T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Theory of Computer Science							**Course Code:** PCC-CS501		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	1	-	4	4	25	75	-	25	**125**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basic Mathematics									

Course Objective: The Objective of this course is to deliver the fundamental concepts of theory of computation describing formal mathematical models of computation such as FA,PDA,LBA and TM by comparing their power, limitations, languages and their applications in computation and complexity theory and also to learn that not all problems are solvable by computers.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Describe formal models of computation, such as finite automata, pushdown automata, and Turing machines.	L1, L2, L3
2	Design Finite Automata's for different Regular Expressions and Languages.	L1, L2, L3
3	Compare different types of Grammars and design context free grammars for formal languages.	L1, L2, L3
4	Construct and analyze Push Down automata and Turing Machine for formal languages.	L1, L2, L3,L4
5	Classify machines by their power to recognize languages.	L1, L2, L3,L4
6	Express the understanding of the decidability and decidability problems.	L1,L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Concepts and Finite Automata** **Basic Concepts:** Alphabets, Strings, Languages, Closure properties. **FA without output:** Finite Automata (FA), Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA): Definitions, transition diagrams and Language recognizers , NFA to DFA Conversion,	9	L1, L2, L3

	Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of DFA. **FA with output:** Definition and construction of Moore and Mealy machines and Equivalence ,Applications and limitations of FA.		
2	**Regular Expressions and Languages** **Regular Expression (RE):** Equivalence of RE and FA, Arden's Theorem, RE Applications. Grammars and Chomsky hierarchy. **Regular Language (RL):** Proving languages to be Nonregular -Pumping lemma and Closure properties of regular languages.	6	L1,L2, L3
3	**Context Free Grammar** Definition, Sentential forms, Leftmost and Rightmost derivations, Parse tree, Ambiguity. Simplification and Applications. Normal Forms: Chomsky Normal Forms (CNF) and Greibach Normal Forms (GNF), CFLs - Pumping lemma, Closure properties	7	L1,L2, L3
4	**Push Down Automata** Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Deterministic PDA , Non-Deterministic PDA , Equivalence of CFG and PDA, Application of PDA	7	L1, L2,L3,L4
5	**Turing Machine** Definition, Transitions, Design of TM as generator, decider and acceptor. Variants of TM: Multitrack, Multitape , Universal TM, Equivalence of Single and Multi Tape TMs. Applications, Power and Limitations of TMs.	10	L1, L2, L3,L4
6	**Undecidability** Properties of recursive and recursively enumerable languages, Decidability and Undecidability , Halting problem , Linear bounded automata (LBA), Rice's Theorem , Post's correspondence problem (PCP).	6	L1, L2
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Introduction to Automata Theory, Languages and Computation	John. E. Hopcroft, Rajeev otwani, J. D. Ullman,	Pearson Education Asia	3rd Edition	2006
2	Elements of the Theory of computation	H.R. Lewis and C.H.Papadimitrou	Prentice Hall Inc	2nd Edition	1997
3	Introduction to languages and the Theory of Computation	John C Martin	TMH	4th Edition	2010
4	Introduction to Computer Theory	Daniel I.A. Cohen	John Wiley	2nd Edition	2007

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.coursera.org	https://www.coursera.org/learn/cs-algorithms-theory-machines	M6
2	nptel.ac.in	https://nptel.ac.in/noc/individual_course.php?id=noc16-cs14	M1-M6

List of Tutorials:

Sr. No.	Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Tutorial on Construction of Finite Automata.	1	L1, L2, L3
2	Tutorial on Regular Expression.	1	L1, L2, L3
3	Tutorial on Regular Expression to Non-Deterministic Finite Automata.	1	L1, L2, L3
4	Tutorial on Conversion of NFA to DFA.	1	L1, L2, L3
5	Tutorial on Construction of Mealy and Moore Machine.	1	L1, L2, L3
6	Tutorial on Construction of CFG and Derivations.	1	L1, L2, L3
7	Tutorial on Simplification of Context Free Grammar.	1	L1, L2, L3
8	Tutorial on Conversion of CFG into Normal Forms (CNF & GNF).	1	L1, L2, L3
9	Tutorial on Construction of PDA.(I)	1	L1, L2, L3
10	Tutorial on Construction of PDA.(II)	1	L1, L2, L3
11	Tutorial on Application of Pumping Lemma.	1	L1, L2, L3
12	Tutorial on Conversion of CFG to PDA.	1	L1, L2, L3
13	Tutorial on Construction of Turing Machine.(I)	1	L1, L2, L3, L4
14	Tutorial on Construction of Turing Machine (II)	1	L1, L2, L3, L4
15	Tutorial on Post Correspondence Problem.	1	L1, L2
	Total Hours	**15**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Introduction to Intelligent System							**Course Code:** PCC-CS502		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Computer and Programming Basics									

Course Objective: To make students understand and explore the techniques underlying the design of Intelligent Systems.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand different types of AI agents.	L1, L2
2	Understand AI building blocks presented in intelligent agents.	L1, L2
3	Understand and Apply various AI search algorithms uninformed, informed, local, adversarial and backtracking search algorithms to real-world problems.	L1, L2, L3
3	Analyze AI approaches for knowledge representation and Uncertain knowledge and reasoning.	L1, L2, L3
4	Understand and apply methods for solving Constraint Satisfaction Problems.	L1, L2, L3
5	Understand various types of planning and forms of learning. Apply decision tree learning to a given problems.	L1, L2, L3
6	Understand various sub areas of Intelligent Systems.	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction, History of Artificial Intelligence, Intelligent System Categorization, Components of AI, Foundations of AI, Applications of AI, Current trends in AI.	4	L1, L2
2	**Intelligent Agents**	4	L1, L2

	Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.		
3	**Problem Solving and Search** Problem Solving Agent, Formulating Problems, Example Problems, Uninformed Search Methods, Informed Search Method, Local Search Methods, Genetic algorithms, Adversarial Search, Constraint Satisfaction Problems	10	L1, L2, L3
4	**Knowledge and Reasoning** Knowledge based Agents, The Wumpus World, The Propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification, Resolution, Uncertain knowledge and reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Inference in belief network	10	L1, L2, L3
5	**Planning and Learning** The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning. Learning: Forms of Learning, Inductive Learning, Learning Decision Tree, Expert System: Introduction, Phases in building Expert Systems, ES Architecture, ES vs Traditional System	9	L1, L2, L3
6	**Sub Areas of Intelligent Systems** Artificial Neural Network, Fuzzy Systems, Natural Language Processing, Robotics	8	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Artificial Intelligence a Modern Approach	Stuart J. Russell and Peter Norvig	McGraw Hill	3rd Edition	2009
2	A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education (India)	1st Edition	2013
3	Artificial Intelligence and Intelligent Systems	N. P. Padhy	Oxford	1st Edition	2005
4	Artificial Intelligence	Elaine Rich and Kevin Knight	Tata McGraw-Hill Education Pvt. Ltd.	3rd Edition	2008
5	Artificial Intelligence	Rob Callan	Palgrave macmillan	1st Edition	2003

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	nptel.ac.in	https://nptel.ac.in/courses/106102220/	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	Specify problem formulation for an AI problem and Implement the same.	2	L1, L2
2	Design Experiments	Apply uninformed search on given problem.	2	L1, L2, L3
3		Apply informed search on given problem.	2	L1, L2, L3
4		Apply Adversarial Search on given problem.	2	L1, L2, L3
5		Apply genetic algorithm on given problem.	2	L1, L2, L3
6		Apply Minimax with Alpha-Beta Pruning on given problem.	2	L1, L2, L3
7		Apply Backtracking Search on given problem.	2	L1, L2, L3
8		Solve a reasoning problem using unification.	2	L1, L2, L3
9		Apply Decision Tree Learning on given problem.	2	L1, L2, L3
10	Case Studies and Mini Project	Game Development Smart Apps Chatbot Prediction Systems Intelligent Systems	12	L1, L2, L3,L4,L5, L6
	Total Hours		30	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Software Engineering							**Course Code:** PCC-CS503		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Object Oriented Programming, Frontend Backend connectivity									

Course Objective: The objective of the course is to introduce to the students about the development of software product, the processes that provides a framework for the engineering methodologies and practices. Also to give the information regarding the phases including the analysis, design, testing methodologies and quality assurance.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the use of basic and advanced models in software engineering	L1, L2
2	Analyze the scenarios to design the UML diagrams	L1, L2, L3,L4
3	Understand and apply the different techniques of project estimation an understand the tracking methods	L1, L2, L3,L4
4	Understand the design concepts and apply them to the project	L1, L2, L3,L4
5	Identify risks, manage the change to assure quality in software project.	L1, L2, L3,L4
6	Apply the principles of testing and develop test plan for the project	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Introduction to software engineering, Importance of Software engineering Software Process, Various models for Software Development (Waterfall, Spiral, Agile (Scrum), V-Model, RAD, DevOps), Capability Maturity Model (CMM).	6	L1, L2,L3

2	**Requirements Analysis and Modelling** Requirement Elicitation, Software requirement specification (SRS),Data Flow Diagram(DFD), Feasibility Analysis, Cost- Benefit Analysis, Developing Use Cases (UML), Requirement Model – Scenario-based model, Class-based model, Behavioral model.	8	L1, L2, L3,L4
3	**Project Scheduling and Tracking** Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO II Model Project scheduling: Timeline charts, CPM	4	L1, L2, L3,L4
4	**Software Design** Design Concepts, Characteristics of Good Design, Effective Modular Design – Cohesion and Coupling. Architectural Styles, UI Design	8	L1, L2, L3
5	**Software Risk, Configuration Management & Quality Assurance** Risk Identification, Risk Assessment, Risk Projection, RMMM, Software Configuration management , Software Quality Assurance: Software Reliability, Formal Technical Review (FTR), Walkthrough	8	L1, L2, L3,L4
6	**Software Testing and Maintenance** Software Testing, Unit testing, Integration testing Verification, Validation Testing, System Testing, Test plan, White-Box Testing , Basis Path Testing, Control Structure Testing, Black-Box Testing, Software maintenance and its types, Software Re-engineering, Reverse Engineering	11	L1, L2, L3,L4
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Software Engineering: A Practitioner‘s Approach"	Roger Pressman	McGraw-Hill Publications	Sixth Edition	2009
2	Software Engineering	Ian Sommerville	Pearson Education	9th Edition	2017
3	Software Engineering Fundamentals	Ali Behfrooz and Fredeick J.Hudson,	Oxford University Press	1st edition	1997
4	Software Engineering – Concepts and Practices	Ugrasen Suman	Cengage Learning	1st edition	2012
5	An integrated approach to Software Engineering	Pankaj Jalote	Springer/Narosa	1st edition	2012

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/sdlc/sdlc_overview.htm	M1-M6
2	www.guru99.com	https://www.guru99.com/software-testing-introduction-importance.html	M1-M3,
3	www.tutorialspoint.com	https://www.tutorialspoint.com/software_testing/software_testing_qa_qc_testing.htm	M4,M6

4	https://en.wikipedia.org	https://en.wikipedia.org/wiki/DevOps	M1

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	**Basic Experiments**	Apply the knowledge of SRS and prepare Software Requirement Specification (SRS) document in IEEE format for the project	2	L1, L2, L3
2		Sketch a DFD (up to 2 levels)	2	L1, L3
3	**Design Experiments**	Sketch UML Use case Diagram for the project.	2	L1, L3
4		Sketch a Class Diagram for the project.	4	L1, L3
5		Sketch Activity, State Transition diagram for the project.	4	L1, L3
6		Sketch Sequence and Collaboration diagram for the project	4	L1, L3
7		Use project management tool to prepare schedule for the project.	2	L1, L3
8		Change specification and use any SCM Tool to make different versions	2	L1, L3
9		Design test cases and generate test scripts in Selenium	4	L1, L2, L3
10	**Mini/Minor Projects/ Seminar/ Case Studies**	**Mini Project:** 1. Online banking system 2. Online hotel management system 3. Online sales Order Processing and Invoicing	4	L1, L2, L3, L4
		TotalHours	**30**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Microprocessor							**Course Code**: PCC-CS504		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basic Mathematics									

Course Objective: The course intends to introduce basic and advanced software and hardware architecture of Intel X86 processors, use of assembly language and mixed mode programming. It also introduces microcontroller and its applications.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Describe 16-bit architecture of 8086 Microprocessor.	L1, L2
2	Apply the assembly and mixed language programming to develop small embedded application.	L1, L2, L3
3	Sketch 8086 based system using memory and peripheral chips.	L1,L2, L3
4	Analyze the role of 32bit microprocessor architecture over 16 bit architecture.	L1,L2,L3,L4
5	Compare Pentium family microprocessors.	L1, L2, L3,L4
6	Differentiate between microprocessor and microcontroller.	L1, L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Intel 8086 Microprocessor** Architecture of 8086 processor , Register set, Memory segmentation, Functional Pin Diagram, Operating Modes, Minimum mode 8086 system and Timing diagrams , Maximum mode 8086 system and Timing diagrams.	8	L1, L2

2	**Instruction set and Assembly Language Programming** Instruction set, Addressing Modes, Assembler Directives, Macros and Procedure, Assembly Language Programming, Mixed Mode programming	6	L1, L2, L3
3	**Memory and Peripheral Interfacing with 8086** Memory Interfacing - RAM and ROM 8259 PIC – Interrupt, Types of Interrupts, Interrupt Service Routine, Interrupt Vector Table, Block Diagram of 8259, Interfacing the 8259 in single and cascaded mode with 8086. 8255 PPI - Block diagram, Command word format, Interfacing 8255 with 8086.	8	L1,L2, L3
4	**Intel 80386DX Processor** Architecture of 80386DX processor, Register Organization, Operating Modes: Real Mode, Protected Mode And Virtual 8086 Mode, Protected mode Address Translation mechanism: Segmentation and Paging.	8	L1,L2,L3,L4
5	**Pentium Family processors** Superscalar architecture, Super pipelining, Data flow architecture, Comparative study of Pentium family processors.	7	L1, L2, L3,L4
6	**The Microcontroller 8051** Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Serial communication, Interrupts	8	L1, L2,L3,L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	8086/8088 family: Design Programming and Interfacing	John Uffenbeck	PHI	First Edition	2009
2	Advanced Microprocessors and Peripherals	K M Bhurchandani, A k Ray	McGraw Hill	Third Edition	2006
3	The 80386DX Microprocessor: hardware, Software and Interfacing	Walter A Triebel	Prentice Hall	First Edition	1992
4	Pentium Processor System Architecture	Tom Shanley & Don Anderson	Addison-Wesley	Fourth Edition	2008
5	Intel Microprocessors	Barry B. Brey	Pearson Education India	Eighth Edition	2009
6	Microprocessor and Interfacing	Douglas Hall	Tata McGraw Hill	Third Edition	2006
	IBM PC Assembly language and Programming	Peter Abel	PHI	Fifth edition	2002
7	The 8051 microcontroller and embedded systems	Mazidi Ali, Muhammad Mazidi Gillispie Janice	PHI	Second Edition	2012

8	The 8051 Microcontroller: Architecture, Programming, and Applications	Kenneth Ayala J	Thomson Delmar learning	Second Edition	1996

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.datasheetspdf.com	https://datasheetspdf.com/pdf/544568/Intel/8086/1	M1, M2, M4
2	nptel.ac.in	https://nptel.ac.in/courses/106108100/	M1,M2,M3, M4,M5
3	www.alldatasheet.com	https://www.alldatasheet.com/view.jsp?Searchword=80386D&sField=2	M4

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Apply Assembly Language Programing to enter and display 8 bit & 16 bits number	2	L1, L2, L3
2		Apply Assembly Language Programing to covert HEX to BCD and BCD to HEX.	2	L1, L2, L3
3	**Design Experiments**	Apply Assembly Language Programing to perform addition and subtraction of two 16 bits numbers using macros and procedure. (Menu Based).	2	L1,L2,L3
4		Apply Assembly Language Programing to perform string operations. (i)Accept, (ii) Display, (iii) Concatenation (iv) Compare	2	L1,L2,L3
5		Make use of 8086 Trainer kits in: 1. Hexkey pad Mode 2. Serial Mode	4	L1,L2,L3
6		Illustrate Interfacing on Intel 8086 with 8255-Programmable Peripheral Interface.	2	L1,L2,L3,L4
7	**Advanced Experiments**	Apply Mixed Language Programing to design a calculator.	2	L1,L2,L3
8		Develop program to interface mouse driver/keyboard/printer drivers.	4	L1,L2,L3,L4
9	**Mini/Minor Projects/ Seminar/**	1. Demonstrate PC-to-PC Communication via RS-232 Serial Port. 2. Develop an application on Mixed mode programming. 3. Develop an application using Arduino Controller. 4. Develop an application using Raspberry-PI.	6	L1,L2,L3,L4

10	**Case Studies/ Group Presentation**	1. Compare Multicore processors i3,i5, i7. 2. Compare Von Neumann , Hardwired and Data flow architecture 3. Recent development in hardware components.	4	L1,L2,L3,L4
	Total Hours		**30**	

T.E. Semester –V

B.E. (Computer Engineering)							T.E. SEM: V		
Course Name: Professional Elective 1(Advanced Operating System)							**Course Code:** PEC-CS5011		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Computer and Programming Basics									

Course Objective: To make students understand and explore the techniques underlying the design and implementation of various concepts of advance operating system.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Demonstrate understanding of design issues of Advanced operating systems and compare different types of operating systems.	L1, L2, L3
2	Analyse design aspects and data structures used for file subsystem, memory subsystem and process subsystem of Unix OS	L1, L2, L3, L4
3	Demonstrate understanding of different architectures used in Multiprocessor OS and analyse the design and data structures used in Multiprocessor operating systems.	L1, L2, L3, L4
4	Differentiate between threads and processes and compare different processor scheduling algorithms used in Multiprocessor OS	L1, L2, L3, L4
5	Classify Real Time OS and analyse various real time scheduling algorithms.	L1, L2, L3, L4
6	Explore architectures and design issues of Mobile OS,Virtual OS, Cloud OS.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction** Functions of operating systems, Design approaches: layered, kernel based and virtual machine approach, types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS)	4	L1, L2, L3
2	**Unix Kernel and File Management**	4	L1, L2, L3, L4

	System Structure, User Perspective, Architecture of Unix Operating System, Buffer cache: Header, Buffer Pool, Retrieving, Reading and Writing Buffer, File Representation: inodes: Structure of file Directories, Path conversion to inode, superblock, inode assignment, allocation of disk blocks		
3	**Unix Process and Memory management**	10	L1, L2, L3, L4
	Detailed design of Process Structure: Kernel Data structures for process, Structure of Uarea and Process table, Process states and Transitions, Context of a Process: Static and Dynamic area of context, Saving the Context Layout of System Memory, Regions, Mapping regions with Process, page table and mapping virtual address to physical address.		
4	**Distributed Operating system concepts**	10	L1, L2, L3, L4
	Goals, Distributed Computing Models, Hardware Concepts, Software Concepts, Architecture of DOS. Design Issues: Transparency, Flexibility, Scalability, Reliability, Performance, fault tolerance		
5	**Multiprocessor Operating System**	9	L1, L2, L3, L4
	Introduction, Basic multiprocessor system architectures, design issues, Threads, Process synchronization: the test and set instruction, the swap instruction, implementation of the process wait, Processor scheduling: Issues, Co-scheduling, Smart scheduling, Affinity Based scheduling		
6	**Real Time Operating Systems and Mobile OS**	8	L1, L2, L3
	Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems, Scheduling in RTOS: Clock driven cyclic, Event driven: EDF and rate monotonic scheduling. Mobile OS: Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues		
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Distributed Systems: Principles and Paradigms	Andrew S. Tanenbaum and Maarten Van Steen	Pearson Education	2nd edition	2016
2	Real-Time Systems: Theory and Practice	Rajib Mall	Pearson Education India	1st Edition	2006
3	Operating System: Internals and Design Principles	William Stallings	Prentice Hall	8th Edition	2014

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/operating-systems/	M1-M6
2	https://www.tutorialspoint.com	https://www.tutorialspoint.com/operating_system/index.htm	M1-M6

Mini Project Hours Distribution:

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers and select a mini project topic.	4	L1.L2
2	Project Title and Modules Identification	4	L1,L2
3	Design & Methodology	2	L1,L2
4	Implementation of Module 1	4	L1,L2,L3
5	Result Phase I	4	L1,L2,L3
6	Implementation of Module 2	4	L1,L2
7	Result Phase II and Validate Modules	4	L1,L2,L3,L4, L5
8	Report Writing	4	L1,L2
	Total Hours	**30**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Professional Elective 1(Mobile Computing)							**Course Code:** PEC-CS5012		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	2@	5	4	25	75	25	25	**150**
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basics of Programming (Java), Computer Networks									

Course Objective: This course introduces the basic concepts and principles in mobile computing. It covers the TCP/IP extensions for mobile networking and provides opportunities to the students to gain hands-on experiences in developing mobile applications.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	RBT level
1	Identify with the basic concepts and principles in mobile computing.	L1, L2
2	Understand the components and functioning of mobile networking.	L1, L2, L3
3	Describe the technologies in telecommunication with their underlying architectures.	L1, L2
4	Explain mobility management	L1, L2, L3
5	Illustrate how mobile Ad-hoc networks function	L1, L2, L3
6	Implement small android based applications.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	**INTRODUCTION TO MOBILE COMPUTING** Mobile Computing vs. Wireless Networking ; Mobile Computing Applications; Characteristics of Mobile computing; Medium Access Control: Motivation for specialized MAC, Introduction to multiple Access techniques (MACA) , Wireless MAC Issues	06	L1,L2
2	**MOBILE IP AND TCP** Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Reverse Tunneling, Routing (DSDV,DSR) Mobile TCP: Traditional TCP, Classical TCP Improvements (like Indirect	09	L1, L2,L3

	TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission)		
3	**MOBILE TELECOMMUNICATION SYSTEMS** GSM Mobile services, System Architecture, Radio interface, Protocols , Localization and Calling, Handover, security (A3,A5 & A8); GPRS system and protocol architecture; UTRAN , UMTS core network ; Improvements on Core Network	07	L1, L2
4	**MOBILITY MANAGEMENT** Co- channel Interference; Mobility: Types of Handoffs; Location Management: HLR-VLR scheme, Hierarchical scheme, Predictive Location management schemes; Cellular IP; PSTN.	07	L1, L2, L3
5	**MOBILE AD-HOC NETWORKS** Ad-Hoc Networks: Basic Concept, Characteristics , Applications ;Design Issues; Routing :Essential of Traditional Routing Protocols, Popular Routing Protocols; Vehicular Ad Hoc networks (VANET);MANET Vs VANET; Security in ad-hoc networks	08	L1, L2, L3
6	**MOBILE APPLICATION DEVELOPMENT** Structure of Mobile Computing Application; Characteristics of mobile devices; Native applications vs. Web-Applications; Internet Protocols for mobile apps; Mobile Platforms: Introduction to Android, Layers, android components, mapping application to process. Android development basics. Hardware tools, Software tools, Android SDK features.	08	L1, L2, L3
	Total hours	45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Mobile Computing	Raj Kamal	Oxford University Press	Second Edition	2011
2	Mobile Communication	Jochen Schillller	Addision wisely, Pearson Education	Second Edition	2004
3	Fundamentals of Mobile Computing	Pattnaik, Prasant Kumar	PHI Learning Pvt. Ltd.	Second Edition	2016
4	Mobility Protocols and Handover optimization: Design, Evaluation and Application	Ashutosh Dutta, Henning Schulzrinne	IEEE Press, Wiley Publication	First Edition	2015

Online References:

S. No.	Website Name	URL	Modules Covered
1	cse.iitb.ac.in	https://www.cse.iitb.ac.in/~mythili/teaching/cs653_spring2014/index.html	M1, M2, M3
2	www.tutorialspoint.com	https://www.tutorialspoint.com/umts/umts_cellular_concepts_mobility_management.htm	M4

4	nptel.ac.in	https://nptel.ac.in/courses/106105160/	M5
3	learn.saylor.org	https://learn.saylor.org/course/view.php?id=95&sectionid=978	M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study articles and research papers: Identification of mini-project title.	4	L1.L2,L3
2	Finalizing title and identifying different modules to be developed.	4	L1,L2,L3
3	Design and Methodology: Finalizing design approach and tools for implementation.	2	L1,L2,L3
4	Implementation of Modules Phase I	4	L1,L2,L3
5	Result Phase I	4	L1,L2,L3,L4
6	Implementation of Modules Phase II	4	L1,L2,L3
7	Result Phase II and Validate Modules	4	L1,L2,L3,L4, L5
8	Report Writing	4	L1,L2,L3
	Total Hours	**30**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Professional Elective 1(Advance Database management system)							**Course Code:** PEC-CS5013		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Basics of Database									

Course Objective: The objective of the course is to study various Advanced Database concepts like Query Processing, Database Security and to study various Advanced Databases like Distributed Databases, Document Oriented Databases, Temporal, Spatial, Multimedia and Mobile Databases.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply appropriate security techniques database systems	L1, L2, L3
2	Apply Query Optimization and Measure Query cost	L1, L2, L3
3	Describe the concepts of Distributed Database Basics	L1, L2
4	Analyze Distributed database for better resource management.	L1, L2, L3, L4
5	Demonstrate the understanding of the concepts of Document Oriented Databases.	L1, L2, L3, L4
6	Discuss Advanced data models for real life applications	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Data Security** Introduction to Database Security Issues; authorization, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based. **Access Control for Multilevel Security** ● SQL Injection ● Introduction to Statistical Database Security, Introduction to Flow Control	6	L1, L2, L3

2	**Query processing and Optimization** ● Overview ● Measures of Query cost ● Selection operation ● Sorting ● Join Operations, and other Operations **Evaluation of Expression Query Optimization :** ● Translations of SQL Queries into relational algebra ● Heuristic approach & cost based optimization	8	L1, L2, L3
3	**Overview of Distributed Database System** Features and Design Issues of Distributed Databases, Types of Distributed Databases, Distributed Database Architectures.	6	L1, L2
4	**Distributed Database Design, Transaction, Concurrency and Recovery** Data Fragmentation, Replication, Allocation Techniques in Distributed Databases, Transparencies for Distributed Database Design, Distributed Transaction Management in Distributed Databases, Distributed Concurrency Control (locking), Recovery in Distributed Databases {2PC/3PC) and Deadlock management.	10	L1, L2, L3, L4
5	**Document Oriented Database** Need of object oriented database, Impedance matching problem between OO languages and Relational database, Case study db4O, Need of Document Oriented database, difference between Document Oriented Database and Traditional database. Types of encoding XML, JSON, BSON, Representation XML, Json Objects. Case study on document Oriented Database	9	L1, L2, L3,L4
6	**Advanced Data Models** **Temporal data models**:- Aspects of valid time , Bi-temporal time and bi-temporal time with examples of each. **Spatial model** :- Types of spatial data models - Raster, Vector and Image **Mobile databases, Multimedia databases.**	6	L1, L2
	Total Hours	**45**	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Database Systems	Elmasri & Navathe	PEARSON Education.	Seventh Edition	2016
2	Database systems concepts	Korth, Silberschatzsudarshan	McGraw Hill	Seventh Edition	2016
3	Database Management System	Raghu Ramkrishnan & Johannes Gehrke	Tata McGraw-Hill Edition.	Third Edition	--
4	Learning MySQL and Mariadb	Ruosell J.T. Dyer	O'Reilly	--	--

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.techotopia.com	https://www.techotopia.com/index.php/Mandatory,_Discretionary,_Role_and_Rule_Based_Access_Control	M1
2	www.geeksforgeeks.org	https://www.geeksforgeeks.org/sql-query-processing/	M2
3	www.tutorialspoint.com	https://www.tutorialspoint.com/distributed_dbms/distributed_dbms_databases.htm	M3-M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Identification and Study of Advanced Database	8	L1,L2
2	Project Title Identification	2	L1,L2
3	Graphical User Interface Design	2	L1,L2,L3
4	Database Design	2	L1,L2,L3
5	Linking of GUI with Advanced Database	8	L1,L2,L3
6	Testing of Mini Project	2	L1,L2, L3
7	Preparation of Report	6	L1,L2
	Total Hours	**30**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Professional Elective 1(Multimedia Systems)							**Course Code:** PEC-CS5014		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Computer Fundaments and Graphics									

Course Objective: The course should be able to introduce students about basic fundamentals and key aspects of Multimedia system, provide knowledge of compression techniques of different multimedia components, students to understand multimedia communication standards along with technology environment & provide an opportunity to gain hands-on experience in building multimedia applications.

Course Outcomes: Upon completion of the course students will be able to

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	To identify basics of multimedia and multimedia system architecture.	L1, L2, L3
2	To understand different multimedia components	L1, L2
3	To explain file formats for different multimedia components.	L1, L2, L3, L4
4	To analyze the different compression algorithms.	L1, L2, L3, L4
5	To describe various multimedia communication techniques.	L1, L2, L3
6	To apply different security techniques in multimedia environment.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Multimedia System: An Introduction** Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Defining Objects for Multimedia Systems, Multimedia Data Interface Standards, The need for Data Compression, Multimedia Database	8	L1, L2, L3
2	**Compression & Decompression And Data File format Standards** Types of Compression, Binary Image Compression Schemes	10	L1, L2

	Color, Gray Scale and Still Video Image Compression, Video Image Compression, Audio Compression, Rich Text Format, TIFF File Format, Resource Interchange File Format (RIFF), MIDI File Format JPEG DIB File Format for Still and Motion Image, AVI File Format, MPEG Standards		
3	**Multimedia Input/output technologies& Storage Retrieval Technologies**	10	L1, L2, L3, L4
	Key Technologies Issues, Pen Input, Video and Image Display Systems, Print output Technologies, Image Scanners ,Digital Camera, Video Images and Animation, Full-Motion Video, Magnetic Media Technology Optical Media , Hierarchical Storage Management , Cache Management For Storage Systems		
4	**Architectural & Telecommunications Considerations And Multimedia Application Design**	8	L1, L2, L3, L4
	Specialized Computational Processors, Memory Systems Multimedia Board Solutions, LAN/WAN Connectivity, Distributed Objects Models, Multimedia Applications Classes, Types of Multimedia System Virtual Reality Design, Components of Multimedia Systems, Distributed Application Design Issues		
5	**Multimedia Authoring & User Interface And Hypermedia Messaging**	5	L1, L2, L3
	Multimedia Authoring System, Hypermedia Application Design Considerations, User Interface Design, Mobile Messaging, Hypermedia, Message Components, Hypermedia Linking and Embedding, Creating Hypermedia Messages		
6	**Distributed Multimedia Systems**	4	L1, L2, L3, L4
	Components of a Distributed Multimedia System, distributed Client-Server Operations , Multimedia Object Servers , Multi-server Network Topologies, Distributed Multimedia Databases		
	Total Hours	**45**	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Multimedia Systems Design	Prabhat K Angleigh& Kiran Thakrar	PHI	1st	2005
2	Multimedia Communication Systems: Techniques, Standards & Networks	K. R. Rao, Zoran S. Bojkovic&Dragorad A. Milovanovic	TMH	1th	2010
3	Multimedia Systems	K. Buford	PHI	3rd	2012
4	Fundamentals of Multimedia	Ze-Nian Li & Mark S. Drew	PHI	2nd	2011
5	Multimedia Computing Communications & Applications,	Ralf Steinmetz & Klara Nahrstedt,	Pearson	1st	2012

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.springer.com	https://www.springer.com/gp/book/9783540408673	M1-M6

2	https://books.google.co.in/	https://books.google.co.in/books?id=34Uuim67mvUC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false	M1-M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool for implementation	2	L1,L2
2	Project Title and Course Identification	2	L1,L2
3	Choose File Format and Compression techniques	4	L1,L2
4	Perform task related to compression or Authoring tool	2	L1,L2,L3
5	Select Authoring tool	4	L1,L2,L3
6	Design the project using Authoring Tool	2	L1,L2
7	Design and implement the Authoring System.	4	L1,L2,L3,L4
8	Design a project in Authoring system	2	L1,L2,L3,L4
9	Test and Evaluate Model designed in Authoring tool.	4	L1,L2,L3,L4,L5
10	Prepare report	4	L1,L2
	Total Hours	**30**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name: Professional Elective 1(Machine Learning)							**Course Code:** PEC-CS5015		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Linear Algebra, Calculus, Probability, Statistics									

Course Objective: The course should be able to introduce Machine Learning techniques and become familiar with its types.

Course Outcomes: Upon completion of the course students will be able to

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand basics of ML	L1, L2
2	Apply preprocessing techniques	L1, L2, L3
3	Apply regression for learning and assess the outcome	L1, L2, L3, L4
4	Apply classification for learning and assess the outcome	L1, L2, L3, L4
5	Apply optimization techniques for performance enhancement	L1, L2, L3, L4
6	Apply unsupervised and reinforcement learning concepts and assess the outcome	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Machine Learning** Machine Learning terminology, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing ML application, How to choose the right algorithm	5	L1, L2
2	**Data Preprocessing** Data Transformation, Data Handling (Missing, Imbalanced), Outlier detection and Visualization, Feature selection and extraction	10	L1, L2, L3
3	**Supervised Learning with Regression** Simple Linear, Gradient Descent, Multiple Linear, Polynomial, Regularization, Evaluation Metric, Use case	5	L1, L2, L3, L4

4	**Supervised Learning with Classification** k Nearest Neighbor, Logistic Regression, Naïve Bayes, Linear SVM, Kernels, Decision Tree (CART), Issues in DT learning, Ensembles (Bagging – Random Forest, Boosting – AdaBoost), Evaluation Metric, Use case	13	L1, L2, L3, L4
5	**Optimization Techniques** Model Selection techniques, Cross Validation, Grid Search method	6	L1, L2, L3, L4
6	**Unsupervised Learning with clustering and Reinforcement Learning** Expectation Maximization algorithm, Use case Elements of Reinforcement Learning, Online Learning (Temporal Difference), Use case	6	L1, L2, L3, L4
	Total Hours	**45**	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Machine Learning In Action	Peter Harrington	DreamTech Press	1st	2012
2	Introduction to Machine Learning	Ethem Alpaydın	MIT Press	4th	2020
3	Machine Learning	Tom M. Mitchell	McGraw Hill	Indian	1997
4	Machine Learning An Algorithmic Perspective	Stephen Marsland	CRC Press	2nd	2011
5	Machine Learning — A Probabilistic Perspective	Kevin P. Murphy	MIT Press	1st	2012
6	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer		2006
7	Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2nd	2017

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.analyticvidhya.com	https://www.analyticsvidhya.com/%20machine%20learning/	M1-M6
2	www.towardsdatascience.com	https://towardsdatascience.com/machine-learning/home	M1-M6
3	www.coursera.org	https://www.coursera.org/learn/machine-learning?utm_source=gg&utm_medium=sem&utm_content=07-StanfordML-IN&campaignid=1950458127&adgroupid=69480953983&device=c&keyword=machine%20learning%20online%20course&matchtype=b&network=g&devicemodel=&adpostion=1t2&creativeid=351281535285&hide_mobile_promo&gclid=Cj0KCQiAn8nuBRCzARIsAJcdIfMYXtdIwVvfyr6ee_ewWcWrBdFmGWrJnWif67PHGt-sEH6r68QbhUoaAvmJEALw_wcB	M1-M6

Mini Project Hours Distribution

Sr. No	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study tool for implementation	2	L1,L2
2	Project Title and Course Identification	2	L1,L2
3	Choose Data	2	L1,L2
4	Perform EDA	2	L1,L2,L3
5	Perform Feature Engineering	2	L1,L2,L3
6	Chose Model	2	L1,L2
7	Train and Validate Model	2	L1,L2,L3,L4
8	Tune Hyper parameters	2	L1,L2,L3,L4
9	Test and Evaluate Model	2	L1,L2,L3,L4,L5
10	Prepare report	2	L1,L2
	Total Hours	**30**	

T.E. Semester –V

B.E. (Computer Engineering)							**T.E. SEM: V**		
Course Name Indian constitution							**Course Code:** MC-CS501		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
1	-	-	1	(Non-Credit)	Passing is mandatory for this course	-	-	25	**25**
Prerequisite: -									

Course Objectives: To understand fundamental of Indian constitutional system , Union structure, Judiciary Structure with hierarchy and it function

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Objectives	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the rights and duties of Individual and government	L1, L2
2	To understand the government structure and hierarchy	L1, L2
3	To understand right of Indian who residing in India or outside India and understand citizenship law	L1, L2
4	To understand and apply the personal, social and economic rights to citizens of India	L1, L2, L3
5	To analyze the functions and powers of state and its limbs i.e. Legislature, Executive.	L1, L2, L3, L4
6	Understand the structure and modalities of state i.e. legislature, executive and judiciary	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1.0	**Introduction** Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	2	L1, L2
2.0	**Union Government and its Administration**	2	

	Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha		L1, L2
3.0	**Citizenship**	3	L1, L2
	Citizenship at the commencement of the Constitution ,Rights of citizenship of certain persons who have migrated to India from Pakistan, Rights of citizenship of certain migrants to Pakistan , Rights of citizenship of certain persons of Indian origin residing outside India , Persons voluntarily acquiring citizenship of a foreign State not to be citizens, Continuance of the rights of citizenship, Parliament to regulate the right of citizenship by law .		
4.0	**Fundamental Rights**	2	L1, L2, L3
	Definition , Laws inconsistent with or in derogation of the fundamental rights, Right to equality, Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and educational Right , Right to constitution Remedies.		
5.0	**The Union**	3	L1, L2, L3, L4
	Executive(President & Vice President) General (office of Parliament) Conduct of Business		
6.0	**The Union Judiciary**	3	L1, L2, L3, L4
	Establishment and constitution of Supreme Court Salaries		
	Total	**15**	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	The Constitution of India	Bare Act	Government of India	NA	2020
2	Introduction to the Constitution of India	D.D. Basu	Lexis Nexis	24th Edition	2019
3	Indian Constitutional Law	M.P Jain	Lexis Nexis	8th Edition	2018

T.E. Semester –V

B.E.(Computer Engineering)						**SEM: VI**		
Course Name: Summer Internship						**Course Code:** SI-CS501		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**			
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**			
Total Hours : Maximum 2 Weeks (60 to 80 Hours during summer vacation)							**TW**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	-	-	50	**50**
-	-	30	30	1				

Note :
1. Internship will be done in institute laboratory in collaboration with industries.
2. Evaluation and assessment will be done as per AICTE guidelines.

Prerequisite: Fundamental knowledge of respective programmes

Course Objectives:

To get industry like exposure in the institute laboratories by carrying out activities / projects. Also design innovative techniques / methods to develop the products.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply subjects knowledge in the college laboratories for carrying out projects	L3, L4,L5
2	Developed innovative techniques / methods to develop the products	L3, L4,L5
3	Contribute for the society	L3, L4,L5

Detailed Syllabus:

Module No.	Topics	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Program Specific Internship** • Training and certification on emerging technologies in domains offered by Department of Computer Engineering • Applying classroom and laboratory knowledge to design , develop and deploy the products	L3, L4,L5
2	**Inter disciplinary Internship** • To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) • Design , develop and deploy cost effective products using multidisciplinary approach	L3, L4,L5

3	**Industry Specific Internship** • To explore and understand issues and challenges in industry • Developing solutions for industry specific problems • Design , develop and deploy products for startup and SMEs	L3, L4,L5
4	**Interpersonal Internship** • To develop interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication • To get competence in problem solving , presentation , negotiation skills	L3, L4,L5
5	**Social Internship** • Identify and study different real life issues in the society • Identify societal problems and provide engineering solutions to solve these problems	L3, L4,L5
6	**Academic Internship** • Study report preparation, preparation of presentations, copy table book preparation , business proposal and IPR • Capture aspirations & expectations through interviews of students. • Ways to connect research in technical institutes with industry. • Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study.	L3, L4,L5

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.letsintern.com/	https://www.letsintern.com/internships/summer-internships	M1-M6
1	https://codegnan.com	https://codegnan.com/blog/benefits-of-internships-and-importance	M1-M6
2	https://www.honorsociety.org	https://www.honorsociety.org/articles?category=internships	M1-M6

T.E. Semester –V

B.E. (Computer Engineering)					T.E. SEM: V		
Course Name Professional Skill V (Web Development)					**Course Code:** HSD-CSPS501		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Hours Per Week					**Presentation**	**Report**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**75**
1	-	2	3	2	50	25	
AC- Activity evaluation **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)							
Prerequisite: Computer Basics, Java							

Course Objectives: By the end of the course students will be able to design and implement static and dynamic websites.

Course Outcomes: Upon completion of the course students will be able to

S.N.	Course Outcomes	Cognitive level attainment as per revised Bloom's Taxonomy
1	Understand different components in web technology and to know about web servers.	L1, L2
2	Develop an interactive Web pages using HTML/XHTML.	L1, L2, L3, L4
3	Present a professional document using Cascaded Style Sheets.	L1, L2, L3, L4
4	Construct websites for user interactions using JavaScript and JQuery.	L1, L2, L3, L4, L5
5	Know the different information interchange formats like XML and JSON.	L1, L2, L3, L4
6	Develop Web applications using PHP.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No.	Topics	Cognitive level attainment as per revised Bloom's Taxonomy
1	**Introduction to the Internet** The World Wide Web, Web Browsers, Uniform Resource Locators, WWW Architecture – SMTP – POP3 – File Transfer Protocol The Hypertext Transfer Protocol, HTTP request – response — Generation of dynamic web pages- W3C Validator, How web works - Setting up the environment (LAMP/XAMP/WAMP server)	L1, L2
2	**HTML/XHTML** Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables Images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5, Syntactic Differences between HTML and XHTML	L1, L2, L3, L4

3	**Introduction to Cascading Style Sheets** Cascading Style Sheets: Levels of Style Sheets - Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags.	L1, L2, L3, L4
4	**Introduction to JavaScript** Introduction: client-side scripting-First program: Displaying a Line of Text-JavaScript Alert-Dynamic Page-Web Application-Variables in JavaScript-Data Types in JavaScript-Operators and Expressions-Simple If Statement- If Else Statement- Nested If Else Statement-Switch Case-For Loop-While Loop-Functions-Events-Arrays-Objects –Math and Date in JavaScript-Redirect to Another HTML Page	L1, L2, L3, L4, L5
5	**Introduction to Data Interchange Formats** XML: The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Applications. JSON(Basics Only): Overview, Syntax, Datatypes, Objects, Schema, Comparison with XML	L1, L2, L3, L4
6	**Introduction to PHP and MySQL** Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs	L1, L2, L3, L4, L5

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Internet &World Wide Web How to Program	P. J. Deitel, H.M. Deitel	Pearson education	4th Edition,	2010
2	Programming the World Wide Web	Robert W Sebesta	Pearson education	7th Edition,	2014
3	HTML 5	DT Editorial services	Dreamtech Press	2nd Edition	2016
4	Web Technologies Black Book	Kogent Learning Solutions	Dreamtech Press	2nd Edition	2016

Online References:

S. No.	Website Name	URL	Modules Covered
1	W3schools	https://www.w3schools.com	M1-M6
2	Tutorialspoint	https://www.tutorialspoint.com	M1-M6
3	Javatpoint	https://www.javatpoint.com	M1-M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basic Experiments**	Explain Installation steps to LAMP / WAMP / XAMP.	2	L1
2		Sketch Simple web page using HTML5	2	L1, L2
3		Develop web page using CSS3 and HTML5.	2	L1, L2, L3

4	**Design Experiments**	Develop a Javascript web page illustrating functions and events	2	L1, L2, L3
5		Develop simple web page using PHP functions.	2	L1, L2, L3
6		Develop XML web page using DTD, XSL.	2	
7	**Advanced Experiments**	Develop a login page using PHP.	4	L1, L2, L3
8		Develop interactive web pages using PHP with database connectivity MYSQL.	4	L1, L2, L3
9	**Mini/Minor Projects/ Seminar/**	1. Online Second-hand Book Buying & Selling Portal 2. College E Print Service Management 3. Online Pizza Ordering System	6	L1, L2, L3
10	**Case Studies/ Group Presentation**	1. Study on MYSQL database 2. Study on different built-in methods of JavaScript 3. Comparative study on Angular JS and Node JS	4	L1, L2, L3
	Total Hours		**30**	

T.E. Semester –V

B.E. (Computer Engineering)						T.E. SEM: V	
Course Name Project Based Learning - III						**Course Code:** HSD-CSPBL501	
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Hours Per Week					**Presentation**	**Report**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**25**
-	-	2	2	1	25	-	
AC- Activity evaluation **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)							
Prerequisite: Computer Fundamentals and Knowledge of Programming Languages							

Course Objective: The Course intends to aid students identify real world problems and apply computing fundamental and technical skill to find solutions to them.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Interpret the basic real time problems.	L1, L2
2	Apply appropriate technologies and programming constructs to solve problems.	L1, L2, L3
3	Inspect the results obtained for documentation and presentation.	L1, L2, L3, L4

Projects Listing:

Sr. No.	Title of Project	Type of Project
1	Implementing Online School Administration System	Application
2	Implementing Employee Transport Management System	Application
3	Implementing Online Course and Examination System	Application
4	Implementation of Online Secondhand Book Buying and Selling Portal	Application
5	Implementing Online Logistics Chatbot System	Application
6	Implementation of Online Newspaper Delivery Management System	Application
7	Design Online Health Shopping Portal with Product Recommendation	Core
8	Design Web-based Chat Application with webcam using PHP	Core
9	Design Internet based Discussion Forum	Core
10	Develop Customer targeted E-Commerce	Core

T.E. Semester –V

B.E. (Computer Engineering)					**T.E. SEM: V**		
Course Name Research Based Learning-I					**Course Code:** HSD-CSRBL501		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**		
Hours Per Week					**Presentation**	**Report**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**50**
-	-	2	2	1	25	25	
AC- Activity evaluation							
Prerequisite: Mathematical Foundation, Computing Methods							

Course Objectives: This course is focused to engage the learner in research by upgrading domain knowledge by participation in technical quiz and debate, critical thinking, innovative idea generation and technical writing.

Course Outcomes: Upon completion of the course students will be able to:

S.N.	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Upgrade the knowledge of latest technologies in their discipline in a competitive environment.	L1, L2
2	Create new idea for problem solving related to industry or societal issues.	L1, L2, L3
3	Understand research methodologies.	L1, L2, L3, L4
4	Students will be able to write a technical paper.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive level attainment as per revised Bloom Taxonomy
1	**Technical Quiz and Technical Debate** I. Quiz competition on technical topics from different domains with 50 MCQ (Questions will vary according to department). II. Formation of 8 teams for four topics. 2 teams (For and Against) for topic I will debate first and the other teams will be audience.	8	L1, L2
2	**Idea generation with design thinking aspects and related literature survey** I. Introduction to design thinking and its stages. II. Formation of groups, generation of an idea and conducting literature survey.	7	L1, L2, L3
3	**Proof of concept and validation of idea through survey** **Seminar on Research methodology** I. Validate the idea by conducting the survey (through Google docs, interviews or any other suitable method).	8	L1, L2, L3,L4

	II. Seminar on different research methods and procedures for 8designing and conducting scientific research.		
4	**Paper writing skills (Seminar/workshop) Documentation of Selected Idea and its validation**	7	L1, L2, L3,L4,L5
	I. Seminar or workshop on paper writing skills. II. Write a research paper on idea generated.		
	Total Hours	**30**	

References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Writing Research Papers: A Complete Guide	James D. Lester	Longman	10th	2001
2.	Creativity in Product Innovation	Jacob Goldenberg	Cambridge University Press	Kindle	2002

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/tag/c-quiz-references/	M1
2.	Interaction Design Foundation: Design Thinking	https://www.interaction-design.org/literature/topics/design-thinking	M2
3.	Scribbr: How to write a research methodology.	https://www.scribbr.com/dissertation/methodology/	M3
4.	https://www.statpac.com	https://www.statpac.com/online-software-manual/Basic-Research-Concepts.htm	M4
5.	https://www.slideshare.net	https://www.slideshare.net/AsirJohnSamuel/1introduction-to-research-methodology?next_slideshow=1	M4