Syllabus of B. Tech. Computer Science and Engineering (CSE) for 4th Semester

Course Title	Probability Theory	Course No	To be filled by the office		
Specialization	Mathematics	Structure (IPC)	3	0	3
Offered for	B.Tech. (COE, EDM), DD (CED, ESD, EVD)	Status	Core ■	Elective □	
Course Objectives	To impart knowledge of basic concepts and applications of Probability and Statistics				
Course Outcomes	At the end of the course, a student will be able to apply the knowledge in solving engineering problems				
Contents of the course *(With approximate break up of hours)*	Introduction to Probability: Sets, Events, Axioms of Probability, Conditional Probability and Independence, Bayes Theorem and MAP Decision Rule (8) Random Variables: Definitions, Cumulative Distribution Functions, mass and density functions, joint and conditional distributions, Functions of Random Variables (8) Expectations: Mean, Variance, Moments, Correlation, Chebychev and Schwarz Inequalities, Moment-generating and Characteristic Functions, Chernoff Bounds, Conditional Expectations (8) Random Vectors: Jointly Gaussian random variables, Covariance Matrices, Linear Transformations, Diagonalization of Covariance Matrices (6) Random Sequences: Sequences of independent random variables, correlation functions, wide-sense stationary sequences, LTI filtering of sequences (6) Law of Large Numbers, Central Limit Theorem (6)				
Textbook	1. Stark and Woods, "Probability and Random Processes with Applications to Signal Processing," 3rd Edition, Pearson Education 2002. 2. S. Ross, "A First Course in Probability," 6th Edition, Pearson.				
References	1. J. S. Milton and J. Arnold, Introduction to Probability and Statistics, Tata McGraw Hill Education Private Limited, 4th Edition, 2006. 2. S. Kay, Intuitive Probability and Random Processes Using MATLAB, Springer, 2008. 3. R. M. Gray and L. D. Davisson, "An Introduction to Statistical Signal Processing," Cambridge University Press, 2004.				

Course Title	Sociology of Technology	Course No	To be filled by the office		
Specialization	Management	Structure (LTPC)	3	0	3
Offered for	UG and DD	Status	Core ■	Elective ☐	
Pre-requisite	None	To take effect from			
Course Objectives	Design as a Social Activity – Level 1				
Course Outcomes	This course will help students understand • Design as a social activity involving people, their relationships & values - How designs can emerge out of or be constrained by social patterns of relating • How technology can influence interactions among people, cooperative work, ethical issues around technology interventions • Exposure to techniques like ethnomethodology				
Contents of the course *(With approximate break up of hours)*	Basics concepts of sociology (behavior, interaction, language) **[6]** Historical evolution of Societies (Agrarian, Industrial, Digital) and current human and organizational contexts in which engineers and other professionals work, Personal and corporate social responsibility & ethics **[10]** Relationship between people (age, gender, cultures) and technology - Social and psychological dimensions of technological change, Technology & Work, Co-operative Work & Coordinative Practices, Ethnomethodology, Critical Systems Heuristics **[10]**				
Textbook and References	1. Manuel Castells (1996); The Rise of Network Society. 2. Herbert Blumer (1986); Symbolic Interactionism: Perspective and Method. 3. Herkert, J. (ed.), Social, Ethical, and Policy Implications of Engineering: Selected Readings. New York, NY: IEEE Press, 2000. 4. Heath, C. and Luff, P. (2000); Technology in Action, Cambridge: Cambridge Univ Press. 5. Werner Ulrich (1983), Critical Systems Heuristics, John Wiley, London.				

Course Title	Design and Analysis of Algorithms	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status	Core ■		Elective ☐
Course Objectives	Data Structure and Algorithm course is essential to understand many areas in Computer Science and Engineering. This course also trains the students to solve problems using computer.				
Course Outcomes	At the end of the course, students will be able to design data structures and efficient algorithms to solve given problem.				
Contents of the course	Introduction to Asymptotic Notation – Solving Recurrence relations – Master's theorem – Recurrence Tree method (8) Incremental and Decremental Algorithm Design Strategies – case studies, lower bound for sorting (3) Divide & Conquer – Merge – Quick sort – Median Finding- (6) Greedy algorithms – knapsack problem (fractional and 0/1 versions) - Minimum spanning tree – Prims- Kruskal's algorithm- Huffman coding, Set of Intervals (6) Dynamic programming – case studies — LCS-Matrix Multiplication – Knapsack (7) Graph algorithms – Topological sort – Shortest path algorithms – Dijskstra's Algorithm, – Bellman-Ford's Algorithm (5) Solvability & Tractability – Introduction to unsolvable problem-Hatling problem- Introduction to NP-completeness – Search/Decision, SAT, Independent set, VC, X3C, Hamilton circuit, etc Backtracking – n queen problem-subset problem - Branch & Bound- Job Scheduling problem (10)				
Textbook	1. E. Horowitz, S. Sahni, and S. Rajasekaran, "Computer Algorithms," 2nd Edition, Galgotia Publications, 2007.				
References	1. T. H. Cormen, C. E. Leiserson, and R. L. Rivest, "Introduction to Algorithms," Prentice Hall India, 2nd Edition, 2001. 2. Aho, Hopcroft, and Ullmann, "Data Structures & Algorithms," Addison Wesley, 1983.				

Course Title	Database Systems	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status	Core ■		Elective ☐
Course Objectives	The focus of this course is on database design, architecture, and relational models. Normal forms, internal schema design would also be explored				
Course Outcomes	Learner would appreciate the systematic design and principles involved in any database development. The importance of canonical normal forms and its design in large scale database systems would be a secondary outcome of this course				
Contents of the course	Introduction to Database Systems, Database System Architecture, Schema, Database Models, Relational Model, ER Modelling and case studies. (7) Expressive power of relational databases, Relational Algebra (5) Database Languages, DDL, DML, Structured Query Language (SQL), SQL views, case studies (8) Database Design, Normal Forms (First to third normal form), Boyce codd Normal Form, Database decomposition, Functional Dependencies, Loss-less Join decomposition(8) Transaction Processing and Concurrency control (4) Internal schema Design, Indexing, B-trees, B+ trees (5) Introduction to advanced concepts like Data mining, Data warehousing, XML (5)				
Textbook	1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems," Pearson, 4th Edition, 2007.				
References	1. A. Silberschatz, H. F. Korth, and S. Sudharsan, "Database System Concepts," Tata McGraw Hill, 5th Edition, 2006. 2. C. J. Date, A. Kannan, and S. Swamynathan, "An Introduction to Database Systems," Pearson, 8th Edition, 2006.				

Course Title	Computer Organization and Design	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	3	0	3
Offered for	UG and DD	Status	Core ■		Elective ☐
Course Objectives	The course aims to introduce various aspects of computer organization such as Instruction format, Instruction codes, Addressing Modes, processor design and hierarchical memory design, Input and Output Interface design using Programmed Controlled and Interrupt Control way				
Course Outcomes	Students will be able to interface and program various components such as Memory, I/O, etc. with the processor.				
Contents of the course	Introduction: function and structure of a computer, functional components of a computer, performance of a computer system. Instruction set architectures – CISC and RISC architectures.(5) Instructions: Language of the Computer, Operations of the Computer Hardware, Operands of the Computer Hardware, Representing Instructions in the Computer, Logical Operations Instructions for Making Decisions, addressing Modes, Parallelism & Instructions. (5) Arithmetic Design: – Carry look ahead adder, Wallace tree multiplier, Floating–point adder/subtractor, Division. (5) The Processor: Logic Design Conventions, Building a Datapath, A Simple Implementation Scheme (3) An Overview of Pipelining, Pipelined Data path and Control, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions and Parallelism via Instructions. (7) Memory Hierarchy: Introduction, Memory Technologies (SRAM, DRAM), The Basics of Caches, Measuring and Improving Cache Performance, Dependable Memory, Virtual Machines, Virtual Memory, A Common Framework for Memory Hierarchy, Using a Finite-State Machine to Control a Simple Cache, Parallelism and Memory Hierarchies: Cache Coherence, Parallelism and Memory Hierarchy: Redundant Arrays of Inexpensive Disks and Implementing Cache Controllers. (9) Input/Output Unit**:** access of I/O devices, I/O ports, I/O control mechanisms – Program Controlled I/O. Interrupt controlled I/O and DMA controlled I/O; I/O interfaces – Serial port, parallel port, USB port, SCSI bus, PCI bus; I/O peripherals – Keyboard, display, secondary storage devices. (8)				
Textbook	1. Patterson and Hennessy, "Computer Organization and Design," Morgan Kaufmann, 5th Edition, 2013. 2. C. Hamacher, Z. Vranesic, and S. Zaky, "Computer Organization," Tata McGraw Hill, 5th Edition, 2002.				
References	1. J. P. Hayes, "Computer Architecture and Organization," Tata McGraw Hill 1998. 2. M. J. Murdocca, V. P. Heuring, "Computer Architecture and Organization - An Integrated Approach," John Wiley & Sons Inc., 2007. 3. A. S. Tanenbaum, "Structured Computer Organization," Prentice Hall,5th Edition, 2006.				

<table>
<tr><td>Course Title</td><td>Object Oriented Algorithm Design and Analysis Practice</td><td>Course No</td><td colspan="3">To be filled by the office</td></tr>
<tr><td>Specialization</td><td>Computer Engineering</td><td>Structure (IPC)</td><td>0</td><td>3</td><td>2</td></tr>
<tr><td>Offered for</td><td>UG and DD</td><td>Status</td><td colspan="2">Core ■</td><td>Elective ☐</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objective is to introduce object oriented programming (OOP) paradigm and implement algorithms using OOP concepts.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students would be capable of using OOP concepts effectively while implementing various algorithmic paradigms.</td></tr>
<tr><td>Contents of the course</td><td colspan="5">The laboratory component will require the student to write computer programs using a careful choice of data structures and algorithmic paradigms (in C++/Java language) from scratch, based on the concepts learnt in the theory course.

OOP concepts: Object oriented programming - Encapsulation – Constructors – Destructors - Composition – Friend functions/classes – this pointer – Dynamic memory management
Operator overloading Reusability – Inheritance – Base & derived classes – Protected members – Constructors –Destructors in derived classes – public/private/protected inheritance–Polymorphism
Virtual functions - Templates – Function & Class templates – Streams – Stream input
Output Stream format states – Manipulators – Exception handling – Re–throwing exceptions –
specifications–and exception handling – Inheritance – STL

Case studies involving Data structures and Algorithms using OOPs concepts.</td></tr>
<tr><td>Textbook</td><td colspan="5">1. P. J. Deitel and H. M. Deitel, “C++ : How To Program,” Prentice Hall, 8th Edition, 2011.</td></tr>
<tr><td>References</td><td colspan="5">1. H. Schildt, “Teach Yourself C++,” 3rd Edition, Tata McGraw Hill.
2. R. Lafore, “Object Oriented Programming in C++,” 4th Edition, Sams Publishing.</td></tr>
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Course Title	Database Systems Practice	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	0	3	2
Offered for	UG and DD	Status	Core ■		Elective ☐
Course Objectives	This course introduces SQL programming. Database design preserving functional dependencies and loss-less decomposition properties would be addressed.				
Course Outcomes	Conceptual design using ER diagrams, programming using structured query language, and database design respecting third normal form shall be the outcomes of this course.				
Contents of the course	Introduction to SQL. Schema, table creation using SQL, Data definition and data manipulation using SQL. Implementation of set theoretic operations on databases. Views using SQL. Implementation of algorithms related to functional dependencies and loss-less decomposition. Indexing using B-trees and B+ trees(creation, insertion, deletion).				
Textbook	1. Loney Koch, Oracle – The complete reference, Tata McGraw Hill, 2002 2. R.Elmasri and S.B.Navathe, Fundamentals of Database Systems, Pearson, 4th Edn, 2007.				
References	1. A. Silberschatz, H. F. Korth, and S. Sudharsan, “Database System Concepts,” Tata McGraw Hill, 5th Edition, 2006. 2. C. J. Date, A. Kannan, and S. Swamynathan, “An Introduction to Database Systems,” Pearson, 8th Edition, 2006.				

Course Title	Computer Organization & Design Practice	Course No	To be filled by the office		
Specialization	Computer Engineering	Structure (IPC)	0	3	2
Offered for	UG and DD	Status	Core ■		Elective ☐
Course Objectives	Exposure to assembly language programming, instruction set design, and processor design for a given instruction set are given. Assembler macros, interrupt service routines, and simple device driver programs would also be introduced. Computer system design concepts are introduced.				
Course Outcomes	Students would be able to demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target computer, and design microcomputer systems.				
Contents of the course	Exercises will mainly involve writing the assembly language programs - Execution of assembly language programs: Single–step, break points, Accessing the contents of registers, accessing the contents of memory locations - Implementation of higher level language assignment statements with arithmetic expressions and logical expressions - Implementation of control transfer statements. Macros - Software interrupts - Operating system function calls - Interrupt service routines - Simple device drivers - Assembly language programming in C language. I/O interfacing and programming. Computer System Design.				
Textbook	1. Patterson and Hennessy, "Computer Organization and Design," Morgan Kaufmann, 5th Edition, 2013.				
References	1. C. Hamacher, Z. Vranesic, and S. Zaky, "Computer Organizaton," Tata McGraw Hill, 2002.				