySQL/Oracle and Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence
2	Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator, all types of Join, Sub-Query and View.
3	Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory. Write a PL/SQL block of code for the following requirements:- Schema: 1. Borrower(Rollin, Name, DateofIssue, NameofBook, Status) 2. Fine(Roll_no,Date,Amt) ● Accept roll_no & name of book from user. ● Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5 per day. ● If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. ● After submitting the book, status will change from I to R. ● If condition of fine is true, then details will be stored into fine table. **Frame the problem statement for writing PL/SQL block inline with above statement.**
4	Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data

	should be skipped. **Frame the separate problem statement for writing PL/SQL block to implement all types** **of Cursors inline with above statement. The problem statement should clearly state the requirements.**
5	PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block for using procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class) **Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements.**
6	Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library_Audit table. **Frame the problem statement for writing Database Triggers of all types, in-line with above statement. The problem statement should clearly state the requirements.**
Group B Large Scale Databases	
7	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).
8	Implement aggregation and indexing with suitable example using MongoDB. Use Zipcode Dataset (download from url https://media.mongodb.org/zips.json) and import in mongoDB and perform following operations a. Return States with Populations above 10 Million. b. Return Average City Population by State c. Return Largest and Smallest Cities by State d. Return States with Population e. Create single field index f. Create a compound index
9	Implement Map reduce operation with suitable example using MongoDB. Use Movies Dataset. Write the map and reduce methods to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating, and a timestamp: The map should emit movie number and list of rating, and reduce should return for each movie number a list of average rating.
Group C Mini Project : Database Project Life Cycle	
10	Write a program to implement MongoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.
11	Implement MYSQL/Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC.

12	Using the database concepts covered in Part-A & Part-B & connectivity concepts covered in Part C, students in group are expected to design and develop database application with following details: **Requirement Gathering and Scope finalization** **Database Analysis and Design:** ● Design Entity Relationship Model, Relational Model, Database Normalization **Implementation :** ● Front End : Java/Perl/PHP/Python/Ruby/.net ● Backend : MongoDB/MYSQL/Oracle ● Database Connectivity : ODBC/JDBC **Testing : Data Validation** Group of students should submit the Project Report which will be consist of documentation related to different phases of Software Development Life Cycle: Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling features, Data Dictionary, Relational Database Design, Database Normalization, Graphical User Interface, Source Code, Testing document, Conclusion. Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work

Reference Books

1. Ivan Bayross, BPB Publication ,“SQL, PL/SQL: The Programming Language of Oracle”
2. Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide”, O’Reilly Publications
3. http://www.tutorialspoint.com/json/ & http://docs.mongodb.org/manual/

CO310: Skill Based Credit Course			
Teaching Scheme		**Examination Scheme**	
Theory:	**1 Hrs. / Week**	**CIA :**	**50 Marks**
Credits:	1	**Total:**	50 Marks

Course Objectives:

The major objectives of skill based credit course inclusion are -

- To make students aware about the current skill set requirements in the industry and
- To give them exposure to the latest technology trends in collaboration with industry experts.
- To bring opportunities to the learners to think, design and implement solutions to the real time problems as per the Industry standards.
- To make students proficient in the selected skill set.

Course Outcomes:

The major outcomes expected from this course are, after the completion of this course, learner will be able to -

- To choose the current skill set requirements in the industry as per his or her choice.
- To explore the acquired knowledge of skill set in the application design and development.
- To apply the latest technology knowledge during the development of solutions to the real time problems as per the Industry standards.

General Guidelines:

This course is intended to make students competent for the particular skill set requirement of the Industry identified by the Department in consultation with the Industry Experts. The department will clearly state the detailed syllabus in the curriculum based on BoS Approval for the learner's reference. The learners will be able to select a particular skill set credit course as per his or her choice and capabilities. The department will run this course in collaboration with the Industry Expert. The respective staff-incharge involved in the conduction of this course, will ensure that he/she will also get trained in the respective skill set and will assist learners later on in the assessment and implementation process.

Skill based Credit Courses offered for the Department of Computer Engineering:

1. **DevOps and Automation**
2. **3D Design Visualization**
3. **Advanced Java Programming**

1] DevOps and Automation

Pre-requisites: Basic Knowledge of Software Engineering

Course Objectives:
The objective is to understand the fundamentals of DevOps culture, its goals, practices and tools for automating the IT infrastructure and manage application life-cycle.
The overall objective of this course is to provide students with practical experience in applying agile methodology to their work environment.
1. Understand the differences between conventional and agile approaches
2. Estimate in an incremental and iterative fashion using practical techniques
3. Plan increment and release cycles
4. Capture and apply metrics
5. Understand scaling issues
6. Apply agile principles to a range of decision possibilities
7. Learn DevOps for CI/CD using containers, container orchestration and piplelines

Course Outcomes:
1. CO1: Be able to compare and contrast the differences between Agile and other project management methodologies
2. CO2: Be able to interpret and apply various principles, phases and activities of the Scrum methodology
3. CO3: Be able to identify and use various tools for Agile development and CI/CD
4. CO4: Be able to understand and implement DevOps principles for CI/CD

Unit I: Introduction to DevOps (1 hour)
Background of SDLC, Agile, ITIL and Need for DevOps, History of DevOps, Role of a DevOps Engineer, Terminologies in DevOps
Unit II: Version Control systems (3 hours)
Introduction to Version Control Systems (VCS), Need for using a Version Control Systems, Types of Version Control Systems: Simple VCS, Centralized VCS and Distributed VCS, Introduction to GIT, SVN and Bitbucket, Git Essentials, Git Commandline, Git architecture and versions of Git, Cloning, Check-in and Commit of Git Repositories, Fetching the Repositories, Git Pull and Git Branching Technique
Unit III: Configuration Management Tools (3 hours)
Introduction to Configuration Management tools, Types of Configuration Management Tools : Push-based & Pull-based, Introduction to Ansible, Puppet, Chef & Salt, Ansible : What is Ansible and its Architecture, Why do we need Ansible, Ansible Terminologies, Advantages, Infrastructure-as-a-code, Writing Ansible Playbooks using YAML, Ansible Case Study : SPLUNK, Best practices
Unit IV: Vagrant and Containerization (3 hours)
Introduction to Vagrant and its Uses, Installation of Vagrant in Linux and Windows, Understanding the VagrantFile, Provisioning Virtual Machines with Vagrant using Virtualbox, Networking & Port Forwarding with Vagrant Introduction to Containerization, Docker Essentials, What is Docker Hub and Images, Fundamentals of Microservices, Understanding the DockerFile, Docker Compose and Docker Swarm, Difference between Docker Swarm and Kubernetes for Container Orchestration

Unit V: CI/CD Pipelines and Continuous Monitoring (3 hours)
What is Continuous Integration and Continuous Deployment (CI/CD), Need of CI/CD in DevOps, Practical Implementation of CI/CD pipelines using Jenkins, Understanding the Jenkins Plugins, Continuous Testing & E-mail notifications, Benefits of a production-ready software
Introduction to Continuous Monitoring, Why Continuous Monitoring is essential, Continuous Monitoring with Nagios, Datadog and AWS CloudWatch, Application Performance Monitoring with New Relic, Centralized Logging with ELK (Elasticsearch-Logstash-Kibana)

Unit VI: DevOps Capabilities (2 hours)
Successful paths to automate the IT processes, Adopting DevOps in organization, Myths about DevOps , Bringing DevOps culture and Team collaboration, Improving the customer feedback and enhancing the Business

Reference Books:
1. Emily Freeman, DevOps For Dummies, John Wiley & Sons (2019), ISBN: 1119552222, 9781119552222
2. Joakim Verona, Practical DevOps – Second Edition, May 2018, Packt Publishing, ISBN: 9781788392570
3. Lorin Hochstein & Rene Moser, Ansible : Up and Running, 2nd Edition, O'Reilly Media, ISBN-13: 978-1491979808

2] 3D Design Visualization

Topics:

1. Principle of Design
2. Digital Design
3. Introduction to 3D Graphics
4. 3D Asset Modelling
5. 3D Asset look and feel Development
6. Lighting and Rendering

3] Advanced Java Programming

Topics:

1. JDBC
2. Socket programming
3. Java Applet/Java Script/JSP

(MC 311) Mandatory Learning Courses [MLC] (Non Credit Course) for TY B. Tech Course Curriculum w. e. f A.Y. 2021-22

Important Note:

● The department has to finalize MLC from the given choices and will prepare suitable course contents at departmental level only.

● The departments are informed to finalize MLC for SEM I and SEM II immediately and will take its approval in the BoS Meeting.

● Department will keep record of its smooth conduction and activity details.

SEMESTER V

Learning an Art Form (Music: vocal or instrumental, dance, painting, clay modeling, etc.):

Cultivation of arts is an integral part of the development of human beings since the arts are what make us most human, most complete as people. They offer us the experience of wholeness because they touch us at the deepest levels of mind and personality. They come into being not when we move beyond necessity but when we move to a deeper necessity, to the deeper human need to create order, beauty and meaning out of chaos. They are the expressions of deepest human urges, imperatives and aspirations. While enriching the process of learning through enhanced perceptual and cognitive skills, learning of arts promotes self-esteem, motivation, aesthetic awareness, cultural exposure, creativity, improved emotional expression, as well as social harmony and appreciation of diversity. They promote an understanding and sharing of culture, and equip the learners with social skills that enhance the awareness and respect of others.

Each institution will offer a range of introductory courses in different art forms: music, dance, theatre, painting, and other art forms. Care should be taken to give adequate representation to local and regional art forms in which our culture abounds. This will, in turn, also ensure wider community involvement/interaction with the institution.

Students will be given an option to choose a particular art form, and learn and practice it under an artist-instructor. At the end of the course, a student should be able to demonstrate basic proficiency in that particular art form. Contact hours per week should be 3-4 hours. Towards the end of the course, the institution can organize a function/program in which all the students publicly demonstrate their skills.

SEMESTER VI

Behavioral and Interpersonal skills (non-verbal skills / behaviors, nonaggression)

Each individual has behavior patterns that are shaped by the context of his or her past. Most often, adapting the behavior to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression.

The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn the goal setting process and thus become more effective in achieving their goals.

The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team. The specific objectives, however, are as following.

• To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.

• To train the students for communicating effectively in both formal as well as in informal settings.

• To help the students to understand the importance of non-verbal aspects of effective communication.

• To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work

• To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.

• To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting. The activities involved are designed to facilitate their career goal decision making. The activities to achieve the above objectives can be suggested as follows.

• Motivational lectures • Group Discussions/activities • Case Study • Games/Stimulation Exercises • Role-Playing • Mindfulness training. 4. Suitable Technical / Non-Technical Activities finalized by Department: Department has flexibility to decide suitable activities.

B.Tech Honors Specialization

Artificial Intelligence and Machine Learning

Mathematical Foundations for Artificial Intelligence and Machine Learning (CO (H1) 801)

Teaching Scheme		Examination Scheme	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Engineering Mathematics

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Course Objectives:

1. To understand the basic concepts of Artificial Intelligence.
2. To understand the basic concepts of Machine Learning.
3. To understand the basics of Linear Algebra.
4. To learn the probability theory concepts for AI and ML.
5. To understand the role of Regression in Machine Learning.
6. To learn different classification techniques in ML.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand the basic concepts of Artificial Intelligence.	2	**Understand**
2. Understand the basic concepts of Machine Learning.	2	**Understand**
3. Use the basic concepts of Linear Algebra	3	**Apply**
4. Apply probability theory concepts in AI and ML	3	**Apply**
5. Apply different regression techniques in ML	3	**Apply**
6. Understand different classification techniques in ML	2	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-
CO2	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	2	1	1	2
CO4	2	1	-	-	-	-	-	-	-	-	-	2	1	1	2
CO5	1	-	1	-	2	-	-	-	-	-	-	2	1	2	1
CO6	1	-	1	-	2	-	-	-	-	-	-	2	1	2	1

COURSE CONTENTS

Unit-I	**Introduction to Artificial Intelligence**	**No. of Hours**	**COs**
	Artificial Intelligence: Introduction, Typical Applications of AI, How Does AI Solve Real World Problems, Problem solving with AI, Search Strategies, And Agents: Intelligent Agents, Rational agent.	06	CO1
Unit-II	**Machine Learning Basics**	**No. of Hours**	**COs**
	Introduction to Machine Learning, Types of machine Learning: Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Applications of Machine Learning	06	CO2
Unit-III	**Linear Algebra**	**No. of Hours**	**COs**
	Scalars, Vectors, Matrices and Tensors, Vector and Matrix Norms, Vectors, Matrices, and Tensors in Python, Special Matrices and Vectors, Eigenvalues and Eigenvectors, Norms and Eigendecomposition	06	CO3
Unit-IV	**Probability Theory**	**No. of Hours**	**COs**
	Introduction to Probability Theory, Probability Distributions, Expectation, Variance, and Covariance, Graphing Probability Distributions, Covariance Matrices	06	CO4
Unit-V	**Regression**	**No. of Hours**	**COs**
	Linear Regression with One Variable, Fitting a Model on Data with scikit-learn, Linear Regression with Multiple Variables, Preparing Data for Protection, Polynomial and Support Vector Regression	06	CO5
Unit-VI	**Classification**	**No. of Hours**	**COs**
	The Fundamentals of Classification: CSV Format , Loading Datasets, Data Pre-processing, Minmax Scaling of the Goal Column, Identifying Features and Labels, Cross-Validation with scikit-learn, The k-nearest neighbor Classifier, Classification with Support Vector Machines	06	CO6

Books:

Text Books:

- Stuart Russell and Peter Norvig (1995), “Artificial Intelligence: A Modern Approach,” Third edition, Pearson, 2003
- Ethem Alpaydin, “ Introduction to Machine Learning”, PHI 2nd Edition-2013, ISBN 978-0-262-01243-0
- Linear Algebra –An Introduction, Ron Larson, David C. Falvo (Cenage Learning, Indian edition)

Reference Books:

- Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH
- Parag Kulkarni and Prachi Joshi, “Artificial Intelligence – Building Intelligent Systems”, PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015
- Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622x
- Dimitri P. Bertsekas and John N. Tsitsiklis “Introduction to Probability” Second Edition, MIT, ISBN-13: 978-1886529236

B.Tech Honors Specialization

Data Science

Mathematical Foundations and SQL Basics for Data Science Learning (CO (H1) 801)			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Structures, Vector Calculus and Differential Equation

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Course Objectives:

1. To understand the fundamental concepts of database management.
2. To Study of Modifying and Analyzing Data with SQL
3. To study of Normal Distribution Poisson Distribution for Data Science
4. To study of basic statistical and Axioms of Probability.
5. To study of Sampling distributions and Testing of Hypothesis
6. To study of Quantitative Analysis, Qualitative Analysis of Data Science

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
Design E-R Model for various real time applications and Basic of data models.	2	**Understand**
Apply the SQL queries to extract data from data base.	3	**Apply**
Understand the importance of discrete and continuous distributions for Data Science	2	**Understand**
Understand the concept of Linear Algebra and Probability Theory	2	**Understand**
Perform test of hypothesis for the population parameter.	3	**Apply**
Understand the concept of Statistics for Data science with Quantitative Analysis, Qualitative Analysis	2	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	3	-	-	-	1	-	-	-	-	-	1	1	-
CO2	-	-	3	-	-	-	1	-	-	-	-	-	2	2	-
CO3	-	-	3	-	-	-	2	-	-	3	-	3	3	1	2

CO4	-	-	3	-	-	-	2	-	-	3	-	-	3	3	2
CO5	-	-	3	-	-	-	2	-	-	2	-	1	3	3	2
CO6	-	-	3	-	-	-	3	-	-	1	-	2	1	1	-

COURSE CONTENTS

Unit I	**Introduction**	**No. of Hours**	**Cos**
	Introduction to Data, Information, Knowledge. Introduction to Database Management Systems. Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process	6	CO1
Unit II	**Basics of SQL**	**No. of Hours**	**Cos**
	Getting Started and Selecting & Retrieving Data with SQL, Filtering, Sorting, and Calculating Data with SQL, Sub queries and Joins in SQL, Modifying and Analyzing Data with SQL	7	CO2
Unit III	**Mathematical Distributions**	**No. of Hours**	**Cos**
	Exponentials, Logarithms, and Compounding ,Normal Distribution Poisson Distribution, Moments of a continuous random variable Combining random variables ,Vector Algebra ,Statistical Regression ,Diversification ,Matrix Calculus ,Matrix Equations	7	CO3
Unit IV	**Linear Algebra and Probability Theory**	**No. of Hours**	**Cos**
	Mean, median mode, standard deviation, Axioms of Probability- Bayes' Theorem ,Co-variance – Correlation and Regression	8	CO4
Unit V	**Hypothesis Testing**	**No. of Hours**	**Cos**
	Sampling distributions, Testing of Hypothesis – Small samples – T Test, F Test and Chi-square Test, Analysis of variance, One Way Classification, Two Way Classification	8	CO5
Unit VI	**Statistics for Data science**	**No.of Hours**	**Cos**
	Introduction To Statistics, Terminologies in Statistics - Statistics for Data Science Types of Analysis: Quantitative Analysis, Qualitative Analysis. Categories in Statistics Descriptive Statistics Inferential Statistics. Understanding Descriptive Analysis, Understanding Inferential Analysis	6	CO6

Books:

Text Books(T):

T1: Distributed Systems: Principles and Paradigms. 2nd Edition, Andrew S. Tannenbaum, Maarten Van Steen, Pearson .
T2: Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
T3: Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.

Reference Books(R):

R1: Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
R2: Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
R3: Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
R4: Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
Ivan Bayross, "SQL, PL/SQL: The Programming Language of Oracle", BPB Publication, ISBN- 10: 8176560723; ISBN-13: 978-8176560726
R5:Probability, Random Variables, Statistics, and Random Processes: Fundamentals & Applications, Ali Grami, ISBN: 978-1-119-30081-6

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF COMPUTER ENGINEERING

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Scie nce
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

COURSE STRUCTURE - 2019 PATTERN

THIRD YEAR B. TECH.

SEMESTER II

SRES's Sanjivani College of Engineering

Kopargaon

(An Autonomous Institute Affiliated to SPPU Pune)

COURSE STRUCTURE- 2019 PATTERN

THIRD YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER II

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme-Marks						
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PCC	CO312	Internet of Things	3	-	-	3	30	50	20	-	-	-	100
PCC	CO313	System Programming and Operating System	3	-	-	3	30	50	20	-	-	-	100
PEC	CO314	Professional Elective-2	3	-	-	3	30	50	20	-	-	-	100
OE	CO315	Open Elective-1	4	-	-	4	30	50	20	-	-	-	100
PRJ	PR316	IPR and EDP	2	-	-	2	15	25	10	-	-		50
PRJ	PR317	IPR and EDP Lab	-	-	2	1	-	-	-	-	-	50	50
HSMC	HS318	Corporate Readiness	1	-	2	2	-	-	-	-	-	50	50
PC	CO318	IoT Lab	-	-	2	1	-	-	-	75	-	-	75
PC	CO319	SPOS Lab	-	-	2	1	-	-	-		75	-	75
MC	MC321	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			17	-	08	20	135	225	90	75	75	100	**700**

Dean Academics ***Director***

Mandatory Course-VI: Behavioral and Interpersonal skills (non-verbal skills / behaviors, nonaggression)

Code	Professional Elective-II
CO314 A	Software Testing and Quality Assurance (STQA)
CO314 B	Advanced Database Management System (ADBMS)
CO314 C	Wireless Sensor Network (WSN)

Dept/Code	Open Elective-1
Comp / CO315	IoT Basics
IT / IT315	OOP : Python/C++/Java
ECE / ET315	Artificial Intelligence
Mech / ME315	Enterprise Resource Planning
Electrical/ EE315	Renewable Energy Sources
Civil	Fire Safety
MBA	Digital Marketing

COURSE STRUCTURE- 2019 PATTERN

B.Tech Honors Specialization

Artificial Intelligence and Machine Learning

Year /Sem	Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks						
								Theory			OR	PR	TW	Total
				L	T	P		ISE	ESE	CIA				
T Y Sem-I	PC	CO1801	Mathematical Foundations of Artificial Intelligence and Machine Learning	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO1802	Python for Artificial Intelligence and Machine Learning	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO1803	Python for Artificial Intelligence and Machine Learning Lab	-	-	2	1	-	-	-	-	-	25	25
Final Sem-I	PC	CO1901	Practical Machine Learning With Tensorflow	4	-	-	4	30	50	20	-	-	-	100
Final Sem-II	PC	CO1902	Practical Machine Learning With Tensorflow	-	-	2	1	-	-	-	-	-	25	25
Final Sem-II	PC	CO1903	Artificial Intelligence and Machine Learning: In Practice	4	-	-	4	30	50	20	-	-	-	100
			Total	16	-	04	18	120	200	80	-	-	50	450

Data Science

Year /Sem	Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks						
								Theory			OR	PR	TW	Total
				L	T	P		ISE	ESE	CIA				
T Y Sem-I	PC	CO2 801	Mathematical Foundation and SQL Basic for Data Science	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO2802	Big Data Engineering	4	-	-	4	30	50	20	-	-	-	100
T Y Sem-II	PC	CO2803	Big Data Engineering Lab	-	-	2	1	-	-	-	-	-	25	25
Final Sem-I	PC	CO2901	Data Science with Python	4	-	-	4	30	50	20	-	-	-	100
Final Sem-II	PC	CO2 902	Data Science with Python.	-	-	2	1	-	-	-	-	-	25	25
Final Sem-II	PC	CO2903	Data Science : Visualization.	4	-	-	4	30	50	20	-	-	-	100
			Total	16	-	04	18	120	200	80	-	-	50	450

Dean Academics *Director*

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

Program Specific Outcomes (PSOs)

1. **Professional Skills:** The ability to apply knowledge of problem solving, algorithmic analysis, software Engineering, Data Structures, Networking, Database with modern recent trends to provide the effective solutions for Computer Engineering Problems.

2. **Problem-Solving Skills:** The ability to inculcate best practices of software and hardware design for delivering quality products useful for the society.

3. **Successful Career:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths.

CO312: Internet of Things			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Digital Electronics, Computer Network

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Course Objectives:

1. To understand fundamentals of IoT and embedded systems including essence, basic design strategy and process modeling.
2. To introduce learners to a set of advanced topics in embedded IoT and lead them to understand research in networks.
3. To develop a comprehensive approach towards building small low cost embedded IoT applications.
4. To learn and implement secure infrastructure for IoT applications.
5. To learn real world application scenarios of IoT along with its social and economic impact using case studies and real time examples.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1) Understand basic fundamentals and the needs of embedded system components for the IoT.	2	Understand
2) Explain what is IoT, its enabling technologies for developing systems with its emergence along with security challenges.	2	Understand
3) Apply knowledge of IoT application design methodology for designing and implementing IoT applications,	3	Apply
4) Classify IoT protocols for making devices communicate in real time applications.	4	Analyse
5) Design an IoT application to work with cloud computing architecture	3	Apply
6) Survey IoT applications based on the knowledge of security measures	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	2	1	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	3	2	3	-	-	2	-	1	-	-	3	-
CO4	1	2	3	2	3	3	-	-	2	1	2	2	3	2	-
CO5	2	2	2	3	3	3	-	-	2	1	2	2	2	2	-
CO6	2	2	1	2	2	2	-	-	1	-	1	-	3	-	3

COURSE CONTENTS

Unit I	**Introduction to IoT**	**No. of Hours**	**COs**
	Embedded Systems: Introduction, Definition, Characteristics of Embedded System, Real time systems, Real time tasks, Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.	6	CO1
Unit II	**IoT: Concepts**	**No. of Hours**	**COs**
	IoT: Definition and characteristics of IoT, Internet of Things: Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks, Physical design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion, Logical design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT	6	CO2
Unit III	**IoT Platforms Design Methodology**	**No. of Hours**	**COs**
	Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT communication models and IoT	6	CO3

	Communication APIs, Sensor Networks, IoT Design Methodology, Four pillars of IoT (M2M, SCADA, WSN, DCM) # Case Studies: Home Automation using IoT communication models and IoT Communication APIs.		
Unit IV	**IoT Protocols**	**No. of Hours**	**COs**
	Protocol Standardization for IoT, M2M and WSN Protocols, SCADA and RFID Protocols, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, IP based protocols: 6LoWPAN and RPL, ZigBee Smart Energy 2.0, ETSI TC M2M, Canbus, LoRa. # Case Studies: LoRa based Smart Irrigation System	6	CO4
Unit V	**IoT: Cloud Platforms for IoT**	**No. of Hours**	**COs**
	Software Defined Networking, Introduction to Cloud Storage Models, Communication API, WAMP: AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework: Django Architecture and application development with Django, Amazon Web Services for IoT, SkyNet IoT Messaging Platform, RESTful Web Service, GRPC, SOAP. #Case Studies: Smart parking, Forest Fire Detection	6	CO5
Unit VI	**IoT Security**	**No. of Hours**	**COs**
	IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, lightweight cryptography #Case Studies: Home Intrusion Detection	6	CO6
Books:			
Text Books(T):			
T1: Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.			

T2: Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition,Wiley Publication,ISBN: 978-1-119-99435-0

Reference Books(R):

R1: Dawoud Shenouda Dawoud, Peter Dawoud,Microcontroller and Smart Home Networks, ISBN: 9788770221566, e-ISBN: 9788770221559.

R2: Charles Crowell,IoT - Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT, ISBN-13 : 979-8613100194

R3: David Hanes,Gonzalo Salgueiro,Robert Barton,Jerome Henry -IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

R4: David Etter, IoT Security: Practical guide book, amazon kindle, ISBN: 1540335011.

R5: Brian Russell, Drew Van Duren, Practical Internet of Things Security - Second Edition,Packt Publishing , ISBN: 9781788625821

e-Books:

- https://www.iotforall.com/ebooks/an-introduction-to-iot
- https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies

MOOC/ Video Lectures available at:

- https://nptel.ac.in/courses/106/105/106105166/
- https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-development/
- https://www.coursera.org/learn/iot
- https://nptel.ac.in/courses/108/108/108108098/

CO313: System Programming and Operating System			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	3	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Computer Organization and Architecture, Operating System and Administration, Data Structures

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Course Objectives:

1. To learn and understand basics of system programming
2. To obtain knowledge of data structures used in design of system software.
3. To learn format of object modules and the loader functions such as linking, relocation, and loading
4. To be familiar with structures and functions of Operating Systems and process management.
5. To learn and understand memory management of operating system.
6. To get acquainted with I/O and File management in operating system

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Identify suitable data structures and design two pass assembler	3	Apply
2. Use suitable data structures and design two pass macro processor and loader	3	Apply
3. Use tools like LEX and YACC to build different phases of compiler.	3	Apply
4. Implement and Analyze the performance of process scheduling algorithms	4	Analyse
5. Demonstrate memory organization and memory management policies	3	Apply
6. Understand I/O, File Management and disk scheduling algorithms.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	-	-	-	-	-	-	1	2	1	-
CO2	2	2	3	2	-	-	-	-	-	-	-	1	2	1	-
CO3	2	2	3	2	2	-	-	-	-	-	-	1	2	1	-
CO4	2	2	2	1	-	-	-	-	-	-	-	1	2	1	-
CO5	2	1	2	1	-	-	-	-	-	-	-	1	2	1	-
CO6	2	1	1	1	-	-	-	-	-	-	-	1	2	1	-

COURSE CONTENTS

Unit I	Introduction and Assemblers	No. of Hours	COs
	Introduction: Introduction to Systems Programming, Need of Systems Programming, Software Hierarchy, Types of software: system software and application software, Machine Structure, Machine language and Assembly Language. **Components of System Software:** Assembler, Macro processor, Compiler, Interpreter, Linker, Loader, Debugger, Operating System. **Assemblers:** General design procedure, design of two pass assembler. **Case Study: Study of Debugging tools like GDB**	8	CO1
Unit II	**Macro Processor, Linkers and Loader s**	**No. of Hours**	**COs**
	Macro Processor: Macro instructions, Features of macro facility, Design of two-pass macro processor. **Loaders:** Loader schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, overlay structure. Design of an absolute loader, Design of direct linking loader. **Linkers:** Relocation and linking concepts, Design of linker, self relocating programs, Static and dynamic link libraries, **Case Study: GNU M4 Macro Processor**	8	CO2
Unit III	**Compilers and Interpreters**	**No. of Hours**	**COs**
	Role of lexical analysis -parsing & Token, patterns and Lexemes & Lexical Errors, regular definitions for the language constructs & strings, sequences, Comments & Transition diagram for recognition of	8	CO3

	tokens, reserved words and identifiers, examples **Introduction to Compilers and Interpreters:** General Model of Complier, Program interpretation, Comparison of compiler and Interpreter, Use of Interpreter and components of Interpreter. **Case Study: LEX and YACC specification and features.**		
Unit IV	**Operating System**	**No. of Hours**	**COs**
	Operating Systems: Introduction to different types of operating Systems, System Components, OS services, System structure- Layered Approach. **Process Management:** Process Concept- Process states, Process control block, Threads, **Process Scheduling:** Types of process schedulers, Types of scheduling: Preemptive, Non preemptive. Scheduling algorithms: FCFS, SJF, RR, Priority, **Deadlocks:** Methods of handling deadlocks, Deadlock prevention, avoidance and detection, Recovery from deadlocks. **Case Study: Process Management in Windows/Linux/Android**	7	CO4
Unit V	**Memory Management**	**No. of Hours**	**COs**
	Introduction: Memory Management concepts, Memory Management requirements. **Memory management:** Contiguous and non-contiguous, Swapping, Paging,Structure of the Page Table, Segmentation. **Virtual Memory:** Background, Demand paging, Page replacement scheme- FIFO, LRU, Optimal, Thrashing **Case Study: Memory Management in Windows/Linux/Android**	7	CO5
Unit VI	**I/O and File Management**	**No. of Hours**	**COs**
	I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Disk Scheduling- Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN. **File Management:** File Concept, Access methods, Directory and Disk Structure, Protection, File System Structure, File System implementation, Directory Implementation, Allocation methods, Free Space management.	6	CO6

	Case study: UNIX File system, Operating System Virtualization		

Books:

Text Books(T):

1. John Donovan, “System Programming”, McGraw Hill, ISBN 978-0--07-460482-3.
2. Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4
3. Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN 978-1-118-06333-0

Reference Books(R):

1. Alfred V.Aho,Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles,Techniques and Tools”, Pearson,ISBN:978-81-317-2101-8
2. John R. Levine, Tony Mason, Doug Brown, “Lex and Yacc”,O’Reilly & Associates,Inc,ISBN:1-56592-000-7
3. Leland Beck, “System Software: An Introduction to Systems Programming”, Pearson

e-Books :

1. https://www.elsevier.com/books/systems-programming/anthony/978-0-12-800729-7
2. https://www.kobo.com/us/en/ebook/linux-system-programming-1
3. https://www.ebooks.com/en-us/subjects/computers-operating-systems-ebooks/279/
4. https://www.e-booksdirectory.com/details.php?ebook=9907

MOOCs Courses Links:

1. https://www.udacity.com/course/introduction-to-operating-systems--ud923
2. nptel video lecture link: https://nptel.ac.in/courses/106/105/106105214/
3. https://www.edx.org/course/computer-hardware-and-operating-systems
4. https://onlinecourses.nptel.ac.in/noc19_cs50/preview
5. https://www.udemy.com/course/system-programming/

CO314A: Software Testing and Quality Assurance (STQA)			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Software Engineering & Design

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Course Objectives:

1. To understand fundamentals concepts of software testing.
2. To learn and understand Black box testing.
3. To develop a comprehensive approach towards building White box testing.
4. To understand Testing Strategies, software quality and assurance systems.
5. To learn Testing planning and Management.
6. To learn various automated testing tools.

Course Outcomes (COs): After successful completion of the course, student will be able to:-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Analyse** real world application scenarios of software testing.	**4**	**Analyse**
2. **Understand** black box testing with subtypes of black box testing	**2**	**Understand**
3. **Understand** white box testing with subtypes of white box testing	**2**	**Understand**
4. **Apply** different approaches of Testing Strategies, software quality and assurance systems.	**3**	**Apply**
5. **Apply** and analyse Testing planning and Management.	**3**	**Apply**
6. **Apply** automated tools for different types of application	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2								1		3	

CO2	3	3	2									3	
CO3		2	3	1					1				3
CO4	3	3	2		1							3	2
CO5	2	3	2								2	2	2	2
CO6	3	3	3			3	2			2			3	

Course Contents

Unit-I	**Introduction to Software Testing**	**No. of hours**	**COs**
	Need of testing, Basics of Software Testing, Testing Principles, Goals, Software Testing Life Cycle, Defects, Defect management, Verification and validation, Test Plan.	6	CO1
Unit-II	**Black Box Testing**	**No. of Hours**	
	Introduction, need of black box testing, Requirements Analysis, Testing Methods - Requirements based testing, Positive and negative testing, Boundary value analysis, Equivalence Partitioning class, Domain testing, Design of test cases, Case studies of Black- Box testing.	6	CO2
Unit-III	**White Box Testing**	No. of Hours	
	Introduction, Need of white box testing, Testing types, Static testing by humans, Structural Testing – Control flow testing, Loop Testing, Design of test cases, Challenges in White box testing, Case-studies of White-Box testing.	6	CO3
Unit-IV	**Testing Strategies and Quality Management**	No. of Hours	

	Unit, Integration, System, Acceptance testing, Usability testing, Regression testing, Scenario testing, Adhoc testing, Functional, Performance testing, Stress testing, Security testing, Alpha-Beta testing, Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan.	6	CO4
Unit-V	**Test Planning and Management**	No. of Hours	
	Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, salient and policy of Software testing, Test Strategy, Test Planning, Testing Process and number of defects found, Cost aspect, establishing testing policy, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process.	6	CO5
Unit-VI	**Automation Testing**	No. of Hours	
	Agile Testing, Model based testing, Need for Automation, Keyword driven automation, Data driven automation, Manual testing versus Automated testing, Automated Testing Tools, Selection of tool, Introducing Selenium, Brief History of The Selenium Project, Selenium‟s Tool Suite, Selenium-IDE, Selenium RC, Selenium Webdriver, Selenium Grid, Test Design Considerations, Junit.	8	CO6
Books:			
Text Books:			
T1: Ron Patton,” Software Testing”, Pearson Educations, ISBN-978-0-672-32798-8. T2: M. G. Limaye,” Software Testing Principles, Techniques and Tools”, Tata McGraw Hill.			

ISBN-978-0070-139909 00-7013990-3

T3: A.B. Mathur, “Fundamental of software Testing”, Pearson. ISBN: 9788131794760

Reference Books:

R1: Srinivasan Desikan, Gopalswamy Ramesh, “Software Testing principles and Practices”, Pearson. ISBN- 97881-7758-1218

R2: Naresh Chauhan, “Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847.

R3: Stephen Kan, “Metrics and Models in Software Quality Engineering”, Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

CO314B: Advanced Database Management System		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Continuous Assessment:**	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: (if any) Database Management System

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Course Objectives:

1. To understand the fundamental concepts of parallel databases.
2. To provide a strong formal foundation in distributed database concepts, technology and practice.
3. To understand Database Architectures and Semistructured data storage techniques.
4. To learn and understand the concept of object oriented databases .
5. To learn and understand emerging trends of databases.
6. To learn various Big data technologies

Course Outcomes (COs):

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

Title	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the basic concept and use of parallel database systems.	2	Understand
2. Understand the basic concept and use of distributed database systems.	2	Understand
3. Design databases with semistructured database storage techniques.	3	Apply
4. Design application by using object oriented database concept.	3	Apply
5. Understand and apply the concept of different emerging database models for real time application development.	3	Apply
6. Understand and apply basic concepts of Bigdata and Hadoop for big data analytics.	3	Apply

Mapping of Course Outcomes to Program Outcomes(POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	2	--	--	--	--	--	2	3	2	2	2	--
CO2	2	--	--	2	--	--	--	--	--	2	2	2	1	2	--
CO3	1	--	--		--	--	--	--	--	3	2	2	2	3	1
CO4	2	--	--	2	--	--	--	--	--	3	2	2	1	3	1
CO5	2	--	--	2	--	--	--	--	--	3	2	2	2	3	2
CO6	2	--	--	2	--	--	--	--	--	3	2	3	2	3	--

Course Contents

Unit-I	**Parallel Databases**	**No.of Hours**	**COs**
	Introduction, Parallel database architecture, speedup, scale-up I/O parallelism, Inter-query and Intra-query parallelism, Inter-operational and Intra-operational parallelism, parallel query evaluation, Design of parallel systems, Implementation issues of Parallel query evaluation, Design of parallel systems, Comparison of Inter-query and Intra-query parallelism.	06 Hrs.	CO1
Unit-II	**Distributed Databases**	No.of Hours	COs
	Introduction, Study of DDBMS architectures, Comparison of Homogeneous and Heterogeneous Databases, Analysis of Concurrency control in distributed databases, Implementation of Distributed query processing. Distributed data storage, Distributed transactions, Commit protocols, Availability, Distributed query processing, Directory systems-ldap, Distributed data storage and transactions.	08 Hrs.	CO2
Unit-III	**Specialty Databases**	**No.of Hours**	**COs**

	Overview of client server architecture, Databases and web architecture, N-tier architecture, XML, Introduction, Structure of XML Data, XML Document Schema, DTD, Querying and Transformation: XQuery, FLOWR, XPath, XML validation, Web server, API to XML, Storage of XML Data, XML Applications: web services, Web based system, Implementation of XML validations, Use of web servers. XML and DTD implementation, Use of Web service like Amazon web service or Microsoft Azure.	06 Hrs.	CO3
Unit-IV	**Object Oriented Database**	**No.of Hours**	**COs**
	Introduction**,** Limitations of Relational databases, The need of Object oriented databases, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Data types (arrays, multi-set etc) and structure in Object oriented databases using SQL, Object-Identity and Reference Types in SQL, ODL and OQL, Implementing O-R Features, Persistent Programming Languages, Object-Oriented versus Object-Relational, An Example of Object oriented and object relational database implementation.	06 Hrs.	CO4
Unit-V	**Emerging Trends in databases**	**No.of Hours**	**COs**
	Multimedia database, Geography databases, Gnome databases, Knowledge databases, deductive databases and semantic databases, Spatial database, Information visualization, Mobile databases, Web databases (JDBC, ODBC), Personal databases, Digital libraries, Data grids, Wireless networks and databases.Distributed Caching, In-Memory databases, Graph databases- Neo4j.	06 Hrs.	CO5
Unit-VI	**Introduction to Big data and Hadoop**	**No.of Hours**	**COs**

	Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem- **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive**: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. **Hbase** : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. **Big SQL** : Introduction, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	08 Hrs.	CO6

Books:

Text Books:

T1: Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition

T2: Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.

Reference Books:

R1: Rob Coronel, Database systems: "Design implementation and management", 4th Edition, Thomson Learning Press

R2: Raghu Ramkrishnan, Johannes Gehrke, "Database Management Systems", Second Edition, McGraw Hill International Edition

R3: Channda Ray, Distributed Database Systems, Pearson.

R4: Saheed K. Rahimi, Distributed Database Systems, Wiley India.

R5: V.K. Jain, Big Data and Hadoop, Khanna Book Publishing, Delhi

CO314C: Wireless Sensor Network		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End-Sem Exam:**	**50 Marks**
	Continuous Assessment:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Digital Electronics and Data Communication, Computer Network

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Course Objectives:

1. To learn and understand Data Communication Concepts and Techniques.
2. To learn and understand different Wireless Communication Algorithms and Techniques.
3. To learn and understand different Concepts of WSN.
4. To learn and understand different protocols for Wireless Network
5. To learn and understand the functionalities of specialized protocols used in Wireless Network.
6. To learn and understand different applications in Wireless Network.

Course Outcomes (COs):

On successful completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand multiplexing techniques and wireless standards.	2	Understand
2. Understand wireless transmission and switching techniques.	2	Understand
3. Learn and understand wireless sensor network concepts.	2	Understand
4. Design, Setup, Install and configure Wireless Sensor Network.	3	Apply
5. Design and implement different routing algorithms for Wireless Network.	3	Apply
6. Develop different applications using Wireless Network.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3							1			3		
CO2	1		3							2	2		3		
CO3	1	3	3											3	
CO4	1		3									1		3	
CO5	1	1	2							2	2	1	3	1	1
CO6	1	1	3	1	1	1	1	1	1		1	1	3	1	1

Course Contents

Unit-I	**Introduction to Wireless Communication**	**No. of Hours**	**COs**
	Introduction, Multiplexing techniques: TDM, FDM, and CDMA, TD-SCDMA, LTETDD, LTE-FDD. LAN standards: Wireless LAN, WiMAX, ZigBee, Bluetooth, Infrastructure based (satellite N/W, Cellular N/W) and Infrastructure less (Adhoc N/W) wireless topologies, VLAN, VPN.	7 Hrs.	1
Unit-II	**Overview of Wireless Network**	**No. of Hours**	**COs**
	Wireless Transmission: Electromagnetic Spectrum, Radio, Micro Waves, Infrared, Light wave, Spread Spectrum Systems, modem Switching Techniques: Circuit Switching, Packet Switching and Message Switching. Hardware Components: Transceivers, Access Points and wireless routers.	7 Hrs.	2
Unit-III	**Basic Concepts of WSN**	**No.of Hours**	**COs**

	Background of Sensor Network Technology, Basic Overview of the Technology: Basic Sensor Network Architectural Elements, Typical sensing node, Brief Historical Survey of Sensor Networks. Applications of WSN: Building Automation, Sensors and Robots, Health Care and Military Applications. Basic WSN Technology: Sensor Node Technology, Hardware and Software, Sensor Taxonomy, Network Organization and Tracking. RFID based data communication, Architecture, Frame formats, CSMA/CA.	7 Hrs.	3
Unit-IV	**Data Link Layer**	**No.of Hours**	**COs**
	Link Layer: Error control, Framing, Link management. MAC Layer: Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols. Networking Sensors: ZigBee, Sensor MAC(S-MAC) protocol for WSN. Naming and Addressing: Fundamentals, Address and name management in wireless sensor networks.	7 Hrs.	4
Unit-V	**Routing Protocols**	**No.of Hours**	**COs**
	Routing Strategies (Proactive and Reactive), Geographic and Energy aware routing, Attribute based routing. Routing Techniques: Flooding, SPIN. Mobile Networking: Mobile IP, AODV, DSDV, DSR.	7 Hrs.	5
Unit-VI	**Applications of Wireless Network**	**No.of Hours**	**COs**
	Wireless Application Protocol (WAP),WML. Case Study: MANET, Cellular Network, Wireless Sensor Network, Military and Surveillance Applications.	7 Hrs.	6
Books:			

Textbooks:
T1: Kazim Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks: Technology, Protocols and Applications”, Wiley ISBN: 978-81-265-2730-4 (Students Edition). T2: Fang Zhaho, Leonidas Guibas, “Wireless Sensor Networks: An information Processing Approach”, Elsevier ISBN: 978-81-8147-642-5.
Reference Books:
R1: Holger Karl and Andreas Willig “*Protocols and Architectures for Wireless Sensor Networks”,* John Wiley & Sons, Ltd., ISBN: 0-470-09510-5. R2: Waltenegus Dargie,Christian Poellabauer, “ Fundamentals of wireless sensor networks Theory and practice”, John Wiley and Sons, Ltd., ISBN 978-0-470-99765-9.

CO315 : IoT Basics			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Digital Electronics, Computer Network

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Course Objectives:

1. To understand the functionalities of various single board embedded platforms fundamentals.
2. To introduce the working of Microcontrollers and its connectivity
3. To understand the basic concepts of IoT.
4 To recognize various sensors, actuators and how they are used.
5. To learn IoT networking and different IoT platforms.
6. To learn real world application scenarios of IoT.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1) Understand embedded platform fundamentals, operating systems for IoT systems.	2	Understand
2) Understand the System on chip and components used.	2	Understand
3) Compare the concepts of IoT with the Computer	2	Understand
4) Compare and understand the working of sensors and actuators	4	Analyse
5) Use the basic networking concepts and IoT platforms.	3	Apply
6) Demonstrate the different real applications using IoT.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	3	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	3	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	2	-	-	-	3	-

CO4	3	3	3	-	-	-	-	-	-	3	-	-	-	3	-
CO5	3	2	2	-	-	-	-	-	-	3	-	-	-	3	-
CO6	3	3	3	-	-	-	-	-	-	3	-	3	-	3	3

COURSE CONTENTS

Unit I	Introduction to Embedded Systems	No. of Hours	COs
	Embedded Systems: Introduction, Definition, Characteristics of Embedded System, Real time systems, Real time tasks, Processor basics: General Processors in Computer Vs Embedded Processors	6	CO1
Unit II	**System-On-Chip**	**No. of Hours**	**COs**
	Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.	6	CO2
Unit III	**IoT Concepts**	**No. of Hours**	**COs**
	IoT: Definition and characteristics of IoT, Internet of Things: Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks, Physical design of IoT: Things in IoT	6	CO3
Unit IV	**Sensors and Actuators**	**No. of Hours**	**COs**
	Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion, Logical design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT	6	CO4
Unit V	**Platforms for IoT**	**No. of Hours**	**COs**
	Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT communication models	6	CO5

	and IoT Communication APIs, Sensor Networks, IoT Design Methodology, Four pillars of IoT (M2M, SCADA, WSN, DCM)		
Unit VI	**IoT Application / Case study**	**No. of Hours**	**COs**
	Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry. Case Studies: Home Automation, Smart parking, Forest Fire Detection	6	CO6

Books:

Text Books(T):

T1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.

T2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition,Wiley Publication,ISBN: 978-1-119-99435-0

Reference Books(R):

R1: Dawoud Shenouda Dawoud, Peter Dawoud,Microcontroller and Smart Home Networks, ISBN: 9788770221566, e-ISBN: 9788770221559.

R2: Charles Crowell,IoT - Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT, ISBN-13 : 979-8613100194

R3: David Hanes,Gonzalo Salgueiro,Robert Barton,Jerome Henry -IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

R4: David Etter, IoT Security: Practical guide book, amazon kindle, ISBN: 1540335011.

R5: Brian Russell, Drew Van Duren, Practical Internet of Things Security - Second Edition,Packt Publishing , ISBN: 9781788625821

e-Books:

- https://www.iotforall.com/ebooks/an-introduction-to-iot
- https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies

MOOC/ Video Lectures available at:

- https://nptel.ac.in/courses/106/105/106105166/
- https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-

development/

- https://www.coursera.org/learn/iot
- https://nptel.ac.in/courses/108/108/108108098/

IT315: Object Oriented Programming with C++/Java		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**
Prerequisite Course: Computer Fundamentals & Programming		

Course Objectives

1. To understand the basics of object oriented programming paradigm and principles.
2. To understand classes and objects.
3. To understand inheritance and polymorphism.
4. To understand exception handling mechanisms.
5. To understand multithreading.
6. To understand the library.

Course Outcomes (COs):

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

	Course Outcome (s)	**Bloom's Taxonomy**	
		Level	**Descriptor**
CO1	**Understand** the basics of object oriented programming paradigm and principles..	**2**	**Understand**
CO2	**Use** classes and objects to write object oriented programs.	**3**	**Apply**
CO3	**Use** inheritance and polymorphism.	**3**	**Apply**
CO4	**Use** exception handling mechanism.	**3**	**Apply**
CO5	**Understand** multithreaded programming.	**3**	**Apply**
CO6	**Use** inbuilt library functions.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	1	2	2	-	-	3	-	-
CO2	2	2	3	-	1	-	-	1	2	2	-	-	3	-	-
CO3	2	2	3	2	1	-	-	1	2	2	1	-	3	-	2
CO4	2	-	3	-	1	-	-	1	2	2	1	-	3	-	2
CO5	2	-	2	2	1	-	1	1	2	2	1	-	3	-	2
CO6	2	-	2	2	1	1	-	1	2	2	1	3	3	-	2

Course Contents			
Unit-I	**Object Oriented Programming Paradigm and Principles**	**No. of Hours**	**COs**
	Procedure and object oriented paradigm, Basic Principles of Object Oriented Programming: Data abstraction and encapsulation, Inheritance, Polymorphism.	08	CO1
Unit-II	**CLASSES AND OBJECTS**	**No. of Hours**	**COs**
	Defining classes and objects, visibility, constructors, instance and static members, array of object.	08	CO2
Unit-III	**INHERITANCE AND POLYMORPHISM**	**No. of Hours**	**COs**
	Inheritance types, single inheritance, multiple inheritance, syntax, abstract class. Overloading and overriding functions/methods, dynamic polymorphism.	08	CO3
Unit-IV	**EXCEPTION HANDLING**	**No. of Hours**	**COs**
	Try-catch block, multiple catch, nested try catch, finally.	08	CO4
Unit-V	**MULTITHREADING**	**No. of Hours**	**COs**
	Introduction, main thread, creating child thread, inter-thread communication, synchronization.	08	CO4
Unit-VI	**LIBRARY**	**No. of Hours**	**COs**
	String, Stream, Standard Template Library/Networking, Date and Time.	08	CO6

Text Books:

1. E. Balagurusamy, "Object Oriented Programming with C++ and Java", 8th Edition, McGraw Hill.
2. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill, 2017.
3. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill, 2003.

Reference Books:

1. Bjarne Stroustrup, "C++ Programming Language", 4th Edition, Addison Wesley.
2. Somashekara M.T., "Object Oriented Programming with Java", PHI.
3. Vasapannarava, et al, "Object Oriented Programming Using C++ and Java" Pearson.

eLearning Resources

1. NPTEL Course: Programming in Java, https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2. NPTEL Course: An Introduction to Programming Through C++, https://onlinecourses.nptel.ac.in/noc22_cs42/preview
3. NPTEL Course: Advanced C++, https://onlinecourses.swayam2.ac.in/aic20_sp01/preview
4. NPTEL Course: Java Business Application, https://onlinecourses.swayam2.ac.in/aic20_sp14/preview
5. Tutorials: Java T Point, https://www.javatpoint.com/java-tutorial , https://www.javatpoint.com/cpp-tutorial

ET315 : Artificial Intelligence			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite : Basics of Statistic, Fundamentals of programming

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Course Objectives :

1. To learn key components of the Artificial Intelligence system.
2. To convey the ideas in AI research and programming language related to emerging technology.
3. To know the concepts of machine learning, pattern recognition, and natural language processing.
4. To elaborate the numerous applications and huge possibilities in the field of AI that go beyond the normal human imagination.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Course Outcome(s)Statement	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Demonstrate the key components of intelligent agents	**2**	**Understand**
CO2	Analyze various uninformed search and informed search strategies.	**4**	**Analyse**
CO3	Apply knowledge representation techniques and problem solving strategies to common AI applications.	**3**	**Apply**
CO4	Categorize different Learning Techniques	**4**	**Analyse**
CO5	Explain various pattern recognition techniques	**4**	**Analyse**
CO6	Review the components of Natural Language Understanding .	**5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	2	-	-	-	-	-	-	-	-	-	-
CO5	1	-	3	-	-	-	-	-	-	-	-	-	-	-

CO6	2	-	-	2	-	-	-	-	-	-	-	-	-	-

Course Contents

Unit-I	**Foundation**	No.of Hours	COs
	Intelligent Agents, Agents and environments, Good behavior, The nature of environments, structure of agents, Problem Solving, problem solving agents, example problems, Searching for solutions, uniformed search strategies, avoiding repeated states, searching with partial information.	8 Hrs.	**CO1**
Unit-II	**Searching Techniques**	No.of Hours	COs
	Search and exploration, Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP, Games: Optimal decisions in games, Alpha-Beta Pruning,	8 Hrs.	**CO2**
Unit-III	**Knowledge Representation**	No.of Hours	COs
	First order logic, representation revisited, Syntax and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining, Resolution, Knowledge representation.	8 Hrs.	**CO3**
Unit-IV	**Learning**	No.of Hours	COs
	Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning.	8 Hrs.	**CO4**
Unit-V	**Pattern Recognition**	No.of Hours	COs
	Basic steps of pattern recognition system, Principal Component Analysis,Linear Discriminant Analysis, Classification, Object Recognition- Template Matching theory,Prototype Matching Theory,Pattern Mining- Apriori Algorithm,Speech Recognition,	8 Hrs.	**CO5**
Unit-VI	**Natural Language Understanding**	No.of Hours	COs

	Why NL, Formal grammar for a fragment of English, Syntactic analysis, Augmented grammars, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding, Grammar induction, Probabilistic language processing, Probabilistic language models.	8 Hrs.	**CO6**

Books:

Text Books:

T1:Stuart Russell, Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education/Prentice Hall of India.
T2: Parag Kulkarni, Prachi Joshi, "Artificial Intelligence- Building Intelligent Systems" PHI Learning Pvt Ltd
T3:Munesh Chandra Trivedi " A classical approach to Artificial Intelligence" , Khanna Publishing House

Reference Books:

R1: Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd.
R2: George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI.
R3: Deepak Khemani, "A First Course in Artificial Intelligence", Mc Graw Hill Education(India), 2013, ISBN : 978-1-25-902998-1
R4: Chandra S. S.& H.S.Anand " Artificial Intelligence and Machine Learning" PHI Publishing
R5: R.B. Mishra "Artificial Intelligence" PHI Publishing.

Guidelines for Continuous Assessment:- Unit Test will be conducted for 10 marks and Related Online Courses on NPTEL/Coursera/Udemy/Simply learn platform will be completed for 10 marks

ME315 : ENTERPRISE RESOURCE PLANNING			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: (if any) Database Management System

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Course Objectives:

1. Basic concepts of ERP systems for manufacturing or service companies, and the differences among MRP, MRP II, and ERP systems;
1. Apply the principles of ERP systems, their major components, and the relationships among these components.
2. The knowledge of typical ERP systems, and the advantages and limitations of implementing ERP systems.
3. To comprehend the technical aspects of ERP systems
4. To be able to map business processes using ERP concepts and techniques

Course Outcomes (COs):

CO1. Classify different processes of the organization and relationship among all processes.
CO2. Examine systematically the planning mechanisms in an enterprise, and identify all components in an ERP system and the relationships among the components
CO3. To describe the Generic Model of ERP and General ERP Implementation Methodology
CO4. To apply the concepts of BPR, SCM
CO5. To demonstrate knowledge of SAP
CO6. To apply the concepts of CRM

Mapping of Course Outcomes to Program Outcomes(POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		01			03				02	01	02				
CO2		01			03				02	01	02				
CO3		01			03				02	01	02				
CO4		01			03				02	01	02				
CO5		01			03				02	01	02				
CO6		01			03				02	01	02				

Course Contents

Unit-I	**Introduction to Enterprise Resource Planning**	No.of Hours	COs
	Introduction of the term Business Process Reengineering(BPR) ,BPR Methodology, Current BPR Tools ,Introduction to material requirement planning (MRP), Definition of Enterprise Resource Planning (ERP); Evolution of ERP; Characteristics, Features, Components and needs of ERP; ERP Vendors; Benefits & Limitations of ERP Packages	03	CO1
Unit-II	**Enterprise Modeling and Integration of ERP**	No.of Hours	COs
	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration	03	CO2
Unit-III	**ERP Architecture and Implementation Methodology of ERP**	No.of Hours	COs
	Generic Model of ERP system; Core Modules functionality; Types of ERP architecture, Client Server Architecture, Web-based Architecture, Service Oriented Architecture (SOA) ; Difficulty in selecting ERP, Approach to ERP selection,General Implementation Methodology of ERP, Vanilla Implementation; Evaluation Criteria of ERP packages;	03	CO 3
Unit-IV	**Introduction to SAP**	No.of Hours	COs
	SAP, Integrated SAP Model, SAP Architecture, SAP R/3 System & mySAP, SAP Modules;	03	CO 4
Unit-V	**ERP for Supply Chain Managemen**t	No.of Hours	COs
	.Definition of Supply Chain Management (SCM); Supply Chain Council's SCOR Model; Stevens Model of Supply Chain Management; Aims of SCM; SCM Key,Benefits of SCM; ERP Vs SCM; Key SCM Vendors	03	CO 5
Unit-VI	**Customer Relationship Management**	No.of	COs

		Hours	
	Definition of Customer Relationship Management (CRM); CRM Evolution; CRM Delivery Processes, CRM support Processes; CRM Analysis Processes; CRM components	03	CO6

Books:

Text Books:

T1. Enterprise Systems For Management, Luvai F. Motiwalla, Jeff Thompson, Pearson Education., 2nd Ed., 2011. ISBN-10: 0132145766 | ISBN-13: 978- 0132145763

T2. Enterprise Resource Planning, Ravi Shankar, S.Jaiswal, Galgotia Publication Pvt. Ltd., 1st Ed., 1999. ISBN 81-203-0417-9

T3. Enterprise Resource Planning, second edition, Alexis Leon, Tata McGraw-Hill, 2008. ISBN 9780070656802

T4. Concepts in Enterprise Resource Planning, Third Edition,Bret Wagner & Ellen Monk©2009 | Course Technology ISBN 10: 1-4239-0179-7 | ISBN 13: 978-1-4239-0179-2

Reference Books:

R1. CRM at the speed of Light : Social CRM strategies, tools and techniques for engaging your customers : 4th edition by Paul Greenberg , McGraw Hill ,2009

R2. Supply Chain Management Casebook : The Comprehensive Coverage and Best Practices in SCM , by Chuck Munson , Pearson FT Press 2013, **ISBN**-13: 978-0- 13-336723-**2**

R3. Definitive Guide to Supply Chain Best Practices, The Comprehensive Lessons and Cases in Effective SCM , by Robert Frankel , Pearson FT Press , 2014

R4. Enterprise Resource Planning by Mary Sumner , Prentice Hall , 2005

EE315: Renewable Energy Systems

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
Tutorial: -- Hrs./Week	**In-Sem Exam:**	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**

Prerequisite Course:
1. Basic Mechanical Engineering & Basic Electrical Engineering

Course Objectives

1. To create awareness about the importance of renewable technology for sustainable future.
2. Impart the knowledge of solar power generation and wind power generation.
3. Introduce forth coming renewable technologies and storage systems in renewable generation

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Determine need of various power generation systems	2	Understanding
CO2	Relate solar power generation and its utilization.	3	Applying
CO3	Analyse wind power generation and its utilization.	4	Analysing
CO4	Explain biomass power generation and its utilization.	2	Understanding
CO5	Analyse trending renewable energy sources and energy storage systems.	4	Analysing
CO6	Relate principles of storage technologies and their applications	3	Applying

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1	1	3	3	-	-	-	1	3	2	3	-	2
CO2	3	2	1	2	1	2	2	-	-	-	1	2	2	3	1	2
CO3	3	2	1	2	1	2	2	-	-	-	1	2	2	3	1	2
CO4	3	2	1	2	1	2	2	-	-	-	1	2	2	3	1	2
CO5	3	1	1	1	1	1	1	-	-	-	1	1	2	2	1	1
CO6	3	1	1	1	1	1	1	-	-	-	1	1	2	2	1	1

Course Contents			
UNIT-I	**Introduction to Renewable Energy Systems**	**Hrs.**	**COs**
	Energy sources: classification of energy sources, introduction to renewable energy, renewable energy trends, and key factors affecting renewable energy supply, advantages and disadvantages of RES and their uses.	6	CO1
UNIT-II	**Solar Energy**	**Hrs.**	**CO**
	PV power generation, basic principle of power generation in PV cell, technology for fabrication of photovoltaic devices, efficiency of PV cell, characteristics curves of PV cell, solar thermal power generation, solar thermal conversion: basics, solar concentrator and tracking system, flat plate collectors-liquid and air type, theory of flat plate collectors, selective coatings, advanced collectors: ETC, Solar Pond	8	CO2
UNIT-III	**Wind Energy**	**Hrs.**	**CO**
	Power available in wind, wind turbine power & torque characteristics, types of rotors, characteristics of wind rotor, local effects, wind shear, turbulence & acceleration effects, measurement of wind, wind speed statistics, energy estimation of wind regimes, capacity factor, aerodynamics of wind turbines, airfoil, lift & drag characteristics, power coefficient & tip speed ratio characteristics, electrical generator machines in wind energy systems	8	CO3
UNIT-IV	**Biomass Energy**	**Hrs.**	**CO**
	Overview of biomass as energy source, biomass as a fuel, physicochemical and thermal characteristics of biomass as fuel, biochemical conversion of biomass for energy production, liquid biofuel, energy plantation- overview on energy plantation, basis of selecting the plants for energy plantation, waste land utilization through energy plantation.	8	CO4
UNIT-V	**Forthcoming Renewable Technologies**	**Hrs.**	**CO**
	Geothermal Energy Generation, ocean-thermal energy generation, tidal energy generation, magneto hydro dynamic power generation- working, layout, different components, advantages, limitations,	8	CO5
UNIT-VI	**Storage Technologies**	**Hrs.**	**CO**
	Introduction, need for storage for RES, basic thermodynamic and electrochemical principles, classification, traditional energy storage system-battery, fuel cell, principle of operation, types, applications for power generation.	8	CO6

Text Books:

[T1] Boyle, Godfrey, “Renewable Energy”, (2nd edition), Oxford University Press, 2004.
[T2] G. S. Sawhney, “Non-Conventional Resources of Energy”, PHI Publication 2012.
[T3] G.D. Rai, Non conventional energy sources, Khanna publication

References:

[R1] Gary-L. Johnson Wind Energy Systems Tata Mc-Graw-Hill Book Company.
[R2] S. P. Sukhatme, J. K. Nayak Solar Energy- Principles of Thermal Collection and Storage (3rd ed.), Tata McGraw-Hill Publication.
[R3] Paul Gipe Wind Power, Renewable Energy for Home, Farm, and Business.
[R4] G.N. Tiwari,Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa Publication

E-References

[1] https://nptel.ac.in/courses/121/106/121106014/
[2] https://nptel.ac.in/courses/103/103/103103206/
[3] https://onlinecourses.swayam2.ac.in/nou22_ge17/course

PR316 : Intellectual Property Rights and Entrepreneurship development			
Teaching Scheme		**Examination Scheme**	
Theory	**2 Hrs. / Week**	**In-Sem Exam:**	**15**
Credits:	**2**	**End-Sem Exam**	**25 Marks**
		Continuous Assessment:	**10**
		Total:	**50 Marks**

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Prerequisite Course: NIL

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Course Objectives:

1.To introduce student with IPR

2. To explain IPR procedure in India such as Patents, Designs and Trademarks

3. To make aware of the economic importance of IPRs.

4. To develop the ability to search and analyse the IPRs.

5. To Instill a spirit of entrepreneurship among the student participants.

6. To give insights into the Management of Small Family Business.

Course Outcomes (COs): After learning the course the learners will be able to,

Course Outcome(s)	Blooms Technology	
	Level	Descriptor
1. Understand patenting system	2	Create
2. Understand the procedure to file patent in India	2	Apply
3.Understanding of financial importance of IPR	2	Understand
4. Search and analyse the patents, designs and Trademarks	4	Analyse
5. Identify the Skill sets required to be an Entrepreneur.	4	Analyse
6. Understand the Role of supporting agencies and Governmental initiatives to promote Entrepreneurship.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			2			3		
CO2						2			2			3		
CO3						2			2			3		
CO4						2			2			3		
CO5						2	2	2			3			
CO6						2	2	2			3			

Course Contents

Unit 1	**Introduction to IPR**	**No.of Hours**	**COs**
	• Concepts of IPR • The history behind development of IPR • Necessity of IPR and steps to create awareness of IPR • Concept of IP Management • Intellectual Property and Marketing • IP asset valuation ● Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Cooperation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO	4	1
Unit-2	**Patents**	No.of Hours	COs
	• Introduction to Patents • Procedure for obtaining a Patent • Licensing and Assignment of Patents i. Software Licensing ii. General public Licensing iii. Compulsory Licensing • Infringement of Patents • Software patent and Indian scenario	4	2

Unit-3	**Designs**	No. of Hours	COs
	● Registrable and non-Registrable Designs ● Novelty & Originality ● Procedure for Registration of Design ● Copyright under Design ● Assignment, Transmission, License ● Procedure for Cancellation of Design ● Infringement ● Remedies	4 Hrs.	3
Unit 4	**Trademarks and Copyrights**	**No.of Hours**	**COs**
	A) **Trademarks** • Concept of trademarks • Importance of brands and the generation of "goodwill" • Trademark registration procedure • Infringement of trademarks and Remedies available • Assignment and Licensing of Trademarks **B) Copyright Right** ● Concept of Copyright Right • Assignment of Copyrights • Registration procedure of Copyrights • Infringement (piracy) of Copyrights and Remedies • Copyrights over software and hardware	4 Hrs.	4
Unit 5	**Entrepreneurship: Introduction**	**No.of Hours**	**COs**
	5.1 **Concept and Definitions**: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **5.2 Entrepreneurial Competencies:** The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow. 5.3 **Factor Affecting Entrepreneurial Growth:**	4	5

	Economic & Non-Economic Factors, EDP Programmes. **5.4 Steps in Entrepreneurial Process:** Deciding Developing Moving Managing Recognizing.		
Unit 6	**Resources for Entrepreneurship**	**No.of Hours**	**COs**
	6.1 Project Report Preparation: Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both Economic and Market Preparation projected financial statement. **6.2 Role of Support Institutions and Management of Small Business:** Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, State Financial Corporation (SFC) EPC, ECGC. **6.3 Various Governmental Initiatives:** Make in India Startup India Stand Up India Digital India Skill India **6.4 Case Studies of Successful Entrepreneurs**	4	

Text Books:

1. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, New Delhi
2. The Indian Patent act 1970.
3. The copyright act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. Intellectual Property Rights- A Primer, R. Anita Rao & Bhanoji, Rao, Eastern BookCo.

9. The Dynamics of Entrepreneurial Development & Management by Desai, Vasant, Himalaya Publishing House, Delhi.
10. Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition.
11. Cases in Entrepreneurship by Morse and Mitchell, Sage South Asia Edition.
12. Entrepreneurship – Indian Cases on Change Agents by K Ramchandran, TMGH.

Reference Books:

1. Handbook of Indian Patent Law and Practice,
2. Entrepreneurship: New Venture Creation by David H. Holt
3. Entrepreneurship Development New Venture Creation by Satish Taneja, S.L.Gupta
4. Project management by K. Nagarajan.

PR317 : Intellectual Property Rights and Entrepreneurship development Lab			
Teaching Scheme		**Examination Scheme**	
Practical	**2 Hrs. / Week**	**In-Sem Exam:**	**–**
Credits:	**1**	**Term Work**	**50 Marks**
		Continuous Assessment:	**–**
		Total:	**50 Marks**

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List of experiments: The term work shall consist following experiments/reports completed within the semester.

1. Searching for patent, design, trademarks, and copy rights at various databases and its report preparation.
2. Patent draft preparation for a sample invention
3. Design draft preparation for a sample design
4. Trademark draft preparation for a sample Trademark/Device
5. Copyright draft preparation for a sample documents/audio/video
6. Report preparation of patent Infringement
7. Preparation of Detailed project report for new business/industry/startup
8. Visit to industry to understand entrepreneurship and its report preparation

HS318: Corporate Readiness			
Teaching Scheme		**Examination Scheme**	
Lectures:	**1 Hrs. / Week**	**In-Sem Exam:**	**-**
Practical	**2 Hrs. / Week**	**Term Work**	**50**
Credits:	**2**	**Continuous Assessment:**	**-**
		Total:	**50**

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Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)

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Course Objectives:

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.

2. To develop required aptitude skills.

3. To design the functional and chronological resume.

4. To demonstrate the importance of critical thinking ability and expression in group discussions

5. To prepare students for the various professional interviews.

6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs): After successful completion of this course students should be able to

1. Interpret placement processes of various organizations and modern jobs search approach.

2. Summarize their skill set to be mentioned in the resume.

3. Develop the presentation skills and group discussion.

4. Apply critical thinking required to solve aptitude problems.

5. Conclude the situation based on the given dataset.

6. Prepare them ready for employment.

Course Contents

Unit-I	Placement Awareness	No.of Hours	COs
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures.	02 Hrs.	CO 1

Unit-II	Resume Writing	No.of Hours	COs
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit.	02 Hrs.	CO2

Unit-III	Group Discussion and Presentation skills	No.of Hours	COs
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion , do's and don'ts of GD and Presentation skills.	02 Hrs.	CO3

Unit-IV	Logical Reasoning I	No.of Hours	COs
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Attention to Details, Flowcharts ,Crypt arithmetic	06 Hrs.	CO4

Unit-V	Logical Reasoning II	No.of Hours	COs
	Data Interpretation, Data Sufficiency	04 Hrs.	CO5

Unit-VI	Logical Reasoning III	No.of Hours	COs
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle	06 Hrs.	CO6

Learning Resources :

Text Books:

T1 : A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal

T2: Reasoning verbal and non verbal by B. S. Sijwali.

Reference Books:

R1: Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)
R2: Analytical Reasoning by MK Panday
R3: Logical and analytical reasoning by k. Gupta
R4: Multi dimensional reasoning by Mishra & Kumar dr. Lal

E- Books : https://themech.in/quantitative-aptitude-and-logical-reasoning-books/ https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html
E-learning Resources/MOOCs/ NPTEL Course Links: (**1.** https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/ 2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/ 3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer

CO318: IoT Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Term Work**	**-**
Credits:	**1**	**Oral Examination**	**75**
		Total	**75**

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Prerequisite Course: Digital Electronics, Computer Network

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Course Objectives:

1. To understand functionalities of various single board embedded platforms fundamentals
2. To explore a comprehensive approach towards building small low cost embedded IoT systems.
3. To implement the assignments based on sensory inputs.
4. To explore the use of Cloud in IoT applications.
5. To understand remote handling of IoT applications using Web Interface.
6. To recognize importance of IoT in real-time application implementation

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. Understand embedded platform fundamentals, operating systems for IoT systems.	2	Understand
2. Use IoT embedded platforms for low cost IoT system implementations	3	Apply
3. Describe various IoT devices, embedded platforms, programming environments for IoT systems	2	Understand
4. Demonstrate the small system for sensor-based application.	3	Apply
5. Solve the problems related to the primitive needs using IoT.	3	Apply
6. Demonstrate IoT application for distributed environment.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	3	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	3	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	2	-	-	-	3	-

CO4	3	3	3	-	-	-	-	-	-	3	-	-	-	3	-
CO5	3	2	2	-	-	-	-	-	-	3	-	-	-	3	-
CO6	3	3	3	-	-	-	-	-	-	3	-	3	-	3	3

Suggested List of Assignment

Group A

1. Study of sensors and actuators used for IOT and create a report on it.
2. Identify different boards like Raspberry-Pi, Beagle bone, Arduino and other microcontrollers.
3. Study of different operating systems for Raspberry-Pi / Beagle bone / Arduino. Understanding the process of installing the OS on Raspberry-Pi / Beagle bone / Arduino.
4. Study of Connectivity and configuration of Raspberry-Pi / Beagle bone circuit with basic peripherals, LEDS. Understanding GPIO and its use in programs.
5. Survey of different commercial and open-source clouds, create a report on it.

Group B

6. Implementation of temperature control using Arduino Uno as master and ESP8266 sensor as slave and upload the data on think space.
7. Implementation of temperature control using Node MCU controller and upload the data on thin space.
8. Understanding the connectivity of Raspberry-Pi /Beagle bone circuit with IR sensor. Write an application to detect obstacles and notify users using LEDs.
9. Control different appliances through Node MCU using locally hosted websites.

Group C

10. Implementation of “Home Automation” using Raspberry-Pi.
11. Design any one IOT based application.

CO319: System Programming and Operating System Lab			
Teaching Scheme		**Examination Scheme**	
Lectures:	**2 Hrs. / Week**	**PR Exam:**	**75 Marks**
Credits:	1	**TW:**	
		Continuous Assessment:	
		Total:	**75 Marks**

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Prerequisite Course: System Programming and Operating System, Computer Organization and Architecture, Operating System and Administration, Data Structures

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Course Objectives:

1. To understand the design of two pass assemblers.
2. To learn design of two pass macro processor.
3. To get acquainted with tools like LEX & YACC.
4. To be familiar with Preemptive and Non-Preemptive Scheduling Schemes.
5. To acquire knowledge of UNIX system calls
6. To learn and understand noncontiguous memory allocation techniques like paging.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Design and Implement Two Pass Assembler	3	Apply
2. Design and Implement Two Pass Macroprocessor	3	Apply
3. Handle tools like LEX & YACC	3	Apply
4. Analyse and Implement Preemptive and Non-Preemptive process scheduling schemes	4	Analyse
5. Implement UNIX system calls	3	Apply
6. Demonstrate and Implement different page replacement policies	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	3	-	-	-	-	-	-	1	2	1	-
CO2	1	2	3	2	3	-	-	-	-	-	-	1	2	1	-
CO3	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
CO4	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
CO5	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
CO6	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-

Guidelines for Student Journal

The laboratory assignments are to be submitted by students in the form of journal. Journal consists of Certificate, Table of Contents, and **Handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Inputs and Outputs, Theory -Concept in brief, algorithm, flowchart, test cases, mathematical model (if applicable), conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy**

List of Assignments

1. Design suitable data structures and implement pass-I of a two-pass assembler for a pseudo-machine using object oriented features. Implementation should consist of a few instructions from each category and few assembler directives.
2. Implement Pass-II of two pass assembler for a pseudo-machine using object oriented features. The output of assignment-1 (intermediate file and symbol table) should be input for this assignment.
3. Design suitable data structures and implement pass-I of a two-pass macro-processor using OOP features.
4. Write a program for pass-II of a two-pass macro-processor. The output of assignment-3 (MNT, MDT and file without any macro definitions) should be input for this assignment.
5. Write a program using Lex specifications to implement lexical analysis phase of compiler to generate tokens of subset of ‘C’ program.
6. Write a program using YACC specifications to implement syntax analysis phase of compiler to validate type and syntax of variable declaration in C program.
7. Write a program using YACC specifications to implement the syntax analysis phase of the compiler to recognize simple and compound sentences given in the input file.
8. Write a program to implement following CPU scheduling algorithms: FCFS , SJF (Non Preemptive), Priority (Non-Preemptive) and Round Robin (Preemptive)
9. Implement UNIX system calls like ps, fork, join, exec family, and wait for process management (use shell script/ Java/ C programming).

10. Write a Program to implement page replacement simulation using following algorithms 1. FIFO 2. LRU and 3. Optimal
Books:
Text Books(T):
T1: John Donovan, “System Programming”, McGraw Hill, ISBN 978-0--07-460482-3. T2: Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4 T3: Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN 978-1-118-06333-0
Reference Books(R):
R1: Alfred V.Aho,Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles,Techniques and Tools”, Pearson,ISBN:978-81-317-2101-8 R2:John R. Levine, Tony Mason, Doug Brown, “Lex and Yacc”,O’Reilly & Associates,Inc,ISBN:1-56592-000-7

MC321: Mandatory Learning Course-VI			
Teaching Scheme		**Examination Scheme**	
Lectures:	**1 Hrs. / Week**	**In-Sem Exam:**	-
Credits:	**Non Credit**	**End-Sem Exam:**	-
		Continuous Assessment:	-
		Total:	-

Each individual has behavior patterns that are shaped by the context of his or her past. Most often, adapting the behavior to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression.

The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn the goal setting process and thus become more effective in achieving their goals.

The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team.

The specific objectives, however, are as follows.

1. To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.
2. To train the students for communicating effectively in both formal as well as in informal settings.
3. To help the students to understand the importance of non-verbal aspects of effective communication.
4. To help the students to understand Emotion and emotional intelligence, Managing one's' own emotional reservoirs, effective dealing with emotions at work
5. To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.

6. To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting.

The activities involved are designed to facilitate their career goal decision making. The activities to achieve the above objectives can be suggested as follows.

- Motivational lectures
- Group Discussions/activities
- Case Study
- Games/Stimulation Exercises
- Role-Playing
- Mindfulness training.

Suitable Technical / Non-Technical Activities finalized by Department: Department has flexibility to decide suitable activities.

CO2802: Big Data Engineering			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Structures, DBMS, Mathematical Foundation for SQL Data Science

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Course Objectives:

1. To understand the Big Data Platform and its Use cases.
2. To understand HDFS Concepts and Interfacing with HDFS.
3. To understand Map Reduce Jobs.
4. To provide hands on Hadoop EcoSystem.
5. Be familiar with Distributed Computing with Spark.
6. To learn MLlib and GraphX for graph-parallel computation.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
Identify Big Data and its Business Implications.	1	Remember
Understand various components of Hadoop and Hadoop Eco-System.	2	Understand
Understand the working environment of Map Reduce.	3	Understand
Understand Hadoop EcoSystem tools.	4	Understand
Understanding distributed computing techniques with Spark	3	Understand
Apply the Big data visualization tools like MLlib and GraphX.	2	Apply

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

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

CO6	2	1	1	-	-	-	-	-	-	-	-	1	1	2	2

COURSE CONTENTS

Unit I	Introduction	No. of Hours	COs
	Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights and Big Sheets.	6	CO1
Unit II	**HDFS(Hadoop Distributed File System)**	**No. of Hours**	**COs**
	The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	6	CO2
Unit III	**Map Reduce**	**No. of Hours**	**COs**
	Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	6	CO3
Unit IV	**Hadoop EcoSystem**	**No. of Hours**	**COs**
	Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, **Hive:** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, **Hbase:** HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. **ZooKeeper, NoSQL, Oozie, Flume, Sqoop.**	6	CO4
Unit V	**Big Data with Spark**	**No. of Hours**	**COs**
	Big Data with Spark, Spark RDD, Spark Streaming, Kafka, Spark R What is Spark SQL, Why Spark SQL, Distributed computing with Spark, Spark SQL architecture.	6	CO5
Unit VI	**MLlib and GraphX**	**No.of Hours**	**COs**
	MLlib Algorithms, MLWorkflow utilities: Feature transformations: standardization, normalization, hashing, ML Pipeline construction,	6	CO6

	Model evaluation and hyper-parameter tuning, ML persistence: saving and loading models and Pipelines. **GraphX** introduction, Programming, Property Graph, Graph Operators, Graph Builder, Vertex and and Edge RDDs, Optimized Representation, Graph Algorithm: Page Rank.		

Books:

Text Books(T):

T1:Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.

T2:Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

T3:Michael S. Malak and Robin East, "Spark GraphX in Action" Manning Publications, 2016.

Reference Books(R):

R1: Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

R2:Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

R3: Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

R4: Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

R5: Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

R6: Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.

R7: ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012

R8: Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

CO 2803: Big Data Engineering Lab			
Teaching Scheme		**Examination Scheme**	
Lectures:	**2 Hrs. / Week**	**Term Work**	**25 Marks**
Credits:	**1**	**End-Sem Exam:**	
		Continuous Assessment:	
		Total:	**25 Marks**

List of practical Experiments

1. Write a Hadoop MapReduce Program using Python.
2. Write a Hadoop Streaming Using Python – Word Count Problem.
3. Write a MapReduce Program – Finding The Average Age of Male and Female Died in Titanic Disaster.
4. Write a MapReduce Program – Weather Data Analysis For Analyzing Hot And Cold Days
5. Write a Matrix Multiplication With 1 MapReduce Step

Mini Project:

1. Credit Card Fraud Detection

Credit card frauds are more common than you think, and lately, they've been on the higher side. Figuratively speaking, we're on the path to cross a billion credit card users by the end of 2022. But thanks to the innovations in technologies like Artificial Intelligence, Machine Learning, and Data Science, credit card companies have been able to successfully identify and intercept these frauds with sufficient accuracy.Simply put, the idea behind this is to analyze the customer's usual spending behavior, including mapping the location of those spendings to identify the fraudulent transactions from the non-fraudulent ones. For this project, you can use either R or Python with the customer's transaction history as the dataset and ingest it into decision trees, Artificial Neural Networks, and Logistic Regression. As you feed more data to your system, you should be able to increase its overall accuracy.

2. Fake News Detection

We're sure fake news needs no introduction. In today's all connected world, it has become ridiculously easy to share fake news over the internet. Every once in a while, you can see false

information being spread online from unauthorized sources that not only cause problems to the people targeted but also has the potential to cause widespread panic and even violence.

To curb the spread of fake news, it is crucial to identify the authenticity of the information, which can be done using this Data Science project. For this, you can use Python and build a model with TfidfVectorizer and PassiveAggressiveClassifier to separate the real news from the fake one. Some of the Python libraries suited for this project are pandas, NumPy, and scikit-learn, and for the dataset, you can use News.csv.

3. Driver Drowsiness Detection

Road accidents take many lives every year, and one of the causes of road accidents is sleepy drivers. Being a potential cause for danger on the road, one of the best ways to prevent this is to implement a drowsiness detection system.A driver drowsiness detection system such as this is yet another project that has the potential to save many lives by constantly assessing the driver's eyes and alerting him with alarms in case the system detects frequent closing of eyes.

A webcam is a must for this project to allow the system to periodically monitor the driver's eyes. To make this happen, this Python project will require a deep learning model and libraries such as OpenCV, TensorFlow, Pygame, and Keras.

Reference:

1. https://intellipaat.com/blog/10-big-data-examples-application-of-big-data-in-real-life/
2. https://towardsdatascience.com/12-cool-data-science-projects-ideas-for-beginners-and-experts-fc75b5498e03
3. https://data-flair.training/blogs/data-science-project-ideas/
4. https://www.geeksforgeeks.org/matrix-multiplication-with-1-mapreduce-step/?ref=lbp

CO1802: Python for Artificial Intelligence and Machine Learning			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**4**	**End-Sem Exam:**	**50 Marks**
		Continuous Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Python, Mathematical Foundations for Artificial Intelligence and Machine Learning

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Course Objectives:

1. To understand the use of python to solve real world problems based on Artificial Intelligence and Machine Learning.
2. To get well versed with different python libraries suitable for machine learning.
3. To learn evaluation of models.
4. To use different python libraries for data analysis.
5. To learn various machine learning algorithms used for classification, regression, clustering.
6. To design a Chat bot for any application.

Course Outcomes:

On completion of the course, students will be able to-

	Course Outcomes	**BTL**	**Blooms Taxonomy Descriptor**
CO1	**Understand** basic concepts in python.	2	Understand
CO2	**Understand** use of different libraries in python so as to implement artificial intelligence and machine learning problems	2	Understand
CO3	**Design** different models using regression techniques.	3	Apply
CO4	**Design** different models using clustering, classification techniques.	3	Apply
CO5	**Design** different models using Ensemble Techniques.	3	Apply
CO6	**Learn** use of NLP in Artificial Intelligence.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	2	1	-	2	-	-	-	-	-	-	2	-	2	2
CO3	2	2	3	2	2	1	-	-	-	-	-	2	1	2	2
CO4	2	2	3	2	2	1	-	-	-	-	-	2	1	2	2
CO5	2	2	3	3	2	1	-	-	-	-	-	2	1	2	2
CO6	2	2	3	2	3	1	-	-	-	-	-	2	1	2	2

COURSE CONTENTS

Unit I	**Python Basics**	**No of Hrs**	**COs**
	String object, List object, Tuples, Sets, Dictionary, Function, Parameter passing, Iterator, Lambda Function, Map function, Reduce function, OOPS concept, Working with files.	06	CO1
Unit II	**Dealing with data in python**	**No of Hrs**	**COs**
	Data analysis with Pandas; Data Manipulation with Numpy, Visualization of Data using Matplotlib, Seaborn, Plotly, MySql, Mongodb, Flask introduction.	06	CO2
Unit III	**Regression Techniques using Python**	**No of Hrs**	**COs**
	Introduction, Train, Test and Validation Split, Overfitting ,Underfitting, Gradient Descent, Polynomial Regression, Logistic Regression, Ridge Regression, Lasso Regression, Precision, Recall, F-score, ROC curve, Sklearn library.	06	CO3
Unit IV	**Clustering and Classification Techniques using Python**	**No of Hrs**	**COs**

	K-Means Clustering, Hierarchical Clustering, DBSCAN clustering, K-Nearest Neighbour for classification, Decision Trees, Logistic Regression for classification, Naive Bayes classifier, Model Evaluation.	06	CO4
Unit V	**Ensemble Techniques using Python**	**No of Hrs**	**COs**
	Decision Tree Regressor, Cross validation, Bias & Variance, Ensemble approach, bagging, Boosting, Stacking, Random Forest classifier, XGBoost, Gradient boost, Ada boost.	06	CO5
Unit VI	**Natural Language Processing**	**No of Hrs**	**COs**
	Introduction to phases of NLP, Analyzing Text with NLTK, POS Tagging, Information retrieval, Sentiment Analysis, Chatbot using Dialogflow/ Amazon Lex	06	CO6

Books

Text Books(T):

T1. Prateek Joshi, Artificial Intelligence with Python: A Comprehensive Guide to Building intelligent Apps for Python Beginners and Developers.

T2. Andreas C. Müller, Srah Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists.

eference Books(R):

R1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited, I SBN10: 1785889621, ISBN-13: 978-1785889622.

R2. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, O'Reilly Media, Inc., ISBN: 9780596516499

CO1803: Python for Artificial Intelligence and Machine Learning Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Term Work**	25
Credits:	**1**	**Oral Examination**	-
		Total	25

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Prerequisite Course: Python, Mathematical Foundations for Artificial Intelligence and Machine Learning ,

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Course Objectives:

1. To use python to solve real world problems based on Artificial Intelligence and Machine Learning.
2. To use different python libraries suitable for machine learning.
3. To learn the evaluation of the models designed.
4. To compare results of different algorithms.
5. To use various machine learning algorithms used for classification, regression, clustering.
6. To learn how to design a chat bot.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. **Use** Numpy library, Pandas, matplotlib for performing a wide variety of operations on data and visualizing the result.	3	Apply
2. **Design** different models for classification, regression, clustering applications.	3	Apply
3. **Design** a chat bot for any real world application.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) and Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	-	2	1	-	1
CO2	2	2	2	1	2	-	1	-	1	-	-	2	1	2	2
CO3	1	2	2	1	3	1	1	1	-	1	-	2	1	2	1

Suggested List of Assignments

[Students have to complete all the assignments towards the successful completion of Term Work, where all the implementation and design assignments are compulsory]

Group A

1. Write a NumPy program to compute the cross product of two given vectors. Crosscheck your result without using Numpy.

Suppose, a fruit-seller sold 20 mangoes and 10 oranges in one day for a total of $350. The next day he sold 17 mangoes and 22 oranges for $500. If the prices of the fruits remained unchanged on both the days, what was the price of one mango and one orange? Solve the given problem using Numpy library in python.

2. Write a Python program using matplotlib to create a pie chart of gold medal achievements of five most successful countries in 2018 Winter Olympics. Read the data from a csv file.

3. Write a Pandas program to add leading zeros to the integer column in a pandas series and makes the length of the field to 8 digit. Use Lambda function.
4. Write a Pandas program to create
   a) Datetime object for March 25 2022.
   b) Specific date and time of 9:05am.
   c) Local date and time.
   d) A date without time.
   e) Current date.
   f) Time from a datetime.
   g) Current local time.

Group B

1. Write a Python program to load the iris data from a given csv file into a dataframe and print the shape of the data, type of the data and first 3 rows. Also get the number of observations, missing values and NAN values.

2. Write a Python program to split the iris dataset into independent and dependent variables. Further using Scikit-learn to split the iris dataset into 70% train data and 30% test data. Print both datasets.

   Train or fit the data from the above assignment into the model and calculate the accuracy of the model using the K Nearest Neighbor Algorithm.
3. Write a Python program to create a scatter plot using sepal length and petal_width to separate the Species classes.
   Develop an elementary chatbot for suggesting investment as per the customers' needs.

Mini Project:

All the students will be divided among groups. Each group has to implement one mini project.

Build the Logistic regression model using scikit-learn in Boston data to predict 'Price' based on other dependent variables. Compare your results with the Linear regression model used for the same dataset.

Predicting Survival in the Titanic Data Set. Use a decision tree to make predictions about the Titanic data set from Kaggle. This data set provides information on the Titanic passengers and can be used to predict whether a passenger survived or not. (You use only Pclass, Sex, Age, SibSp (Siblings aboard), Parch (Parents/children aboard), and Fare to predict whether a passenger survived.)

Car Price Prediction using suitable Ensemble technique. Download relevant data set. Also print the confusion matrix.

Sports prediction is usually treated as a classification problem, with one class (win, lose, or draw) to be predicted. In sports prediction, large numbers of factors including the historical performance of the teams, results of matches, and data on players, have to be accounted for to help different stakeholders understand the odds of winning or losing. Download tennis data from the ATP World Tour website. Use a suitable algorithm.