परीक्षा नियंत्रण प्रकोष्ठ, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर (म.प्र.)

क्रमांक / प.नि.प्र. / 2024 / 2682 जबलपुर, दिनांक 18 / 10 / 2024

सूचना

महाविद्यालय में अध्ध्यनरत B.Tech. (AICTE) / B.Tech. (PTDC) [AICTE] [Regular/Ex.] विद्यार्थियों को सूचित किया जाता है कि वे नवम्बर 2024 की परीक्षा एवं आगामी सत्र की परीक्षाओं में सम्मिलित होने से पूर्व अपने पेपर / विषय का Equivalence Syllabus महाविद्यालय के पोर्टल से Download कर प्राप्त कर सकते हैं अथवा महाविद्यालय के परीक्षा नियंत्रण प्रकोष्ठ में संपर्क कर सकते हैं। नवम्बर 2024 परीक्षा एवं आगामी सत्र की परीक्षा में उन्हें अपने पेपर / विषय में Equivalence Syllabus में ही सम्मिलित होना है। अतः Equivalence Syllabus की जानकारी न होने की दशा में सम्पूर्ण जिम्मेदारी स्वयं छात्र / छात्राओं की होगी।

Equivalence Syllabus हेतु निम्नानुसार Link का उपयोग कर सकते है:–

https://www.jecjabalpur.ac.in/UploadContent/frm_ViewScheme.aspx

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जबलपुर इंजीनियरिंग महाविद्यालय
जबलपुर

पृ.क्रमांक / प.नि.प्र. / 2024 / जबलपुर, दिनांक / 10 / 2024

प्रतिलिपिः–

01. समस्त विभागाध्यक्ष, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।
02. पीटीडीसी कार्यालय, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।

प्राचार्य / मुख्य परीक्षा नियंत्रक
जबलपुर इंजीनियरिंग महाविद्यालय
जबलपुर

EQUIVALENCE OF SUBJECTS OF DIFFERENT SCHEMES OF UNDER GRADUATE COURSES (B.Tech.)
OF COMPUTER SCIENCE & ENGG.

S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
1	AICTE	BT203 Computer Programming and Problem Solving **B.Tech. I/II Sem.**	BT23 Computer Programming and Problem Solving **B.Tech. I/II Sem.**
	Scheme 2023	BT23 Computer Programming and Problem Solving **B.Tech. I/II Sem.**	
2	AICTE	CS403 Operating Systems **B.Tech. IV Sem.**	CS53 Operating Systems **B.Tech. V Sem.**
	Scheme 2023	CS53 Operating Systems **B.Tech. V Sem.**	
3	AICTE	CS404 Design and Analysis of Algorithms **B.Tech. IV Sem.**	CS44 Design and Analysis of Algorithms **B.Tech. IV Sem.**
	Scheme 2023	CS44 Design and Analysis of Algorithms **B.Tech. IV Sem.**	
4	AICTE	BT511 Professional Ethcs **B.Tech. V Sem.**	BT51 Professional Ethcs **B.Tech. V Sem.**
	Scheme 2023	BT51 Professional Ethcs **B.Tech. V Sem.**	
5	AICTE	CS502A Virtual Reality **B.Tech. V Sem.**	CS51C Virtual Reality **B.Tech. V Sem.**
	Scheme 2023	CS51C Virtual Reality **B.Tech. V Sem.**	
6	AICTE	CS502B Theory of Computation **B.Tech. V Sem.**	CS51A Theory of Computation **B.Tech. V Sem.**
	Scheme 2023	CS51A Theory of Computation **B.Tech. V Sem.**	
7	AICTE	CS502C Advance Computer Architecture **B.Tech. V Sem.**	CS51B Advance Computer Architecture **B.Tech. V Sem.**
	Scheme 2023	CS51B Advance Computer Architecture **B.Tech. V Sem.**	

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8	AICTE	CS503 Database Management Systems **B.Tech. V Sem.**	CS42 Database Management Systems B.Tech. IV Sem.
	Scheme 2023	CS42 Database Management Systems **B.Tech. IV Sem.**	
9	AICTE	CS504 Computer Graphics & Multimedia **B.Tech. V Sem.**	CS54 Computer Graphics & Multimedia **B.Tech. V Sem.**
	Scheme 2023	CS54 Computer Graphics & Multimedia **B.Tech. V Sem.**	
10	AICTE	CS601A Image Processing **B.Tech. VI Sem.**	CS62A Image Processing **B.Tech. VI Sem.**
	Scheme 2023	CS62A Image Processing **B.Tech. VI Sem.**	
11	AICTE	CS601B Parallel Computing **B.Tech. VI Sem.**	CS61B Parallel Computing **B.Tech. VI Sem.**
	Scheme 2023	CS61B Parallel Computing **B.Tech. VI Sem.**	
12	AICTE	CS601C Robotics **B.Tech. VI Sem.**	CS62C Robotics **B.Tech. VI Sem.**
	Scheme 2023	CS62C Robotics **B.Tech. VI Sem.**	
13	AICTE	CS602A Wireless Sensor Networks **B.Tech. VI Sem.**	CS71C Wireless Sensor Networks **B.Tech. VII Sem.**
	Scheme 2023	CS71C Wireless Sensor Networks **B.Tech. VII Sem.**	
14	AICTE	CS603 Software Engineering **B.Tech. VI Sem.**	CS64 Software Engineering **B.Tech. VI Sem.**
	Scheme 2023	CS64 Software Engineering **B.Tech. VI Sem.**	
15	AICTE	CS605 Computer Networks **B.Tech. VI Sem.**	CS63 Computer Networks **B.Tech. VI Sem.**
	Scheme 2023	CS63 Computer Networks **B.Tech. VI Sem.**	

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16	AICTE	CS701 Computer Vision **B.Tech. VII Sem.**	CS75 Computer Vision **B.Tech. VII Sem.**
	Scheme 2024	CS701M Computer Vision **B.Tech. VII Sem.**	
	Scheme 2023	CS75 Computer Vision **B.Tech. VII Sem.**	
17	AICTE	CS702 Compiler Design **B.Tech. VII Sem.**	CS73 Compiler Design **B.Tech. VII Sem.**
	Scheme 2024	CS702M Compiler Design **B.Tech. VII Sem.**	
	Scheme 2023	CS73 Compiler Design **B.Tech. VII Sem.**	
18	AICTE	CS703 Cryptography & Network Security **B.Tech. VII Sem.**	CS703M Cryptography & Network Security **B.Tech. VII Sem.**
	Scheme 2024	CS703M Cryptography & Network Security **B.Tech. VII Sem.**	
19	AICTE	CS704A Information Retrieval **B.Tech. VII Sem.**	CS71B Information Retrieval **B.Tech. VII Sem.**
	Scheme 2024	CS704M A Information Retrieval **B.Tech. VII Sem.**	
	Scheme 2023	CS71B Information Retrieval **B.Tech. VII Sem.**	
20	AICTE	CS704B Natural Language Processing **B.Tech. VII Sem.**	CS704M B Natural Language Processing **B.Tech. VII Sem.**
	Scheme 2024	CS704M B Natural Language Processing **B.Tech. VII Sem.**	
21	AICTE	CS705A Computational Intelligence **B.Tech. VII Sem.**	CS81A Computational Intelligence **B.Tech. VIII Sem.**
	Scheme 2024	CS705M A Computational Intelligence **B.Tech. VII Sem.**	
	Scheme 2023	CS81A Computational Intelligence **B.Tech. VIII Sem.**	

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22	AICTE	CS705B Optimization Techniques **B.Tech. VII Sem.**	CS72 B Optimizatin Techniques **B.Tech. VII Sem.**
	Scheme 2024	CS705M B Optimizatin Techniques **B.Tech. VII Sem.**	
	Scheme 2023	CS72 B Optimizatin Techniques **B.Tech. VII Sem.**	
23	AICTE	CS705C Internet of Things **B.Tech. VII Sem.**	CS705M C Internet of Things **B.Tech. VII Sem.**
	Scheme 2024	CS705M C Internet of Things **B.Tech. VII Sem.**	
24	AICTE	CS801 Network Management **B.Tech. VIII Sem.**	CS81C Network Management **B.Tech. VIII Sem.**
	Scheme 2024	CS801M B Network Management **B.Tech. VIII Sem.**	
	Scheme 2023	CS81C Network Management **B.Tech. VIII Sem.**	
25	AICTE	CS802 Data Warehousing & Mining **B.Tech. VIII Sem.**	CS82C Data Warehouse & Mining **B.Tech. VIII Sem.**
	Scheme 2024	CS801M C Data Warehousing & Mining **B.Tech. VIII Sem.**	
	Scheme 2023	CS82C Data Warehouse & Mining **B.Tech. VIII Sem.**	
26	AICTE	CS803A Distributed Systems & Cloud Computing **B.Tech. VIII Sem.**	CS801M A Distributed Systems and Cloud Computing **B.Tech. VIII Sem.**
	Scheme 2024	CS801M A Distributed Systems and Cloud Computing **B.Tech. VIII Sem.**	
27	AICTE	CS803B Ethical Hacking **B.Tech. VIII Sem.**	CS802M C Ethical Hacking **B.Tech. VIII Sem.**
	Scheme 2024	CS802M C Ethical Hacking **B.Tech. VIII Sem.**	
28	AICTE	CS804A Data Analytics **B.Tech. VIII Sem.**	CS82B Data Analytics **B.Tech. VIII Sem.**
	Scheme 2024	CS802M B Data Analytics **B.Tech. VIII Sem.**	
	Scheme 2023	CS82B Data Analytics **B.Tech. VIII Sem.**	

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	AICTE	CS303 Data Structures & Algorithms **B.Tech. III Sem.**	CS33 Data Structures & Algorithms **B.Tech. III Sem.**
	Scheme 2023	CS33 Data Structures & Algorithms **B.Tech. III Sem.**	
	AICTE	CS704C Data Centre Management **B.Tech. VII Sem.**	CS61A Data Centre Management **B.Tech. VI Sem.**
	Scheme 2024	CS704M C Data Centre Management **B.Tech. VII Sem.**	
	Scheme 2023	CS61A Data Centre Management **B.Tech. VI Sem.**	

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B. Tech. I/II Sem. (Computer Science & Engineering)

Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
BT23	**Computer Programming and Problem Solving**	70	20	10	30	20	150	3	0	2	4

Course Contents:

Module I: Computer Hardware - Block diagram of computer Hardware, Software , Firmware. Type of software, General function of CPU, ALU, Control unit and memory, Type of memory, Motherboard and BIOS, Understanding the Boot Process.

Module II: Introduction to algorithm and Flowchart, Generations of Programming Languages, Introduction to Programming. History of C , Characteristics of C, C Program Structure , Constants, Data types, Variables, Keywords ,Console Input/Output Statements, Compiling, linking and executing C programs.

Module III: Operators and expressions: arithmetic, Unary, Assignment, Relational, Logical & Conditional, Type Casting. Branching Statements - if Statement, switch Statement. Looping Statements - for, while, do-while loop Jump statement- goto, continue and break. Arrays- Array Concepts, Rules & Restrictions, Single & Multi-Dimensional arrays.

Module IV: Functions- Types of Functions, Built-in Functions, Function definition, Function Prototypes, Function calls. Storage classes & Scope of Variables. Strings- String manipulation functions. Structures-Defining New Data types, Unions, Enumerated Data types, Static Variables.

Module V: Pointers-Pointer Concepts, Pointers and Functions, Pointers and Arrays, Array of Pointers Static Initialization, Pointers and Structures, Dynamic Memory Allocation and Data Structures- sizeof(), malloc(), calloc(), realloc() and free()

Suggested Books:

1. C Programming Language by Karnighan & Ritchie, TMH publications.
2. Let us 'C' by Yashwantkanetkar, BPB publications
3. Fundamentals of Computers by E Balagurusamy, TMH publications

Computer Programming and Problem Solving (BT23)
Course Outcomes:

CO1: Explain hardware, software, booting process, types of statements in C language such as 1/0, branching and looping etc.

CO2: Describe various ingredients of C program such as constants, variables, keywords. data types, header files, functions. pointers and dynamic memory allocation functions.

CO3: Compose C program to solve simple arithmetic and logical problems.

CO4: Compose C program using arrays, pointers, functions and structures ete.

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w.e.f. July 2023

Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS53	**Operating Systems**	70	20	10	30	20	150	3	0	2	4

Course Content:

Module I: Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems.

Module II: Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. **Thread:** Definition, states, Types of threads, Concept of multi threads and its benefit. **Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; CPU Scheduling Algorithms.

Module III: Inter-process Communication and Deadlock: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module IV: Memory Management: Basic concept, Logical and Physical address map, Memory allocation, Fragmentation and Compaction, Paging, Protection and sharing, Disadvantages of paging. **Virtual Memory**: Basics of Virtual Memory, page fault, Demand paging, Page Replacement Algorithms.

Module V: Device Management: File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency and performance.

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software, Secondary-Storage Structure. **Disk Management:** Disk structure, Disk Scheduling Algorithms, Disk reliability, Disk formatting,Case study on UNIX and WINDOWS Operating System.

Suggested books:

1. Operating Systems, 3rd Edition by H.M.Deitel, P.J. Deitel And D.R.Choffnes. Pearson Publications Prentice Hall.
2. Modern Operating Systems, 4th Edition by Andrew S. Tanenbaum. Pearson publication.
3. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
4. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
5. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing.
6. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley.
7. Design of the UNIX Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India.
8. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, and Associates.

Operating Systems (CS53)
Course Outcomes: After completion of the course, Students will be able to:

CO1: Understand the fundamental concepts, types, structures and architectures of operating systems.

CO2: Apply process management concepts, including process states, scheduling algorithms, and the benefits of multithreading.

CO3: Analyze inter-process communication mechanisms and strategies for deadlock prevention, avoidance, and recovery.

CO4: Implement memory management techniques, including paging, fragmentation, and virtual memory, to optimize system performance.

CO5: Evaluate file and device management methods, including file system structures, disk scheduling algorithms, and I/O device management.

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w.e.f. July 2023

Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS44	**Design and Analysis of Algorithms**	70	20	10	30	20	150	3	0	2	4

Course Contents:

Module I: Algorithm Analysis: Time, Space Tradeoff, Asymptotic Notations, Conditional asymptotic notation, removing condition from the conditional asymptotic notation, properties of big -Oh notation, Recurrence equations, Solving recurrence equations.

Module II: Divide and Conquer: Design and analysis of algorithms: binary search, Heap sort, Merge sort, quick sort, Multiplication of large Integers, Strassen's matrix Multiplication

Module III: Greedy Algorithms: Knapsack Problem, Job Scheduling algorithms, Huffman Code , Spanning tree.

Module IV: Dynamic Programming: General Method ,Multistage Graphs ,All-Pair of shortest paths ,Optimal Binary Search Trees ,0/1 Knapsack,Travelling Salesperson Problem

Backtracking: General method, 8 queen problem, sum of subsets, graph coloring, Hamiltonian Problem, knapsack problem, graph traversals.

Module V: Branch and Bound: General Methods (FIFO & LC), 0/1 knapsack, Introduction to NP Hard and NP Completeness

Suggested Books:

1. Horowitz & Sahani; Analysis & Design of Algorithm
2. Anany Levitin, "Introduction to Design and Analysis of Algorithm" pearson Education, 2003
3. Coreman Thomas, leiserson CE, Rivest RL Introduction to Algorithms, PHI
4. Dasgupta Algorithms , TMH
5. Ullman, Analysis & Design of Algorithms.
6. Michaer Goodrich, Roberto Tamassia, Algorithm Design, Wiley India.

Design and Analysis of Algorithms (CS44)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Analyze the different algorithm design techniques for a given problem.
CO2: Design algorithms for various computing problems.
CO3: Argue the correctness of algorithms using inductive proofs and invariants.
CO4: Synthesize set operations
CO5: Explain how to cope with the limitations of algorithms.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
BT51	**Professional Ethics**	70	20	10	-	-	100	3	1	-	4

Course Contents:

Module I: HUMAN VALUES

Morals, values and Ethics - Integrity - Work ethics-Service learning - Civics virtue - respect for others-Living peacefully-Caring-Sharing-Honesty-Courage Valuing time - Cooperation - Commitment - Empathy - Self confidence - Character - Spirituality Introduction to Yoga and meditation for professional excellence and stress management.

Module II: ENGINEERING ETHICS

Sensors of 'Engineering Ethics' - Variety of moral issues - Types of inquiry Moral dilemmas - Moral Autonomy - Kohiberg's theory-Gilligan's theory - Consensus and Controversy - Models of Professional roles - Theories about right action- Self-interest Customs and Religion - Uses of Ethical Theories.

Module III: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation - Engineering as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law.

Module IV: SAFETY, RESPONSIBILITIES AND RIGHT

Safety and Risk Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - Respect for Authority - collective Bargaining - Confidentially - Conflicts of interest - Occupational Crime Professional Rights - Employee Rights intellectual Property Rights (IPR) - Discrimination

Module V: GLOBAL ISSUES

Multinational Corporations - Environment Ethics Computer Ethics - Weapons Development - Engineering as Managers - Consulting Engineers - Engineering as Expert Witnesses and Advisors - Moral Leadership-Code of Conduct - Corporate Social Responsibility

Suggested Books:

1. Mike W.Martin and Roland Schinzinger, " Ethics in Engineering" Tata Mc-Graw Hill New Delhi, 2003
2. Govindarajan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004
3. A Textbook on Professional Ethics and Human Values, R S Nagarajan, New Age International Publishers
4. Charies B. Feddemann, "Engineering Ethics" Pearson Prentics Hall, New Jersey, 2004
5. Charies E. Herris, Michael S. Pritchard and Michael J. Rabins "Engineering Ethics - Concepts and Cases", Learning, 2009
6. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
7. Edumund G Seebauer and Robert L. Barry," Fundamental of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
8. Laura P. Hartman and joe Desjardins, " Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education India Pvt. Ltd., New Delhi 2013.
9. World Community Service Centre, " Value Education ", Vethathiri publication, Erode, 2011

Professional Ethics (BT51)

Course Outcome:After completion of the course, Students will be able to:

CO1. Understand the importance of Values and Ethics in their Personal lives and professional careers.
CO2. Explain the awareness of professional ethics and human values.
CO3. Know professional rights and responsibilities of an Engineer, safety and risk benefit analysis of an Engineer.
CO4. Know their role in technological development.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS51C	**Virtual Reality**	70	20	10	-	-	100	3	1	-	4

Course Contents:

Module I: Introduction to Virtual Reality:
Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Simple 3D modelling, Illumination models, Reflection models.

Module II: Geometric Modelling:
Introduction, From 2D to 3D, 3D space curves, 3D boundary representation. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.

Module III: Virtual Environment
Virtual Environment: Introduction, Model of interaction, VR Systems, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Module IV: VR Hardware and Software
Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

Module V: VR Applications
Introduction, Engineering, Entertainment, Science, Training. The Future: Virtual environment, modes of interaction.

Suggested Books:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
3. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill
4. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science.
5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann.

Virtual Reality (CS51C)

Course Outcomes: After completion of the course, Students will be able to:

CO1: Understand the historical and modern overview and perspectives on virtual reality.
CO2: Describe important issues of VRML ,3D objects , Human Computer Interaction
CO3: Analysis of VR applications for Education, Medical, and learning environments.
CO4: Apply various types of hardware and software to virtual reality systems.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS51A	**Theory of Computation**	70	20	10	-	-	100	3	1	-	4

Course Contents:

Module-I : Introduction of Automata Theory:

Examples of automata machines, Finite Automata as a language acceptor and translator, Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, Equivalence of NDFA and DFA, minimization of automata machines, Moore mealy machines, Conversion from Mealy to Moore and vice versa.

Module-II: Regular Expressions and Languages:
Arden's theorem. Finite Automata and Regular Expressions, Converting from DFA's to Regular Expressions, Properties of Regular Languages, The Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

Module –III: Grammars:
Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, Eliminating null and unit productions. Chomsky normal form and Greibach normal form.

Module-IV: Push down Automata:
Examples of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA.

Module-V: Turing Machine:
Techniques for construction. Universal Turing machine Multitape, multihead and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable & undecidable languages, Halting problem of Turing machine & the post correspondence problem.

Suggested Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Pearson Education, India.
2. K. L. P Mishra, N. Chandrashekaran "Theory of Computer Science-Automata Languages and Computation", Prentice Hall of India.
3. Harry R. Lewis & Christos H. Papadimitriou, , "Element of the Theory computation ", Pearson.
4. Cohen, D.I. and Cohen, D.I., "Introduction to computer theory" , Wiley.

Theory of Computation(CS51A)

Course Outcomes:

CO1: Outline the concept of Finite Automata and Regular Expression.
CO2: Illustrate the design of Context Free Grammar for any language set.
CO3: Demonstrate the push down automaton model for the given language.
CO4: Make use of the Turing machine concept to solve the simple problems.
CO5: Explain decidability or undecidability of various problems.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS51B	**Advance Computer Architecture**	70	20	10	-	-	100	3	1	-	4

Course Contents:

Module I: Fundamentals:
Flynn's Classification, System Attributes to Performance, Parallel computer models - Multiprocessors and multicomputers, Multivector and SIMD Computers. Data and resource dependencies, Hardware and software parallelism,Program partitioning and scheduling, Grain size and latency, Control flow, data flow and Demand driven mechanisms. Static interconnection networks, Dynamic interconnection Networks: Bus Systems, Crossbar Switch, Multiport Memory, Multistage and Combining Networks.

Module II: Memory Organization:
Instruction set architecture, CISC Scalar Processors , RISC Scalar Processors, VLIW architecture, Memory Hierarchy, Inclusion, Coherence and Locality, Memory capacity planning. Interleaved memory organization- memory interleaving, pipelined memory access, Bandwidth and Fault Tolerance. Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt.

Module III: Pipelining:
Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling- score boarding and Tomosulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscaler pipeline design, Super pipeline processor design.

Module IV: Vector Processing & Memory models:
Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer network, deadlock and virtual channel. Vector Processing Principles, Vector instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD organization: distributed memory model and shared memory model. Principles of Multithreading: Multithreading Issues and Solutions, Multiple-Context Processors

Module V: Programming models:
Parallel Programming Models, Shared-Variable Model, Message-Passing Model, Data-Parallel Model, Object-Oriented Model, Functional and Logic Models, Parallel Languages and Compilers, Language Features for Parallelism, Parallel Programming Environment, Software Tools and Environments.

Suggested Books:

1. John L Hennessey, David A Patterson, "Computer Architecture: A Quantitative Approach", Elsevier.
2. Kai Hwang and Faye Briggs, "Computer Architecture and Parallel Processing", McGraw-Hill.
3. Sima D, Fountain T and Kacsuk P, "Advanced Computer Architectures: A Design Space" Addison Wesley

Advance Computer Architecture (CS51B)

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

CO1: Demonstrate concepts of parallelism in hardware/software.
CO2 : Discuss memory organization and mapping techniques.
CO3 : Describe architectural features of advanced processors.
CO4 : Interpret performance of different pipelined processors.
CO5 : Development of software to solve computationally intensive problems.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS42	Database Management Systems	70	20	10	30	20	150	3	0	2	4

Course Contents:

Module I: Introduction:

General introduction to database systems, DBMS Concepts and architecture, Data models-Hierarchical, Network and Relational, Three-schema architecture of a database, Data independence- Physical and Logical data independence. Challenges in building a DBMS, Various components of a DBMS.

Module II: Entity Relationship Model:

Conceptual data modeling - motivation, Entities, Entity types, Various types of attributes, Relationships, Relationship types, E/R diagram notations, Keys: Super key, Candidate key, Primary Key, Alternate key and Foreign key. Extended ER features: Specialization, Generalization, Aggregation, Examples.

Module III: Relational Data Model:

Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys; Relational Algebra: Selection, Projection, Cross product, Various types of joins, Division, Example queries; Converting the database specification in E/R notation to the relational schema; SQL: Introduction, Data definition in SQL, Table, key and foreign key definitions, Update behaviors, Querying in SQL, Basic select-from- where block and its semantics, Nested queries, Aggregation functions group by and having clauses.

Module IV: Functional Dependencies and Normal forms:

Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, Minimal covers; Definitions of 1NF, 2NF, 3NF and BCNF, Decompositions and desirable properties of them; Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.

Module V: Transaction Processing and Recovery Concepts:

Concepts of transaction processing, ACID properties, Testing for Serializability of schedules, conflict & view serializable schedule, recoverability; Concurrency Control: Locking based protocols for CC; Deadlock handling; Recovery from transaction failures: Log based recovery, Checkpoints.

Suggested Books:

1. Avi Silberschatz, Henry F. Korth, S. Sudarsan, Database System Concepts.
2. Elmasi, R. and Navathe, S.B., "Fundamentals of Database Systems", Pearson Education.
3. Date, C. J., "Introduction to Database Systems", Pearson Education.
4. Ramakrishnan, R. and Gekhre, J., "Database Management Systems", McGraw-Hill.
5. Vipin C Desai, "An Introduction to Database Systems", Galgotia.

Database Management Systems (CS42)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Explain the fundamental concepts of Database Management Systems, Data models, Normalization, Transaction Management & Recovery.

CO2: Apply normalization concepts when designing the database.

CO3: Design the database's ER and Relational Model for the given problem.

CO4: Formulate SQI- commands (DDL, DML and DCL) for the given problem statement.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS54	**Computer Graphics & Multimedia**	70	20	10	30	20	150	3	-	2	4

Course Content:

Module-I : Fundamentals:
Introduction to Raster Scan displays, Pixels, Frame buffer, Vector & Character generation, Random Scan systems, Display devices, Scan Conversion techniques, Line Drawing: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms: Midpoint Circle drawing and Bresenham's Algorithm, Polygon fill algorithm: Boundary-fill and Flood-fill algorithms

Module-II : 2-D Transformation:
Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogenous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping & Polygon Clipping Algorithms.

Module-III : 3-D Transformations:
Translation, Rotation and Scaling. Parallel & Perspective Projection: Types of Parallel & Perspective Projection, Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm.

Module-IV : Curve Generation and color model:
Curve generation, Bezier and Bspline methods. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong Shading, Gouraud shading, Ray Tracing, Color models like RGB, YIQ, CMY, HSV.

Module-V : Multimedia & Animation:
Text –Types, Unicode Standard ,text Compression, Text file formats, Audio file formats , Image file formats , Digital Video processing, Video file formats. Compression techniques. Animation: Principles of Animation, Computer based animation, 2D and 3D Animation, Animation file formats, Animation software.

Suggested Books:

1. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill.
2. Donald Hearn and M.P. Becker "Computer Graphics" Pearson Pub.
3. Parekh "Principles of Multimedia" Tata McGraw Hill .
4. Maurya, "Computer Graphics with Virtual Reality System " , Wiley India.
5. Pakhira,"Computer Graphics ,Multimedia & Animation",PHI learning.
6. Andleigh, Thakral , "Multimedia System Design " PHI Learning.

Computer Graphics & Multimedia (CS54)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Explain the basic concepts used in Computer Graphics, Multimedia and Animation.

CO2: Build and apply various algorithms for Scanning, Geometrical transformations, Area filling & Clipping.

CO3: Develop Curve Generation Algorithm, conclude for Illumination Model and select Color Model .

CO4: Design computer Graphics applications, Animation, Virtual Reality and Multimedia applications.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS62A	**Image Processing**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I: Digital Image Fundamentals:

Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures

Module II: Intensity transformation and filtering:

Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters- first and second derivative, two-dimensional DFT and its inverse, frequency, domain filters – low-pass and high-pass.

Module III: Color Image Processing:

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Module IV: Image Compression:

Fundamentals, Huffman Coding, Arithmetic Coding, LZW coding, Bit plane Coding, Symbol Based Coding, Block Transform Coding (walsh-Hadamard transform Discrete Cosine Transform), Wavelet Coding.

Module V: Mathematical morphology:

Erosion,Dilation,Duality,Opening And Closing,Hit-or-miss transformation, Boundary Extraction, Hole Filling, Extraction of Connected Components, convex Hull, Thinning, Thickening, Skeletons, Pruning. **Image Segmentation**: Point, Line and Edge Detection, Thresholding, Region based Segmentation.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods "Digital Image Processing" Pearson.
2. Milan Sonka and Vaclav Hlavac and Roger Boyle "Image Processing, Analysis and Machine Vision" Springer-Science.
3. Anil Kumar Jain "Fundamental of Digital Image Processing" pearson education.
4. Rafael C. Gonzalez, Richard E. Woods , "Digital Image Processing Using MATLAB", Mc Graw Hill India.

Image Processing (CS62A)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Review the fundamental concepts of a digital image processing system.
CO2: Analyze images in the frequency domain using various transforms.
CO3: Evaluate the techniques for image enhancement and image restoration.
CO4: Categorize various compression techniques.
CO5: Interpret Image compression standards.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS61B	**Parallel Computing**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I : Introduction:
Parallel computing, scope of parallel computing, Abstract model of serial & parallel computation, pipelining, data parallelism, control parallelism, scalability , topologies in processor organization, parallel computing design consideration, parallel algorithms & parallel architectures, applications of parallel computing.

Module II : Memory Architecture:
Shared memory multiprocessors (UMA-Uniform memory Access), Distributed memory multiprocessors (NUMA- Non Uniform memory Access), SIMD, Systolic processor ,Cluster computing, Grid computing, Multicore Systems.

Module III : Introduction to Parallel Algorithms:
Introduction to parallel algorithms, parallel algorithm models, Decomposition Techniques, characteristics of tasks & interactions, mapping techniques for load balancing, methods for containing interaction overheads.

Module IV: Parallel Algorithms:
Matrix multiplication, parallel reduction, parallel sorting : bubble, quick sort, Graph algorithm: Minimum spanning tree(prim's algorithm), Fast Fourier transform: serial and transpose algorithm .

Module V : Parallel Programming Models & Performance Measures:
Paradigms, parallel programming models, shared memory programming, message passing programming , MPI , PVM ,Threads. Sources of overhead in parallel programs , performance metrics for parallel systems , effect of granularity & data mapping on performance, scalability of parallel systems, analysis of parallel programs.

Suggested Books:

1. Ananth Grama ,George Karypis, Vipin Kumar, Anshul Gupta. "Introduction to Parallel Computing", Addison.
2. Fayez Gebali , "Algorithms and Parallel Computing ", Wiley India.
3. M.Sasikumar , Dinesh shikhare, P. Ravi Prakash , "Introduction to parallel processing " Eastern Economy edition.
4. P. Venkata Krishna, Ane's , "Principles of Grid computing ", Ane Books Pvt Ltd.

Parallel Computing (CS61B)
Course Outcomes: After completion of course, student will be able to:

CO1: Understand the basics of parallel computing, including its models, techniques, and applications.

CO2: Explain different memory architectures used in parallel computing, including shared and distributed memory systems.

CO3: Describe parallel algorithm models and techniques for task decomposition, load balancing, and minimizing interaction overheads.

CO4: Apply parallel algorithms to problems such as matrix multiplication, sorting, and graph algorithms.

CO5: Evaluate parallel programming models and measure performance, considering overheads, granularity, and scalability.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS62C	**Robotics**	70	20	10	-	-	100	3	1	0	4

Course Content:

Module I: Introduction: Classification ofRobots, Basic Robot Components, Manipulator End Effectors, Controller, Power Unit, Sensing Devices, Specification ofRobot System, Accuracy Precision and Repeatability. Coordinate Systems: Cartesian Coordinates, Transformation Matrices, Reference Frame Transformations, Orientation, Inverse Transformations, and Graphs.

Module II: Robotic Sensing Devices: Position, Velocity and Acceleration Sensors, Proximity and Range Sensors, Touch and Slip Sensors, Tactile Sensors, Force and Torque Sensors. Robotic Vision System: Imaging Components Picture Coding, Object Recognition, Training and Vision Systems, Review of Existing Systems.

Module III: Robotics Programming: Methods of Robotics Programming, Types of Programming, Robotics Programming Language, Artificial Intelligence. Robot Application: Material Transfer and Machine Loading Unloading, Processing Applications, Welding and Painting Assembly and Inspection, Future Robotic Application and Related Technologies Development.

Module IV: Image Identification: Lenses, Vidicon Tube, Solid-State Vision System, Image Process Binary [mage Analysis Identification, The Transformation. Actuators and Power Transmission Devices: Pneumatic and Hydraulic Actuators, Electrical Actuators, Power Transmission Trajectory Planning & Control: Manipulator Equations of Motion Manipulator Control, The Measure of the Robot.

Module V: Control: Basic Concepts in Control Systems, Digital Control for Positions. System Inte$ation: Mechanism, Actuators and Sensors

Suggested Books:

1. J.craig, "Introduction to Robotics" Addision Wesley.
2. Klafter, chmielewski and nagrin, "Robotics Engineering", Prentice hall.
3. Robert J. Schilling, "Fundamental of Robotics analysis and control", Pearson education.

Robotics(CS62C)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: To learn about knowledge for the design of robotics.

CO2: Will understand robot kinematics and robot programming.

CO3: Will understand the application of Robots.

CO4:To learn about force and torque sensing.

CO5:To learn about the application of robots.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS71C	**Wireless Sensor Networks**	70	20	10	0	0	100	3	1	0	4

Course Content:

Module I: Fundamentals: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Module II: Ad hoc networks: . Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Module III: Routing: Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

Module IV: Data dissemination: Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Module V: Design : Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Suggested Books:

1. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication.
3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications.
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols ard Applications, Wiley-Inter science.
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press

Wireless Sensor Networks (CS71C)

Course Outcome: After completion of the course, Students will be able to:

CO1: Understand the basics, challenges, and applications of wireless sensor networks.

CO2: Explain the key technologies, issues, and challenges in MANETs and wireless sensor networks.

CO3: Describe routing protocols and MAC protocols, including IEEE 802.15.4 and ZigBee.

CO4: Analyze data dissemination and fusion techniques, focusing on real-time support and security in sensor networks.

CO5: Apply design principles for WSNs, including gateway concepts, communication methods, and operating systems like TinyOS.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS64	**Software Engineering**	70	20	10	30	20	150	3	-	2	4

Course Content:

Module I: Introduction:
Phases in Software development, Software Development Life Cycle (SDLC), software development process models Software process models (Linear Sequential Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, and Rational Unified Process), Agile process.

Module II: Software Requirement specification (SRS):
Role of SRS, Requirements gathering and problem analysis, requirement specification, validation of SRS document. Use cases: Use case modeling, Use case diagram and use case documents/specifications.

Module III: Object-Oriented Modeling (using UML):
Analysis Modeling, Developing Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram. System and Subsystem Design, Design goals.

Module IV: Software Testing:
Unit testing, Integration testing, System testing, Regression testing, Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis.

Module V: Software Project Management:
Software Project Planning, Cost Estimation, Scheduling, Risk Management, Quality Management, Software Change Management, Software refactoring, Re-engineering, Reverse Engineering, Defect cycle and bug management.

Suggested Course Project Work (One of the Lab Assignment) : Develop and Deploy a small project on some OSS platform like GitHub.

Suggested books:

1. R S. Pressman ,"Software Engineering: A Practitioner's Approach", McGraw-Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning.
3. Sommerville,"Software Engineering", Pearson Education.
4. Grady Booch, Robart A. Maksimchuk, Michael W. Engle, Bobbij Young, Jim Conallen, and Kellia Houston, "Object Oriented Analysis & Design with Applications" , Pearson Education India.
5. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa.
6. Bernd Bruegge, Allen Dutoit: "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Prentice Hall.
7. Blaha and Rumbaugh. "Object-Oriented Analysis and Modeling using UML",TMH.

Software Engineering (CS64)

Course Outcomes: After successful completion of the course, the students will be able to:

CO1: Understand and Explain concepts of software engineering such as SDIC and software process models, SRS, UML models (or Software Artifacts), software testing and software project management

CO2: Analyze SRS/problem specifications to extract relevant domain clements such as domain class, class attributes, operations and relationships between classes

CO3: Develop the use case models, analysis level class diagram and sequence diagrams for the given problem

CO4 : Design UML models such as Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram and test cases for a given software problem.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS63	**Computer Networks**	70	20	10	30	20	150	3	-	2	4

Course Content:

Module I: Computer Network:

Definitions, Goals, Components, Architecture, Classifications & Types. Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service primitives, Design issues & its functionality, ISO OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/P. Network standardization. Queuing Models: Little's Theorem, Queuing System: M/lvV1, M,Azl/m, M/N4/oo, MIM/mJm, }1/GI l.

Module Il: Data Link Layer:

Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol. Elementary & Sliding Window protocol: l-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Bit oriented protocols: SDLC, HDLC, BISYNC, LAP and LAPB. Protocol verification: Finite State Machine Models & Petri net models.

Module III: MAC Sub layer:

MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes Contention Schemes: for Data Services (ALOHA and Slotted ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bitmap, BRAP, Binary Countdown, MLMA. Limited Contention Protocols: Adaptive Tree Walk, URN Protocol, High Speed LAN: Fast Ethernet, Gigabit Ethemet, FDDI, Performance Measuring Metrics. IEEE Standards 802 series & their variants.

Module IV: Network Layer :

Need, Services Provided , Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing, Congestion Control Algorithms: General Principles of Congestion control, Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram subnets. IP protocol, IP Addresses, Comparative study of IPv4 & IPv6, Mobile IP.

Module V: Transport Layer:

Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/lVlulticast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Session layer: Authentication, Authorization, Session layer protocol (PAP, SCP, H.245). Presentation layer: Data conversion, Character code translation, Compression, Encryption and Decryption, Presentation layer protocol (LPP, Telnet, X.25 packet Assembler/Disassembler). Application Layer: WWW and HTTP. FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP). Study of internetworking devices and their configuration- Switches, Hubs, Bridges; Routers and, Gateways etc.

Suggested Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks" Pearson Education.
2. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication.
3. Uyless Black, "Computer Networks", PHI Publication, Second Edition.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill.

Computers Networks (CS63)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Explain OSI and TCP/IP Protocol based reference model used for constructing Computer Networks.

CO2: Construct a computer Network using the Data Link Layer protocol and MAC Layer protocol.

CO3: Compare Routing Strategies, Networks Configuration and Various Protocols

CO4: Design computer Network by using efficient protocols and Internetworking devices,

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS75	**Computer Vision**	70	20	10	30	20	150	3	-	2	4

Course Content :

Module-I:Introduction to Computer Vision: Introduction to computer vision, Human visual system, Camera models, Image Formation and understanding, pixel and color transform, Image processing in computer vision, Application of computer vision. Image processing in computer vision: Spatial filtering operations, histogram operations, thresholding techniques, edge detection techniques, corner and interest points, 3D image processing.

Module-II: Feature Detection and Matching: Introduction to Feature Representation, Feature descriptors, GLCM, SIFT, and DWT. Image Matching, Feature distances, Accuracy Measurements (Precision, Recall, Sensitivity and Specificity) and Cross Validation Models, feature dimensionality reduction, principal component analysis.

Module-III: Shape and Region Analysis: Binary shape analysis, connectedness, object labeling and counting, size filtering, skeletons and thinning, deformable shape analysis, boundary tracking procedures, shape models and shape recognition, boundary length measures, boundary descriptors, chain codes, Fourier descriptors, region descriptors.

Module-IV: Image Classification: Introduction to Classification and learning techniques, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models. Introduction to 3D vision and motion, camera model, camera calibration, epipolar geometry. Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Module-V: Application and Research in Computer Vision: Object Recognition, Photo album, Face detection, Face recognition, Eigen faces, foreground-background separation, Medical image analysis, Security and Surveillance (Activity Recognition, Biometrics etc.), Document processing, image fusion, Super-resolution, Augmented Reality, Introduction to Deep learning in computer vision.

Suggested Books:

1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer.
3. Simon J.D.Prince "Computer Vision: Models, Learning, and Inference" Cambridge University Press
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press.
5. D. L.Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing.
6. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing. images", O'Reilly Media.

Computer Vision (CS75)

Course Outcome: after completion of the course, students will be able to:

CO1: Understand the fundamental image processing techniques required for computer vision.
CO2: Analysis of the shape descriptors and boundary tracking techniques.
CO3: Apply chain codes and other region descriptors.
CO4: Design a content based image retrieval system and develop applications using computer vision techniques.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS73	**Compiler Design**	70	20	10	30	20	150	3	-	2	4

Course contents:

Module l: Introduction: Compilers and Translators: The phases of the compiler - Lexical Analysis. Syntax Analysis, Intermediate Code Generation. Optimization, Code generation, Bookkeeping, Error handling.

Module II: Lexical Analysis: The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata: Regular expressions, NFA, DFA. Design of a lexical analyzer generator.

Module III : Syntax Analysis: The role of parser, context free grammars, writing a grammar, Top down Parsing: Recursive descent parser, Predictive parser. Bottom up Parsing: Handles. Viable prefixes, Operator precedence parsing. LR parsers: SLR, LALR, cLR. Parser generator (yACC).Error Recovery techniques for different Parsers. Syntax directed translation: Syntax directed definitions, Synthesized and inherited attributes, Construction of syntax trees.

Module IV: Run time environments: Source language issues (Activation trees, Control stack, scope of declaration, binding of names), Storage organization (Subdivision of mn-time memory, Activation records), Storage allocation strategies. Symbol tables: storage, data structures used.

Module V: Intermediate code generation: Intermediate languages, Graphical representation, Three Address code, Implementation of three address statements (Quadruples, Triples, indirect triples). Code optimization and code generation: introduction. Basic blocks & flow graphs, DAG, principle sources of optimization: loop optimization, eliminating induction variables, eliminating common sub-expression, loop unrolling, Ioop jamming etc. Peephole optimization, Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Suggested Books:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network. Defense". Second Edition. CENGAGE Learning
2. Allied V. Aho. Monica S. Lam, Ravi Sethi. JefTiey D. Ultman, Compilers: P nciples, Techniques and Tools!, Second Edition. pearson Education
3. Randy Allen. Ken Kennedy. Optimizing Compilers for Modern Architectures: A Dependence based Approach,Morgan Kaufmann Publishers.
4. SteveD S. Muchnick Advanced Compiler DesigN and ImplemeNtation , Morgan Kauftnann Publishers Elsevier Science, India, Indian Reprint.
5. Keith D Cooper and Linda Torczon, Engineering aCompiler, Morgan Kaufinann Publishers Elsevier ScieDce. 2004.
6. V. Raghavan Principles of Compiler Design, Tata Mcgraw Hill Education Publishers.

Compiler Design (CS73)
Course Outcomes: After completion of the course, student will be able to:

CO1: Understand the key phases of a compiler and their roles in translating source code to machine code.

CO2: Apply lexical analysis techniques to implement a token recognizer using regular expressions and finite automata.

CO3: Analyze and implement parsing techniques for context-free grammars.

CO4: Evaluate storage allocation strategies and their impact on run-time efficiency.

CO5: Create optimized intermediate code and apply basic code optimization techniques.

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		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS 703M	Cryptography & Network Security	70	20	10	30	20	150	3	-	2	4

Module-I: Overview: Services, Mechanisms and attacks, OSI security architecture, Model for network security. Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography, Problems. Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems.

Module-II: Public Key Cryptography and RSA: Principles of public key crypto systems, RSA algorithm, Problems. Other Public Key Crypto Systems and Key Management: Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems. Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC, Problems.

Module-III: Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard. Authentication Applications: Kerberos, X.509 authentication service, Kerberos encryption technique, Problems.

Module-IV: Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator. IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security pay load), Security associations, Key management, Problems.). Firewalls: Firewall design principles; Trusted systems, Problems.

Module-V: Intruders and Viruses: Intruders, Viruses, Worms, Trojan horses, Distributed Denial-Of-Service (DDoS), Firewalls, IDS, Honey nets, Honey pots.

Suggested Books:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education.
2. B. Forouzan, "Cryptography & Network Security", Tata McGraw-Hill.
3. AtulKahate, "Cryptography and Network Security," Tata McGraw-Hill.
4. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India.
5. Eric Maiwald, "Fundamentals of Network Security," McGraw-Hill.

Cryptography & Network Security (CS703M)

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

CO1: Understanding of the basics of network security and cryptographic techniques.
CO2: Illustrate various symmetric key cryptographic techniques'
CO3: Evaluate the asymmetric and hash algorithms.
CO4: Discuss Internet-Security Protocols.
CO5: Discuss and design the concepts of EMail and Network Security.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS71B	**Information Retrieval**	70	20	10			100	3	1	0	4

Course Content:

Module I: INTRODUCTION: Introduction, History of IR, Components of IR, Issues, Open source Search engine Frameworks, The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus Web Search, Components of a Search engine, Characterizing the web.

Module II: INFORMATION RETRIEVAL: Boolean and vector space retrieval models, Term weighting, TF-IDF, weighting- cosine similarity, Preprocessing, Inverted indices, efficient processing with sparse vectors, Language Model based IR, Probabilistic IR, Latent Semantic Indexing - Relevance feedback and query expansion.

Module III: WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING:
Web search overview, web structure, paid placement, search engine optimization/ spam. Web size measurement, search engine optimization/spam, Web Search Architectures, crawling, meta-crawlers, Focused Crawling, web indexes, Near-duplicate detection, Index Compression, XML retrieval.

Module IV: WEB SEARCH – LINK ANALYSIS AND SPECIALIZED SEARCH: Link Analysis, hubs and authorities, Pagerank and HITS algorithms, Searching and Ranking, Relevance Scoring and ranking for Web, Similarity, Hadoop & Map Reduce Evaluation, Personalized search, Collaborative filtering and content-based recommendation of documents and products, handling "invisible" Web, Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.

Module V: DOCUMENT TEXT MINING: Information filtering; organization and relevance feedback, Text Mining, Text classification and clustering, Categorization algorithms: naive Bayes; decision trees; and nearest neighbor, Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Suggested Books:
1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press.
2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley.

Information Retrieval (CS71B)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Apply information retrieval models.
CO2: Design Web Search Engine.
CO3: Use Link Analysis.
CO4: Use Hadoop and Map Reduce.
CO5: Apply document text mining techniques.

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		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS704M B	Natural Language Processing	70	20	10	-	-	100	3	1	-	4

Module-1:Introduction: Origins and challenges of NLP, Language Modelling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

Module-II:Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff, Words and Vectors Cosine for measuring similarity TF-IDF: Weighing terms in the vector, Applications of the tf-idf vector model – Word Classes, Part-of-Speech (POS) Tagging, The Penn Treebank POS Tagset, Rule-based, Stochastic and Transformation-based tagging, Issues in POS tagging – Hidden Markov and Maximum Entropy models.

Module-III: Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Dependency Parsing – Dependency Relation, Transition-based dependency parsing, Graph-based dependency parsing.

Module-IV: Semantics and Pragmatics: Logical representation of sentence meaning - First-Order Logic, Event State Representation, Description Logics; Word Sense Disambiguation; Semantic Role Labelling; Co-reference Resolution.

Module-V: Application of NLP: Sentiment Analysis, Information Retrieval, Question Answering System, Dialog System and Chatbots, Machine translation, Document or Text Summarization.

Suggested Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media.
3. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher.
4. Richard M Reese, —Natural Language Processing with Java, OReilly Media.
5. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press.
6. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press

Natural Language Processing (CS704M B)
Course Outcomes: Upon completion of the course, the students will be able to

CO1: Tag a giver text with basic Language features.
CO2: Design an innovative application using NLP components.
CO3: Implement a rule based system to tackle morphology/syntax of a language.
CO4: Design a tag set to be used for statistical processing for real-time applications.
CO5: Compare and contrast the use of different statistical approaches for different types of NLP applications.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS81A	**Computational Intelligence**	70	20	10	-	-	100	3	1	-	4

Course Contents:

Module-I: Introduction to Computational Intelligence; types of Computational Intelligence, components of Computational Intelligence. Concept of Learning/Training model. Parametric Models, Nonparametric Models. Multilayer Networks: Feed Forward network, Feedback network.

Module-II: Fuzzy Systems: Fuzzy set theory: Fuzzy sets and operations, Membership Functions, Concept of Fuzzy relations and their composition, Concept of Fuzzy Measures; Fuzzy Logic: Fuzzy Rules, Inferencing; Fuzzy Control - Selection of Membership Functions, Fuzzification, Rule Based Design & Inferencing, Defuzzification.

Module-III: Genetic Algorithms: Basic Genetics, Concepts, Working Principle, Creation of Offsprings, Encoding, Fitness Function, Selection Functions, Genetic Operators-Reproduction, Crossover, Mutation; Genetic Modeling, Benefits.

Module-IV: Rough Set Theory - Introduction, Fundamental Concepts, Set approximation, Rough membership, Attributes, Optimization. Hidden Markov Models, Decision tree model.

Module-V: Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization etc. Applications of Computational Intelligence.

Suggested Books:

1. Russell C. Eberhart and Yuhui Shi, Computational Intelligence: Concepts to Implementations, Morgan Kaufmann Publishers.
2. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley Publishing.
3. Simon Haykin, Neural Networks: A Comprehensive Foundation, Prentice Hall.
4. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education.
5. Jagdish Chand Bansal, Pramod Kumar Singh, Nikhil R. Pal, Evolutionary and Swarm Intelligence Algorithms, Springer Publishing, 2019.
6. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, GeneticAlgorithms Synthesis and Applications".
7. J.S. Roger Jang, C.T.Sun, E. Mizutani, 'Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning & Machine Intelligence", PIil., 2002.

Computational intelligence (CS81A)

Course Outcomes: After completion of the course, Students will be able to:

CO1: Describe in depth theories, methods, algorithms and learning models in Computational Intelligence.

CO2: Compare and contrast traditional algorithms with nature inspired algorithms.

CO3: Examine the nature of a problem and determine whether a computation intelligent technique/ algorithm can solve it efficiently enough.

CO4: Design and implement Computational Intelligence algorithms and approaches for solving real life problems.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS72B	**Optimization Techniques**	70	20	10	-	-	100	3	1	0	4

Module I: Introduction to Optimization: Engineering application of Optimization,Statement of an Optimization problem, Optimal Problem formulation, Classification of Optimization problem. Optimum design concepts: Definition of Global and Local optima – Optimality criteria - Review of basic calculus concepts – Global optimality

Module II: Linear Programming (LP): Introduction to LP and formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Algorithm, Minimization – Simplex Algorithm using BigM method, Two phase method, Duality in linear programming, Integer linear programming.

Module III: Unconstrained optimization problems: Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method.

Module IV: Constrained optimization problems: Optimization algorithms for solving constrained optimization problems – direct methods – Necessary and sufficient condition – equality constraints, inequality constraints - kuhu – tucker conditions – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Module V: Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications.

Suggested Books:

1. Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd.
2. David G.Luerbeggan, "Introduction to Linear and NonLinear Programming", Addison Wesley Publishing Co.
3. E. K. P. Chong and S. Zak, An introduction to optimization, John Wiley and Sons (Asia) Pvt. Ltd., Singapore
4. R. Fletcher, Practical methods of optimization, 2nd Edition, Wiley, New York
5. D. Luenberger, Linear and nonlinear programming, Kluwer Academic Publisher, New YorkN D Vohra, Quantitative Techniques in management, Tata McGraw Hill.

Optimization Techniques (CS72B)

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

CO1: Comprehend the techniques and applications of Engineering optimization.
CO2: Analyze characteristics of a general linear programming problem.
CO3: Apply basic concepts of mathematics to formulate an optimization problem.
CO4: Analyse various methods of solving the unconstrained minimization problem.
CO5: Analyze and appreciate the variety of performance measures for various optimization problems.

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		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS705M C	Internet of Things	70	20	10	-	-	100	3	1	-	4

Module-I: IoT definition, Characteristics, IoT conceptual and architectural framework, Physical and logical design of IoT, IoT enablers, Modern day IoT applications, M2M communications, IoT vs M2M, IoT vs WoT, IoT reference architecture, IoT Network configurations, IoT LAN, IoT WAN, IoT Node, IoT Gateway, IoT Proxy, IPv4 vs IPV6

Module-II: Sensor, Basic components and challenges of a sensor node, Sensor features, Sensor resolution; Sensor classes: Analog, Digital, Scalar, Vector Sensors; Sensor Types, bias, drift, Hysteresis error, quantization error; Actuator; Actuator types: Hydraulic, Pneumatic, electrical, thermal/magnetic, mechanical actuators, soft actuators

Module-III: Basics of IoT Networking, IoT Components, Functional components of IoT, IoT service oriented architecture, IoT challenges, 6LowPAN, IEEE 802.15.4, ZigBee and its types, RFID Features, RFID working principle and applications, NFC (Near Field communication), Bluetooth, Wireless Sensor Networks and its Applications

Module-IV: MQTT, MQTT methods and components, MQTT communication, topics and applications, SMQTT, CoAP, CoAP message types, CoAP Request-Response model, XMPP, AMQP features and components, AMQP frame types

Module-V: IoT Platforms, Arduino, Raspberry Pi Board, Other IoT Platforms; Data Analytics for IoT, Cloud for IoT, Cloud storage models & communication APIs, IoT case studies

Suggested Books:

1. Vijay Madisetti, Arshdeep Bahga, "Ïnternet of Things, A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

Internet of Things (CS705M C)

Course Outcome: after completion of the course, students will be able to:

CO1: Understand the various concepts, terminologies and architecture of IoT systems.
CO2: Implement the use of sensors for the design of IoT and apply various protocols for design of IoT systems
CO3: Evaluate various techniques of data storage and analytics in IoT
CO4: Understand various applications of IoT.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS81C	**Network Management**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I: Introduction to Network Managements: Network Management Framework, Network Based Managements, Evolution of Network Management: SGMP, CMIP, SNMP. Network Implementation and Management Strategies, Network Management Categories: Performance Management, Fault Management, Configuration Management, Security Managements, Accounting Managements. Network Management Configuration: Centralised Configuration, Distributed Configuration. Selected Management Strategy.

Module II: Management Information Base (MIB), Structure of Management Information, NMS Presentation of the sMI, NMS Meter-ware Network view. Remote Monitoring (RMON), RMON Group. Desktop Management: Desktop Management Interface (DMI), DMI Architecture, DMI Browser, DMVSNMp Mapping, Desktop SNMP Extension Agents. Setting up LAN Access, SNMP Configuration.

Module III: OSI Layering, TCP/IP Layering, Protocols & Standards, Internet standards, Internet administration, Internet Addresses, Internet protocol: introduction, IP header, IP routing, Subnet addressing, subnet mask, special case of IP addresses, Comparative Study of IPV4 & IPV6, port numbers Address Resolution Protocol, ARP packet format, Proxy ARP, ARP command, ARP Example, Reverse Address Resolution Protocol (RARP): Introduction, RARp Packet format, RARP Examples, RARP server design.

Module IV: Delivery and Routing of IP Packets, Routing Methods, Static versus Dynamic Routing, Routing table. and Routing Module, Classless Addressing: CIDR. Internet Protocol (lP), Datagram, Fragnrentation, Options, IP Package. Interior and Exterior Routing, Routing information protocol (RIP), Open shortest path first protocol (OSPF). BGP, GGP. Private Netrvorks. Virtual Private Network (VPN), Network Address Translation (NAT).

Module V: Internet Control Message Protocols (ICMP):- Types of message, message for,at. error reporting. query. checksum" ICMP Package. IGMP, IGMP Message and its operation, IcMp package. Transmission control protocol, Process-to-Prooess Communication. TCP Services Flow Control, TCP Timers. TCP Operation, TCP Package. Application layers protocols Telnet Protocol. File Transfer Protocol (FTP), Simple Mail 'I'ransfer Protocol (SMT'P). X-Window system protocol, Remote procedure call, and Network file system.

Suggested Books:

1. Forouzan. TCP/IP Protocol Suite 4th edition, TMH
2. J.RichardBurkey. Netrvork Management Concept and Practice. PHI
3. Stevens,'I'CP/IP Illustrated Volume-I, Pearson
4. Tittel:TCP/IP, Cenage Learning
5. TCP/IP and related protocols, McGraw Hill.
6. DougJrals E. Comer, Internet working with TCP/IP Vol. I, Principles" Protocols, and Architecture, Prentice Hall,India.

Network Management (CS81C)

Course Outcomes: On successful completion of the course, the students will be able to:

C01: Explain and demonstrate Network Management Architecture, Routing & Protocols used for Network Management.

C02: Select Routing methods and Protocols for Network Based Management and Construct Computer Network.

C03: Compare Routing Strategies, Network Configuration and various Protocols.

C04: Select Network Management Protocols and maintain the network by performing a routine maintenance task

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS82C	**Data Warehouse & Mining**	70	20	10	-	-	100	3	1	-	4

Module-I: Data Warehouse: Introduction, Delivery Process, Data warehouse Architecture, Data Preprocessing: Data cleaning, Data Integration and transformation, Data reduction. Data warehouse Design: Data warehouse schema, Partitioning strategy Data warehouse Implementation, Data Marts, Meta Data, and Example of a Multidimensional Data model. Introduction to Pattern Warehousing.

Module-II: OLAP Systems: Basic concepts, OLAP queries, Types of OLAP servers, OLAP operations etc. Data Warehouse Hardware and Operational Design: Security, Backup and Recovery.

Module-III: Introduction to Data & Data Mining: Data Types, Quality of data, Data Preprocessing, Similarity measures, Summary statistics, Data distributions, Basic data mining tasks, Data Mining V/s knowledge discovery in databases. issues in Data mining. Introduction toFuzzy sets and fuzzy logic.

Module-IV: Supervised Learning: Classification: Statistical-based algorithms, Distance-based algorithms, Decision tree-based algorithms, neural network-based algorithms, Rule-based algorithms, Probabilistic Classifiers Advanced techniques: Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing). Bayesian approach to classifying text Web mining: classifying web pages, extracting knowledge from the web Data Mining software and applications

Module-V: Clustering & Association Rule mining: Hierarchical algorithms, Partitional algorithms, Clustering large databases BIRCH, DBSCAN, CURE algorithms, Association rules: Parallel and distributed algorithms such as Apriori and FP growth algorithms.

Suggested Books:

l. Pang-Ning Tan, Steinbach & Kumar, "Introduction to Data Mining", Pearson Education.
2. Data Mining Techniques; ArunK.Pujari; University Press.
3.Jiawei Han, MichelineKamber,"Data Mining : Concepts and Techniques", Morgan Kaufmann Publishers.
4. Anahory& Murray, "Data Warehousing in the Real World", Pearson Education.
5. Margaret H. Dunham,"Dato Mining : Introductory and Advanced topics", Pearson Education.
6. Data Mining: Adriaans & Zantinge; Pearson education.
7. Mastering Data Mining; Berr ,Linoff; Wiley.

Data Warehouse & Mining (CS82C)

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

CO1: Understand the functionality of the various data mining and data warehousing components.
CO2: Analyse OLAP tools.
CO3: Apply Data Mining Techniques and methods on large data sets.
CO4: Compare and contrast classification and prediction techniques.
CO5: Explain data mining tools on various applications and understand the basics of big data analytics.

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(AICTE Model Curriculum based scheme) with provision for internship
B. Tech. (AICTE) VIII Sem. (Computer Science & Engineering) w.e.f. July 2024

Subject code	Subject Name & Title	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS801M A	Distributed Systems & Cloud Computing	70	20	10	-	-	100	3	1	-	4

Module-I: Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks; Lamport's & vectors logical clocks. Concepts in Message Passing Systems: causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, and termination detection.

Module-II: Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non-token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized deadlock detection, distributed deadlock detection, path pushing algorithms, edge chasing algorithms.

Module-III: Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system. Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.

Module-IV: Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, obtaining consistent Checkpoints, Recovery in Distributed Database Systems. Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols

Module-V: Cloud Computing Definition: Cloud Types: private, public and hybrid cloud. Cloud computing Services: IaaS, PaaS, SaaS. Introduction to cloud Virtualization concepts. Types of Virtualization & its benefits. Benefits and challenges of cloud computing, Next generation Cloud Applications.

Suggested Books:

1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Computing, Wiley
4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education 5. Tanenbaum,Steen," Distributed Systems", PHI
5. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, .
6. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press.

Distributed System & Cloud Computing (CS801M A)

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

CO1: Explain fundamental concepts of Distributed System and Cloud Computing.

CO2: Classify various architectural and fundamental models of distributed system design.

CO3: Apply the election algorithms in a given scenario to select the coordinator.

CO4: Analyze different agreement protocols and communication protocols like RPC, RMI etc. in Distributed systems.

CO5: Examine various deadlock handling mechanisms in distributed environment.

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CS 802M C	Ethical Hacking	70	20	10	-	-	100	3	1	-	4

Module-1: Ethical Hacking: Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and Non-Repudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker, Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking & Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors.

Module-II: Foot Printing And Social Engineering: Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking.

Module-III: Data Security: Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.

Module-IV: Network Protection System & Hacking Web Servers: Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking.

Module-V: Ethical Hacking Laws And Tests: An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

Suggested Books:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network Defense", Second Edition, CENGAGE Learning.
2. Steven DeFino, Barry Kaufman, Nick Valenteen, "Official Certified Ethical Hacker Review Guide", CENGAGE Learning.
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Basics Series –Elsevier.
4. Whitaker & Newman, "Penetration Testing and Network Defense" , Cisco Press, Indianapolis.

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Ethical Hacking (CS 802M C)

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

CO1: Understand how intruders escalate privileges.
CO2: Understand intrusion Detection, Policy Creation, Social Engineering, Buffer.
CO3: Define overflows and different types of Attacks and their protection mechanism.
CO4: Learn about ethical laws and tests.

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W.e.f. July 2023

Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS82B	**Data Analytics**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I: Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing Introduction to Statistical Concepts: Sampling Distributions, Resampling, Statistical Inference, and R-Programming Descriptive Statistics Measures of central tendency Measures of location of dispersions.

Module II: Basic Data analysis techniques: Statistical hypothesis generation and testing, Chi-Square test, t-Test Analysis of variance Correlation analysis, Maximum likelihood test

Module III: Advance Data analysis techniques: Regression Modelling, Multivariate Analysis, Bayesian Modeling, Inference And Bayesian Network, Regression analysis, Classification techniques, Clustering Techniques, Clustering Association rules analysis

Module IV: Frameworks and Visualization: MapReduce - Hadoop, Hive, MapR - Sharding - NoSQL Databases - 53 - Hadoop Distributed File Systems - Visualisations - Visual Data Analysis Techniques, Interaction Techniques; Systems and Applications

Module V: Case studies and projects: Understanding business scenarios, Feature engineering and visualisation, Scalable and parallel computing with Hadoop and Map-Reduce Sensitivity Analysis, Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Suggested Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. AnandRajaraman And Jeffrey David Ullman, Mining Of Massive Datasets,Cambridge University Press.
3. Bill Franks, Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics, John Wiley & Sons.
4. Glenn J. Myatt, Making Sense Of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O"Reilly.

Data Analytics (CS82B)

Course Outcomes:

CO1: Demonstrate specialist knowledge of how a range of data sources and analytical methods are used to inform decision making across multiple domains.

CO2: Understand Big Data and its analytics in the real world.

CO3: Analyse the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics.

CO4:Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm.

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w.e.f. July 2023

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab work	Total Marks				
CS33	**Data Structure & Algorithms**	70	20	10	30	20	150	3	0	2	4

Course Contents:

Module I: Introduction

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.
Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module II: Linked Lists

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linkedlist; doubly linked list and Circular Linked Lists. Linked representation of Stack and Queue.

Module III: Stacks and Queues

Stack and its operations. Applications of Stacks: Expression Conversion and evaluation–corresponding algorithms. Queue and its operations. Types of Queue: Simple Queue, Circular Queue, Priority Queue.

Module IV: Trees

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions and operations.

Module V: Sorting and Hashing

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort; Performance and Comparison among all the methods. Hashing and Collision handling techniques. **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested books:

1. "Fundamentals of data structures in C " 2nd edition, by S Sahni, Universities Press.
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Edu.
3. "Data Structures using C and C++" 2nd edition, Tenenbaum, PHI publication.
4. "Introduction to algorithms" 3rd edition by Cormen, MIT press.

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Data Structures and Algorithms (CS33)
Course Outcomes:

CO1: Describe various data structures such as Arrays. linked lists. stacks. queues, trees and graphs and the operations performed on them.

CO2: Apply the concepts of various data structures such as linked lists, stacks, queues. trees and graphs to write algorithms and programs to implement them.

CO3: Analyze various searching and sorting algorithms such as Linear search, Binary search, Selection sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort and Heap sort to estimate their time and space complexity

CO4: Develop solutions of the given problem using appropriate data structures.

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Subject code	Subject Name	Maximum Marks Allotted						Hours/Week			Total Credits
		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS61A	**Data Center Management**	70	20	10	-	-	100	3	1		4

Course Contents:

Module-I: Introduction to Data Center: Role of data center in digitalization, components of datacenters, Types and tier classification of datacenters. Carbon footprints of data center, methods to reduce the carbon footprint. Natural Cooling solutions. Energy Optimization techniques in data center, Power Usage Effectiveness (PUE). Data localization: Policies resulting in need of Data centers to be hosted in the Country (GDPR, Indian Personal Data Protection bill).

Module-II: Data Center Design: features of a good datacenter Design: layout, flexibility, modularity, scalability, environmental control, network infrastructure, high availability, security and service oriented infrastructure (SOI). **Server Architecture:** Tower, Rack and Blade servers. Network server types: mail server, file server, web server etc. standalone, stateful and stateless servers. Server Clustering.

Module-II: Data Center Networking: Data Center cabling standards: TIA/EIA-942, Structured and unstructured cabling, fiber and copper cabling characteristics, cable management, bandwidth requirements, I/o connectivity. Datacenter Network design: core, aggregation and access layers. Top of rack (ToR), end of row (EOR), architectures, solutions that reduce power and cabling.

Module-IV: Virtualization: Server virtualization, Virtual machine monitors (VMM) : Type 1 and Type 2 Hypervisor, Containers; Provisioning of virtual CPUs using a Hypervisor, Virtual storage and Connectivity to storage area networks (SAN) . Case Study: VMWare workstation, / Oracle VirtualBox / Microsoft Hyper-V .

Module-V: Resource Management and Monitoring: Load balancing: Need, Types of Load balancers: internal, external, software/ hardware based, layer 4, layer 7 implementation. Load balancing algorithms: Static, dynamic, round robin, IP hashing etc.

Suggested Books:

1. Administering Data centers: servers, Storage and voice over IP, Kailas Jayaswal.
2. Data Center Handbook by Hwaiyu Geng, Wiley; 1 edition.
3. Virtualization Essentials, 2nd Edition, by Matthew Portnoy , sybax-wiley brand

Data Center Management (CS61A)
Course Outcomes: After completion of course, student will be able to:

CO1: Explain the Data Center, carbon footprint of data centers, Need of cooling, need of data localization, a good datacenter design, datacenter standards, virtual servers, load balancing and resource monitoring techniques.

CO2: Select the right type of servers, datacenter components, right design, cooling methods, cables, hypervisors, datacenter tier for max availability.

CO3: Classify types of data centers, types of servers, types of network design (TOR/EOR), types of cables, types of load balancing and types of hypervisors.

CO4: Evaluate a data center's PUE.

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