| B.TECH. II Semester-3 | L | T | P | C |
|---|---|---|---|---|
| CS 301: Operating Systems | 3 | 0 | 2 | 4 |

| Unit - 1 | 10 Hours |
|---|---|
| *Introduction*: Operating Systems (OS) Objectives, Formal Definition, Evolution, Types, DMA & Multiprogramming, OS Interfaces, - The Command-less command interpreter systems, Device drivers– Examples<br><br>*Processes, Threads, Scheduling*: Process Management: The process concept - Programs, Processes & Threads – Process Control Block – PCB as a data structure in contemporary operating systems - Process Hierarchy - System Calls - CPU Scheduling & algorithms metrics – Examples, Uniprocessor-Multiprocessor and Real-Time Scheduling,<br>Case Study: Unix and its related System Calls. | |
| **Unit - 2** | **10 Hours** |
| *Interprocess Synchronization & Communication*: Concurrent Processes - The Critical Section & Mutual Exclusion problem - Algorithms - Semaphores, Critical Region, Conditional Critical Region, Monitors, Messages - Examples in Contemporary OS - Classical Process Co-ordination Problems. Deadlocks: Characterization - Prevention - Avoidance - Detection - Recovery - Combined Approach to Deadlock handling & Deadlock Handling in contemporary OS,<br>Case Study: Unix and its related System Calls. | |
| **Unit - 3** | **10 Hours** |
| *Memory Management*: Memory Hierarchy, Static and Dynamic Memory Allocation, Overview of Swapping, Multiple Partitions Contiguous and Non-Contiguous Memory Allocation, Concepts of Paging, Segmentation, Case Study: Unix and its related System Calls.<br><br>*Virtual Memory*: Virtual Memory Concepts - Demand paging - Performance - Fragmentation & Compaction. Page replacement and Allocation algorithms – Resident Set Management - Cleaning Policy - Memory Protection - System Calls – Linux/Windows Virtual Memory Techniques,<br>Case Study: Unix and its related System Calls. | |
| **Unit - 4** | **12 Hours** |
| *Device Management*: Terminals & Capability Databases - Emulators - Virtual Terminals - Disk Devices - Device Independence - Free space management - Performance and Reliability - Storage hierarchy, Case Study: Unix and its related System Calls.<br><br>*File Systems and Protection Mechanism*: Levels - File Systems in Disk Partitions - File-naming & File Access - Allocation strategies - Directory systems & their implementations - File Systems to device drivers - File Systems Reliability – Examples of fsck() and fsdb() utilities - File protection - Implementation issues, Case Study: Unix and its related System Calls. | |
| **Total Contact Time: 42 Hours** | |

**Recommended Books**


1. Silberschatz, Galvin and Gagne, “Operating System Concepts”, 8th Edition, John Wiley & Sons, 2014.
2. W. Stallings, “Operating Systems: Internals and Design Principles”, 7th Edition, Pearson Pub., 2014.
3. A. Tanenbaum & A. Woodhull, “Operating Systems - Design & Implementation”, 3rd Edition, PHI EEE,2006.
4. Crawley, “Operating Systems - An Design Oriented Approach”, 1st Edition, McGraw Hill,1998.
5. Kernighan and Pike, “UNIX programming Environment”, 2nd Edition, PHI-EEE,2001.
6. W. Richard Stevens, Stephen A. Rago, “Advanced Programming in the UNIX Environment”, 3rd Edition, Addison Wesley Professional,2013.

| B.TECH. II Semester-3 | L | T | P | C |
|---|---|---|---|---|
| CS 302: Database Management Systems | 3 | 0 | 2 | 4 |

| Unit - 1 | 12 Hours |
|---|---|

*Introduction*: Introduction, Applications, Advantages of DBMS, Levels of ANSC SPARC database system, Data Abstraction, mappings and Data Independence and its Types, Database users and DBA.

*Entity Relationship Model* - Basic Concepts, Design Process, E-R Diagrams, Attribute Types, Mapping Cardinality, Types of Relationship, Weak and Strong Entity Sets, Limitations of E-R Diagram, Keys, Extended E-R Features – Generalization, Specialization, Aggregation.

*Relational Model*- Structure of Relational Databases, Domains, Relations, Reduction of ER diagram to Table, Constraints, Anomalies, Relational Algebra – Fundamentals, Operators and Syntax, Relational Algebra Queries Tuple Relational Calculus.

| Unit - 2 | 12 Hours |
|---|---|

*Relational Database Design*: Functional Dependency – Definition, Trivial and Non-trivial FD, Closure of FD Set, Closure of Attributes, Irreducible Set of FD, Multi-Valued Dependencies, Normalization – 1NF, 2NF, 3NF, BCNF, Higher Normal Forms, De-normalization.
*SQL Concept*: Basics of SQL, Structure – Creation/Alteration, DDL, DML, DCL, Join and Types of Join, WHERE Clause, ORDERED BY Clause, IN Operator. Query and Subquery, Aggregate functions, Defining Constraints – Primary Key, Foreign Key, Unique, Not Null, Check
*PL-SQL Concept*: pl/sql basic structure, procedure, function, cursor, triggers.

| Unit - 3 | 10 Hours |
|---|---|

*Query Processing And Optimization*: Overview, General Strategies, Query Representation, Query Transformation and Expressions, Catalogue Information, Estimated Size of relations, Measures of Query cost, Selection, Sorting, Join & other operations, Query Evaluation & Choice of Evaluation Plans.

*Transactions & Concurrency Control*: ACID Properties, Serializability, Recoverability, The problems in Concurrency control, Semantics of Concurrent Transactions, Locking Scheme, Protocols: Time - stamp based, Validation - based, Deadlock handling, Recovery System - Failure Classification, Recovery & Atomicity, Buffer Management, Recovery with Concurrent Transactions.

| Unit - 4 | 8 Hours |
|---|---|

*Object Oriented & Object Relational Databases*: New Applications, The limitation due to 1NF, The Object-oriented Data Model - Persistent Programming languages. Nested Relational Model - Querying with Complex types. Comparison of Object-oriented & Object-relational Databases.

*Advanced Databases And Applications*: Parallel and Distributed Database, Introduction to data mining: Functionalities, Classification of data mining systems, major issues in data mining. Introduction to data warehouse.

**Total Contact Time: 42 Hours**

**Recommended Books**


1. A. Silberschatz, H. F. Korth and S Sudarshan, "Database System Concepts", 6th Edition, TMH, 2010.
2. J. A. Hoffer, M. B. Prescott and F. R. McFadden, “Modern Database Management”, 8th Edition, Pearson Prentice Hall, 2007.
3. C. J. Date, “An Introduction to Database Systems”, Addison, Wesley, 8th Edition, 2003.
4. Raghu Ramakrishnan and Gehrke: “Database Management System”, 3rd Edition, WCB/McGraw-Hill, 2003.
5. Margaret. H. Dunham, “Data Mining. Introductory and Advanced Topics”, Pearson Education, 2003.

| B.TECH. II Semester-3 | L | T | P | C |
|---|---|---|---|---|
| CS 303: Programming for Problem Solving | 3 | 0 | 2 | 4 |

| Unit - 1 | 10 Hours |
|---|---|
| *Data Structures and Functions:* Strings, Indexing and Slicing, String Operators, Escape Sequences, String Formatting. List, Tuples. Dictionary, dictionary methods, sorting dictionary, inverting dictionary. | |
| **Unit - 2** | **12 Hours** |
| *List and Dictionary Comprehensions:* List comprehension, List comprehension using for, nested for loops, if, if-else. Dictionary comprehension, Useful Functions: Lambda operator for defining anonymous functions, Map, filter, and reduce functions. Enumerate and zip functions. | |
| **Unit - 3** | **10 Hours** |
| *Basics programming for Numerical methods***:** Creating n-dimensional array, Array indexing andslicing, Integer Indexing, Boolean Indexing, Broadcasting, Arithmetic and Statistical operations, any conditionals, Merging and splitting, Important built-in methods (example using Python: np.zero, np.ones, np.where, np.unique etc). | |
| **Unit - 4** | **10 Hours** |
| *Data Manipulation Analysis:* Creating series, Data manipulation with series, Creating Dataframes, Data manipulation with data frames, Data Cleaning, Data Analyzing, Data Visualization, and Exploratory Data Analysis. | |
| **Total Contact Time: 42 Hours** | |

**Recommended Books**


1. Richard L. Halterman, Learning to Program with Python.
2. Miller Curtis, Hands-On Data Analysis with NumPy and pandas, Packt Publishing Limited, ISBN: 9781789530797.
3. Jake Vanderplas, Python Data Science Handbook, O'Reilly Media, ISBN: 978-1-491- 91205-8

| B.TECH. II Semester-3 | L | T | P | C |
|---|---|---|---|---|
| CS 304: Automata and Formal Languages | 3 | 0 | 0 | 3 |

| Unit - 1 | 12 Hours |
|---|---|
| *Introduction*: Basic Mathematical Objects: Sets, Logic, Functions, Relations, Strings, Alphabets, Languages. Mathematical Induction: Inductive proofs, Principles; Recursive Definitions; Set Notation.<br><br>*Finite Automata and Regular Expressions*: Finite State systems, Regular Languages & Regular Expressions, Deterministic Finite Automata; Nondeterministic Finite Automata, Kleene' Theorem; Two-way Finite Automata, Finite Automata with output, Properties of Regular Sets: The Pumping Lemma for Regular sets, Closure properties, Decision properties of regular languages, Equivalence and minimization of Automata. | |
| **Unit - 2** | **12 Hours** |
| *Context Free Grammars*: Definition, Derivation trees & Ambiguity, Inherent ambiguity, Parse tree, Application of CFG, Simplification of CFG, Normal form of CFG, Chomsky Normal form and Chomsky Hierarchy, Unrestricted grammars, Context-sensitive languages, Relations between classes of languages, Properties of Context Free Languages: The Pumping Lemma, Closure properties, Decision properties of CFL. | |
| **Unit - 3** | **10 Hours** |
| *Pushdown Automata*: Definitions, Languages of PDA, Equivalence of PDA and CFG, Deterministic PDA.<br><br>T*uring Machines*: Turing Machine Model, Language of a Turing Machine, Programming techniques of the TM, Variations of TM (Multiple TM, One-tape and Multi-tape TM etc.), Deterministic and Non Deterministic TM, Universal TM, Churche thesis, Recursively Enumerable Languages. | |
| **Unit - 4** | **8 Hours** |
| *Computational Complexity*: Time and Space Complexity, Growth Rate, Complexity classes, Tractable and Non tractable Problems: P and NP, Cooks's theorem. | |
| **Total Contact Time: 42 Hours** | |

**Recommended Books**


1. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, "Introduction to Automata theory, languages computation, 3rd Edition, Pearson India, 2008.
2. John C Martin, "Introduction to Languages & the Theory of Computation", 3rd Edition, Tata McGraw-Hill, 2011.
3. Daniel I.A. Cohen, "Introduction to Computer Theory", John Wiley & Sons, 2nd Edition, Reprint 2008.
4. A. M. Natarajan, A. Tamilarasi, "Theory of Computation", New Age Publication, 1st Edition,2003.
5. Sushil Kumar Azad, "Theory of Computation, An introduction to Automata, Formal Languages and Computability", Dhanpat Ray & Co., New Delhi, 2005.
6. Andrew Ilachinski, "Cellular Automata", World Scientific, 2001.
7. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning, 3rd Edition, 2013.

| B.TECH. II Semester-3 | L | T | P | C |
|---|---|---|---|---|
| AS 305: Probability and Statistical Analysis | 3 | 0 | 0 | 3 |

| **Probability** | |
|---|---|
| **Unit - 1** | **9 Hours** |
| *Introduction*: Axiomatic definition, Properties, Conditional probability, Bayes rule and independence of events.<br><br>*Random Variable*: Random Variables, Distribution function, Discrete and Continuous random variables, Probability mass and density functions, Expectation, Function of random variable, Moments, Moment generating function, Chebyshev's inequality. Transformation of Random Variable. | |
| **Unit - 2** | **16 Hours** |
| *Special Discrete Distributions*: Bernoulli, Binomial, Geometric, Negative binomial, Hypergeometric, Poisson, Uniform. Special continuous distributions: Uniform, Exponential, Gamma, Normal, Weibull, Reyleigh. Random vector: Joint distributions, Marginal and conditional distributions, Moments, Independence of random variables, Covariance, Correlation, Functions of random variables. Law of Large Numbers: Weak law of large numbers, Levy's Central limit theorem (i.i.d. finite variance case), Normal and Poisson approximations to Binomial. | |
| **Statistics** | |
| **Unit - 3** | **9 Hours** |
| *Introduction*: Population, Sample, Parameters.<br><br>Point Estimation: Method of moments, Maximum likelihood estimation, Unbiasedness, Consistency.<br><br>*Interval Estimation*: Confidence interval. | |
| **Unit - 4** | **8 Hours** |
| *Tests of Hypotheses*: Null and Alternative hypothesis, Type-I and Type-II errors, Level of significance, p-value, Likelihood ratio test, Chi-square goodness of fit tests.<br>*Regression Problem*: Scatter diagram, Simple linear regression, Least square estimation, Tests for slope, prediction problem, Graphical residual analysis, Q-Q plot to test for normality of residuals. | |
| **Total Contact Time: 42 Hours** | |

**Recommended Books**


1. Sheldon Ross, "A First Course in Probability", 8th edition, Pearson Prentice Hall, 2009.
2. V. K. Rohatgi and A. K. Saleh, "An Introduction to Probability and Statistics", 2nd Edition, Wiley interscience, 2000.
3. R. Hogg, J. McKen and A. Craig, "Introduction to Mathematical Statistics", Pearson, 2012.
4. S. M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Academic Press, 2014.
5. K. S. Trived, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition, Wiley India Private Limited, 2008.
6. A. M. Mood, F. A. Grabill and D. C. Boes, "Introduction to the Theory of Statistics", 3rd Edition, McGraw Hill, 1974.
7. D. P. Bertsekas and J. N. Tsitsiklis, "Introduction to Probability", 2nd Edition, Athena Scientific, 2008.

| B.TECH. II Semester-3 | L | T | P | C |
|---|---|---|---|---|
| HM 306: Economics and Business Management | 2 | 0 | 0 | 2 |

| Economics | 14 Hours |
|---|---|
| Introduction to Economics, Micro & Macro Economics, Applications & Scopes of Economics, Demand Analysis, Demand Forecasting, Factors of Production, Types of Cost, Market Structures, Break Even Analysis<br>Basic Economic Problems: Poverty, Unemployment, Inflation<br>Money, Monetary policy, Fiscal policy<br>Banking, Central Bank – RBI, CRR, bank rate, repo rate, reverse repo rate, SLR | |
| **Management** | **14 Hours** |
| Introduction to Management, Features of Management, Nature of Management, Development of Management Thoughts – Scientific Management by Taylor & Contribution of Henry Fayol, Coordination & Functions of Management, Centralization & Decentralization, Decision Making<br>Fundamentals of Planning<br>Objectives & MBO<br>Types of Business Organizations: Private Sector, Public Sector & Joint Sector<br>Theories of Motivation, Leadership<br>Introduction To ERP, e – CRM, SCM, RE – Engineering, WTO, IPR Etc. | |
| **Total Contact Time: 28 Hours** | |

**Recommended Books**


1. Prasad L.M., Principles & Practice of Management, Sultan Chand & Sons, 8th Edition,2015
2. Banga T. R. & Shrama S.C., Industrial Organisation & Engineering Economics, Khanna Publishers, 25th Edition, 2015
3. Everett E. Adam, Ronald J. Ebert, Production and Operations Management, Prentice Hall of India, 5th edition, 2012
4. Kotler P., Keller K. L, Koshi A.& Jha M., Marketing Management – A South Asian Perspective, Pearson, 14th Edition, 2014
5. Tripathi P.C., Personnel Management & Industrial Relations, Sultan Chand & sons, 21st Edition, 2013
6. Chandra P., Financial management, Tata McGraw Hill, 9th Edition, 2015