INTRODUCTION: Purpose of Database system, Characteristics of database approach, Advantages of using DBMS, Database concept and architecture, Data Abstraction, Data Models, Instances and schema, Data independence, 3-schema architecture, Database Languages, Database Manager, Database Administrator, Database Users. (3)

DATA MODELING: Entity sets attributes and keys, Relationships (ER), Database modeling using entity, Type role and structural constraints, Weak and Strong entity types, Enhanced entity-relationship (EER), Entity-Relationship Diagram Design of an E-R Database schema, Object modeling, Specialization and generalization, (3)

DATA MODELS: Hierarchical models - basic concepts, Tree structure, Tree-structure Diagrams, Virtual records, Mapping hierarchies to files, The IMS Database system, Network model - basic concepts, Mapping networks to files, DBTG CODASYL model. (3)


DATABASE DESIGN: Database design process, Relational database design, Relation Schema, Anomalies in a database, Functional dependencies, Membership and minimal covers, Normal forms, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Multivalued dependencies, Fourth Normal Form, Join dependencies, Fifth Normal Form, Inclusion dependencies, Reduction of an E-R schema to Tables, Effect of de-normalization on database performance. (5)

QUERY LANGUAGES: Query-by-example(QBE), Introduction to SQL, Basic queries in SQL, Advanced queries in SQL, Functions in SQL, Basic data retrieval, Aggregation, Categorization, Updates in SQLs, Views in SQL, Different types of views, Theoretical Updatability of Views. (6)

FILE ORGANIZATION, INDEXING AND HASHING: Overview of file organization Techniques, Secondary storage devices, Operations in files, Heap files and sorted files, Indexing and Hashing- Static Hashing, Dynamic Hashing and Extendible hashing, Ordered indices, Types of single level ordered index, Multi-level indexes basics, Other types of indexes Multi-level indexes, RAID technology, Buffer management. (4)

TRANSACTION PROCESSING: Desirable properties of transactions, Implementation of atomicity and durability, Read only and write only model
Concurrent executions, Schedules and recoverability, Serializability of schedules concurrency control, Serializability algorithms, Testing for Serializability, Precedence graph.

**CONCURRENCY CONTROL**: Overview of Concurrency Control, Locking techniques, Lock based protocols, Time stamp based protocols, Commit protocols, Optimistic Technique, Granularity of data items, Time stamp ordering multi version concurrency control, Deadlock handling - detection and resolution.

**DATABASE BACKUP AND RECOVERY**: Recovery mechanisms, Crash recovery, Recovery from transaction failure, Recovery in a Centralized DBMS, Virtual memory and Recovery, Database recovery techniques based on immediate and deferred update, ARIES recovery algorithm, Shadow paging and Write-ahead Logging.


**BOOK:**

**REFERENCES:**
2. BC Desai, An Introduction to Database Systems, Galgotia Publications
3. An Introduction to database systems, Sixth Edition C. J. Date Addison Wesley
5. Computer Data Base Organization by Martin J. (Latest edition), PHI

**CS 336H, DATABASE MANAGEMENT SYSTEMS**

**ADVANCED DATABASE APPLICATION**: Evolution of an Information system, Decision making and MIS, MIS as a technique for making programmed decisions, Navigation Database System Architecture Overview, Data Mining, Data warehouse, Types of transaction processing system: OLAP, OLTP, DSS

**DISTRIBUTED DATABASES**: Structure and design, Distributed query processing, Fragments of Relations, Optimization transmission cost by semi joins, Distributed Concurrency Control, Client/Server Model, Parallel databases

**OBJECT ORIENTED DATABASE DESIGN**: Introduction, Approaches to OODs, Object oriented data model, Object identity, Complex Objects, Persistance, Type and
class hierarchies, Inheritance, Modelling and designing of OODs, Object oriented queries, Object Relational DBMS-Overview

<table>
<thead>
<tr>
<th>COURSE NAME</th>
<th>PRINCIPLES OF PROGRAMMING LANGUAGES</th>
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<tbody>
<tr>
<td>COURSE CODE</td>
<td>CS 337</td>
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<tr>
<td>CREDITS</td>
<td>04</td>
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<tr>
<td>L T P</td>
<td>4 0 0</td>
</tr>
</tbody>
</table>

LECTURE WISE BREAKUP NO. OF LECTURES

**OVERVIEW**
Principles of Language Design, Programming Paradigms and Application Domains, Pragmatic Considerations, A Brief history of programming languages, Programming Language outcomes/qualities and Goals of this study.

**SYNTAX**
Formal Methods, Syntax Analysis, Linking syntax and semantics

**TYPE SYSTEMS AND SEMANTICS**
Type Systems, Semantic Domains and State Transformation, Operational Semantics, Axiomatic Semantics, Denotational Semantics

**IMPERATIVE PROGRAMMING**
von Neuman machines and imperative programming, naming and variable, elementary data types and expressions, syntax and semantics of statements, scope, visibility and lifetime, syntax and type system for methods and parameters

**MEMORY MANAGEMENT**
The overall structure of run-time memory, Methods, local parameters, and the run-time stack, pointers, Arrays, structures, semantics of arrays and structures, memory leak and garbage collection

**EXCEPTION HANDLING**
Traditional techniques, model, Exceptions in Java

**OBJECT ORIENTED PROGRAMMING**
Data Abstraction and modular Programming, the object oriented model

**OVERVIEW OF FUNCTIONAL AND LOGIC PROGRAMMING**
Introduction to Prolog, Data Structures in Prolog, Programming techniques, Control in Prolog.

**EVENT-DRIVEN PROGRAMMING**
The event model, programming paradigm, event handling

**CONCURRENT PROGRAMMING**

**.NET FRAMEWORK**
Architecture, interfacing with VC#, VB.NET and other programming languages.

**BOOK:**
1. Programming Languages: Principles and Paradigms By Allen Tucker, Robert Nooman, TMH.

**REFERENCES:**
1. Programming Languages: Design & Implementation By - Pratt & Zelkowitz.
2. Programming Languages: Principles and Practices By Kenneth C. Louden,
Thomson
3. Theory Of Automata By Mishra.

COURSE NAME : WEB TECHNOLOGIES
COURSE CODE : CS 338
CREDIT : 4
L T P : 4 0 0

LECTURE WISE BREAKUP

Introduction to JAVA: Creation of Java, Why Java is important to Internet, Java applets and applications, security, portability, Java’s Bytecode. OOP paradigms and principles, Understanding the java programs, compiling the program, control statements, lexical issues, Data types in Java, Java literals, Variables, Scope and lifetime of Variables, Type conversion, Declaring and using arrays. (6)

Operators in Java: (Arithmetic, Modulus, Assignment, Bitwise, Relational, Short circuit logical operators, Assignment, ternary operator, Operator precedence. Control statements, Classes, Garbage Collection, Overloading methods, overloading constructors, using objects as parameters, Argument passing by value and by reference, returning objects, static and final keywords, Inheritance in Java (using super keyword), overloading methods in Java, Abstract classes. (6)

Exception Handling in Java: Exception types, using try and catch, multiple catch classes, nested try statement, using throw, throws, finally keywords, Java Built in Exceptions, creating user defined exceptions. (6)

Multithreaded programming in Java: Java thread model, Thread priorities, synchronization, creating thread using Thread class and Runnable interface, creating multiple threads, Interthread communication, Deadlocks (6)

Applets: Applet fundamentals, Applet architecture, creating and running applets, Passing parameters in Applets, AWT – AWT Basics, AWT classes, Working with event frame windows, working with graphics – Drawing lines, rectangles, ellipses, circles, Arcs, polygons), creating and selecting a font, Managing Text output using Font Metrics. (5)

AWT controls: Layout Managers, Menus, using Labels, Buttons, Checkboxes, Check box group, Choice controls, using Lists, Managing scrollbars, using a Text Field, Text Area, Layout Manager – Flow Layout, Border Layout, Grid Layout, Menu bars, Menus (7)

Static Vs Dynamic pages, Server Database Connectivity, Client side and Server side technologies, content deliver: HTTP and variants, Client side scripting, Server side scripting, HTML and Dynamic HTML, Java Script. (10)

BOOK:

1. The Complete Reference Java, by Herbert Schildt
REFERENCES:

1. Web Technologies by Jeffery C Jackson, PHI
2. Programming with JAVA by E.Balagurusamy, TMH,

CS 338H, WEB TECHNOLOGIES

Advanced Java Technologies: Remote Method Invocation, Java Native Interface.
Java Beans, Java Servlets, Windows programming in JavaScript, Java Server Pages.

COURSE NAME : SOFTWARE ENGINEERING
COURSE CODE : CS 339
CREDITS : 04
L T P : 4 0 0

LECTURE WITH BREAKUP

Introduction to software engineering, process, product, project. (3)
SOFTWARE DEVELOPMENT LIFE CYCLE: Requirements Analysis, Software Design, Coding, Testing, Maintenance etc. (4)
SOFTWARE PROCESS MODELS: Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model, RAD model, 4th Generation models. (5)
SOFTWARE PROJECT MANAGEMENT: Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Risk and configuration Management, Software Process and Project metrics. (9)
SOFTWARE REQUIREMENT ANALYSIS AND SPECIFICATION: Software Requirements, Requirements Specification document, Behavioural, Process and data Modelling, Object-oriented Analysis. (9)
SOFTWARE DESIGN: Design Concepts, Top-down and bottom-up design, Function-oriented and Object-Oriented Design approach, Software Design Document. (9)
CODING AND TESTING: Coding styles and documentation, Black-box and White-box Testing Techniques, Test Plan, Test Cases Specification. (9)
SOFTWARE MAINTENANCE: Types, Software maintenance Activities. (5)
CASE TOOL: Rational Rose (3)

BOOK:

REFERENCES:

2. Fundamentals of Software Engineering, By Rajib Mall, PHI Learning Pvt. Ltd
3. Software Project Management, By Bob Hughes and Mike Cotterell
CS 339H, SOFTWARE ENGINEERING
Traditional and Object Oriented Metrics, Object Oriented Modelling, Unified Modelling Language, Software Reuse, Reverse Engineering, Forward Engineering and Re-engineering, Software Reliability.

COURSE NAME : DEPARTMENTAL LAB II
COURSE CODE : CS 314
CREDITS : 02
L T P : 0 04

Programs and problems based on the courses of Database management systems.

COURSE NAME : DEPARTMENTAL LAB III
COURSE CODE : CS 315
CREDITS : 02
L T P : 0 04

Programs and problems based on the courses of Web Technology and Software Engineering.

COURSE NAME : THEORY OF COMPUTATION
COURSE CODE : CS 316
CREDITS : 04
L T P : 4 0 0

LECTURE WITH BREAKUP

INTRODUCTION TO MACHINES (10)
Basic Machine, Finite State machine (FSM), State tables, transition graphs, transition matrix, Acceptance and rejection, properties and limitations of FSM.
Deterministic and Non-deterministic FSM’s, equivalence of NDFA and DFA, Mealy and Moore Machines, Equivalence of Mealy and Moore machines, minimization of finite automata, two way finite automata.

REGULAR SETS & REGULAR GRAMMARS (08)
Alphabets, Words, Regular sets, regular expressions, finite automata and regular expressions, pumping lemma and regular sets, closure properties of regular sets.

GRAMMARS AND LANGUAGES (07)
Definitions, Chomsky hierarchy, regular grammars, context free & context-sensitive grammars, context free languages, simplification of context free grammars, Chomsky normal form and Greibach normal form.
PUSHDOWN AUTOMATA  (08)
Definitions, equivalence of PDA’s and CFL’s

TURING MACHINE  (07)
Turing machine model representation, Language acceptability of Turing Machine, Design of Turing Machine, Universal Turing Machine and modified Turing machines.

UNCOMPUTABILITY  (05)
Recursive functions, halting problem, Turing Enumerability, Turing Acceptability and Turing Decidability.

COMPUTATIONAL COMPLEXITY  (03)
Time Bound Turing machines, Rate of Growth of functions, problem classes.

BOOK:

REFERENCES:
1. Introduction to Automata Theory, Languages and Computation: By J.E Hopcroft, J.D. Ullman
2. Elements of Theory of Computation: By Harry R. Lewis, Christos H. Papadimitriou

COURSE NAME : ADVANCED COMPUTER ARCHITECTURE
COURSE CODE : CS 317
CREDITS : 4
L T P : 4 0 0

LECTURE WISE BREAKUP

REVIEW OF COMPUTER ARCHITECTURES  (3)
Overview of Computer Architecture, A Taxonomy of MIMD Computers, Multi-vector and SIMD, Computers, Vector Supercomputers SIMD Supercomputers

ARCHITECTURAL DEVELOPMENT TRACKS  (4)
Parallel Random Access Machines, VLSI Complexity Model
Multiple –Processor Tracks, Multi-vector and SIMD Tracks, Multithreaded and Dataflow Tracks
Data and Resource Dependences, Hardware and Software parallelism, the role of Compilers

PROGRAM PARTITIONING AND SCHEDULING AND PERFORMANCE  (8)
Grain Sizes and Latency, Grain Packing and Scheduling, Static Multiprocessor Scheduling
Control flow Mechanism, Demand-Driven Mechanism, Comparison of Flow Mechanisms, System Interconnect Architectures: Network properties and Routing, Static Connection networks, Dynamic Connection Networks
Parallelism Profile in Programs, Harmonic mean Performance, Efficiency, Utilization and Quality, Standard Performance Measures
Amdahl’s law for a fixed workload, Gustafron’s Law for Sealed problems
Scalability metrics and Goals, Evolution of Scalable Computers

**ADVANCE PROCESSOR TECHNOLOGY**
Instruction set architecture, CISC and RISC Scalar processors

**VECTOR PROCESSORS**
Superscalar Processors, The VLIW Architecture, Vector and Symbolic processors, Vector Instruction Types, Vector Access Memory Schemes

**SIMD COMPUTER ORGANIZATION**
Implementation Models, The CM-2 architecture

**MULTIPROCESSOR SYSTEM INTERCONNECTS**
Hierarchical Bus system, Crossbar Switch and Multiport Memory, Multistage and Combining networks, Performance- Directed Design rules, Cray Y – MP,C-90 and NTP
Principles of synchronization, Multiprocessor execution Models, Shared-Variable Program Structures, Locks for Protected access, Semaphores and Applications, Monitors and Applications, Message-passing program Development, Distributing the Computation, Synchronous Message passing, Asynchronous message passing
Domain Decomposition Techniques, Control Decomposition techniques, Heterogeneous processing

**MEMORY**
Hierarchical Memory Technology Inclusion, Coherence and Locality, Memory Capacity Planning.
The cache coherence problem, Snoopy bus protocol, Hardware Synchronization Mechanisms

**BOOK:**

**REFERENCES:**

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**Course Name:** SIMULATION AND MODELING
**Course Code:** CS 318
**CREDITS:** 04  **L T P : 4 0 0**
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<tr>
<th>LECTURE WISE BREAKUP</th>
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<tbody>
<tr>
<td>Concept of a system, stochastic activities, continuous and discrete system, principles used in simulation and modeling for various applications., Simulation Model Design, Methodology, Causes of Simulation Failure</td>
<td>(10)</td>
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<tr>
<td>Techniques of simulation, Monte Carlo method, type of system simulations, real time simulation stochastic variables, discrete probability function, generation of random number</td>
<td>(8)</td>
</tr>
<tr>
<td>Poisson arrival pattern, exponential distribution, service time, normal distribution, queuing discipline, measures of queues.</td>
<td>(4)</td>
</tr>
<tr>
<td>Representation of time, generation of arrival pattern, Discrete simulation languages.</td>
<td>(3)</td>
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<tr>
<td>Inventory control systems for illustration of applications.</td>
<td>(2)</td>
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<tr>
<td>Introduction to the basic principles underlying dynamic feedback systems</td>
<td>(2)</td>
</tr>
<tr>
<td>The principles underlying growth, exponential decay, and sigmoid growth</td>
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</tr>
<tr>
<td>The Bufon Needle Problem</td>
<td>(4)</td>
</tr>
<tr>
<td>Queues and Inhibitor Arcs, Hierarchical Modeling</td>
<td>(4)</td>
</tr>
<tr>
<td>SimNet: a Simulation Net Tool, Some Modeling Examples</td>
<td>(4)</td>
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</tbody>
</table>

Simulation Languages: Simula, SIMNEX,GPSS

**BOOK:**
1. Discrete event simulation by Jerry Banks
2. Simulation and Modeling by Gordon, PHI
REFERENCES:
1. Simulation and Modeling by N. Deo, TMH
2. Simulation Modeling and Analysis by Averill Law, W. David Kelton

Course Name : DISTRIBUTED OPERATING SYSTEM
Course Code : CS 319
Credits : 4
LTP : 4 0 0
Pre Req : Operating systems.

LECTURE WISE BREAKUP NO. OF LECTURES

Operating system fundamentals: Evolution of modern operating systems, overview of systems, sample distributed applications. (5)

Processes and processors in distributed systems: Threads, system models, Processor allocation, Scheduling in Distributed system, Real time distributed system. (5)

Network operating systems, Network operating systems, centralized operating systems, distributed operating systems. (5)

Cooperative autonomous interprocess communication and coordination (3)

Selection factors, message passing communication, pipes, sockets, request/reply communication, transaction communication, name and directory services, distributed mutual exclusion. (4)

Distributed process scheduling (3)

A system performance model, static process scheduling with communication, dynamic load sharing and balancing, distributed process implementation, real time scheduling (I)

Transparencies and characteristics of dfs, dfs design and implementation, transaction service and concurrency control, data and file replication. (4)

Distributed shared memory: What is shared memory, Consistency models, Page based distributed shared memory, shared variables distributed shared memory. (4)

Non-uniform memory access architectures, memory consistency models, multiprocessor cache systems, distributed shared memory, implementation of dsm. (5)

Distributed computer security, Fundamentals of computer security, discretionary (4)
access control models, mandatory flow control models,  (4)

Synchronization in distributed system: Concurrency control, Mutual exclusion &
critical regions, semaphores, locks, token passing/mutual exclusion, deadlocks.  (4)

Transaction management & concurrency control models
Transaction management, acid properties of a transaction, consistency models,  (5)
two phase commit protocol, nested transaction.

BOOK:
1. Distributed Operating Systems: Andrew S. Tanenbaum

REFERENCES:
1. Distributed Operating Systems: Principles and Paradigms: Andrew Tanenbaum and
Maarten Van Steen
3. Distributed Systems and Algorithm Analysis: Randy Chow, Theodore Johnson

COURSE NAME : EMBEDDED SYSTEMS
COURSE CODE : CS 320
CREDITS : 04
L T P : 4 0 0

LECTURE WISE BREAKUP NO. OF LECTURES

FUNDAMENTALS TO EMBEDDED SYSTEMS 9
Definition and Classification – Overview of Processors and Hardware Units in an
Embedded System – Software Embedded into the System – Exemplary Embedded
Systems – Embedded Systems on a Chip (SoC) and the Use of VLSI Designed Circuits.

DEVICES AND BUSES FOR DEVICES NETWORK 9
I/O Devices – Device I/O Types and Examples – Synchronous – ISO–synchronous and
Asynchronous Communications from Serial Devices – Examples of Internal Serial–
Communication Devices – UART and HDLC – Parallel Port Devices – Sophisticated
interfacing features in Devices/Ports – Timer and Counting Devices – ‘12C’– ‘USB’–
‘CAN’ and Advanced I/O SerialHigh Speed Buses – ISA – PCI – PCI – X – CPCI and
Advanced buses.

EMBEDDED PROGRAMMING 9
Programming in Assembly Llanguag (ALP) vs. High Level Language – C Program
Elements – Macros and Functions – Use of Pointers – NULL Pointers – Use of Function
Calls – Multiple Function Calls in a Cyclic Order in the Main Function Pointers –
Function Queues and Interrupt Service Routines Queues Pointers – Concepts of
EMBEDDED PROGRAMMING in C++ – Objected Oriented Programming – Embedded
programming in C++ – ‘C’ Program compilers – Cross compiler – Optimization of Memory Codes.

REAL TIME OPERATING SYSTEMS – PART – 1


REAL TIME OPERATING SYSTEMS – PART – 2


BOOK:


REFERENCES:

Course Name: HUMANITIES II (MANAGEMENT CONCEPTS & PRACTICES)  
Course No: HU 301  
Credits: 3  
L-T-P: 3-0-0 
Pre Req: 

Lecture wise breakup  

1. **INTRODUCTION TO MANAGEMENT**  
   No. of Lectures: (07)  
   Evolution of Management thoughts, Management Processes and Functions. 

2. **MANAGEMENT AND SOCIETY**  
   No. of Lectures: (05)  
   Social Responsibility of Business and Ethics. 

3. **MANAGERIAL PLANNING**  
   No. of Lectures: (05)  
   Concept, Scope and Process of Planning. 

4. **ORGANIZING**  
   No. of Lectures: (07)  
   Nature and Objectives of Organizing, Organization Structure and types of organizations. 

5. **STAFFING**  
   No. of Lectures: (06)  

6. **DIRECTING**  
   No. of Lectures: (10)  
   Principles of Directions, Motivation: Concept and theories of motivation (Maslow’s), Leadership Styles, Essentials of effective Communication. 

7. **CONTROLLING**  
   No. of Lectures: (05)  
   Meaning and essential of Control. 

**BOOKS**  
1. Prasad, L.M. Principles & Practice of Management, Sultan Chand & Sons  

**REFERENCES**  
5. Peter F. Drucker, Essentials of Management  

**HU301H HUMANITIES II (MANAGEMENT CONCEPTS & PRACTICES)**  
In addition to the contents of HU 302, the additional topics: 
Course Name:  HUMANITIES II (ENTREPRENEURSHIP)  
Course Code: HU302   Credits: 3   L T P: 3-0-0  
Pre Req: 
Lecture wise breakup 

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<thead>
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| 1. INTRODUCTION | (08)  
| Need, Scope and Characteristics of entrepreneurship, Factors affecting entrepreneurship, Culture of Modern entrepreneurship.  
| 2. WOMEN ENTREPRENEURS | (05)  
| Entrepreneurial ventures in India including Women entrepreneurs in India.  
| 3. PROJECT IDENTIFICATION | (05)  
| Internal and external constraints, Project objectives and Project life cycle.  
| 4. PROJECT FORMULATION | (08)  
| Element of project formulation, Feasibility analysis and Preparation of project report.  
| 5. SOURCES OF PROJECT FINANCE | (07)  
| Institutional and Non-Institutional finance to entrepreneurs.  
| 6. MARKETING PLAN | (07)  
| Importance of Marketing for entrepreneurs.  
| 7. CASE STUDIES OF ENTREPRENEURS | (05)  

BOOKS:  

REFERENCES:  

HU302H HUMANITIES II (ENTREPRENEURSHIP) In addition to the contents of HU 302, the additional topics: Entrepreneurship and innovation, Small business and Entrepreneurship, Case studies of women entrepreneurs in northern India, Role of capital in making entrepreneurs.