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UNIVERSITY OF MUMBAI

Syllabus for the M.Sc. Part - I
Program: M.Sc.
Course : Computer Science

(Credit Based Semester and Grading System with effect from the academic year 2012–2013)

Preamble

This syllabus is the extension of the existing syllabus which is currently being taught to MSc Computer Science of University of Mumbai for the last few years, but modified to be placed within the credit based system to be implemented from the academic year 2012-2013. However, there are few changes incorporated in the existing syllabus based on the feedback of the teaching and student community as well as to incorporate recent trends.

The syllabus proposes four subjects for each of the semesters. Each subject has theory as well as practical components. The theory component offers 4 credits and practical component offers 2 credits. Thus, each semester is of 24 credits. The four subjects in the first semester are Principles of Compiler Design- I, Digital Signal Processing- I, Mobile Computing, and Data warehousing and mining. The second semester offers Principles of Compiler Design-II, Digital Signal Processing- II, Computer Simulation and Modelling, and Advanced Database Systems. Each of the theory paper has five units and is expected to cover in 60 lecture periods. Each of the practical paper is of 60 hours duration.

It is believed that the proposed changes as part of the credit based system will bring a qualitative change in the way MSc Computer Science is taught, which will offer a more enriched learning experience.

Revised syllabus of M.Sc. Computer Science
(Based on Credit and grading system)

Semester I							
Paper code	Paper nomenclature	Lectures	Credit	Practical Paper	Hrs	Credit	Total Credit
PSCS101	Principles of Compiler Design-I	60	04	Paper I	60	02	06
PSCS102	Digital Signal Processing-I	60	04	Paper II	60	02	06
PSCS103	Mobile Computing	60	04	Paper III	60	02	06
PSCS104	Data Warehousing and Mining	60	04	Paper IV	60	02	06
						Total	**24**
Semester II							
PSCS201	Principles of Compiler Design-II	60	04	Paper V	60	02	06
PSCS202	Digital Signal Processing-II	60	04	Paper VI	60	02	06
PSCS203	Computer Simulation & Modeling	60	04	Paper VII	60	02	06
PSCS204	Advanced Database Systems	60	04	Paper VIII	60	02	06
						Total	**24**

Total credits for M.Sc. Part I =(Semester I - 24 and Semester II - 24) =48

Evaluation: The students will be evaluated internally and externally. The external evaluation will be done by the committee appointed by the University norms. Standard passing and scale will be as per the university norms.

M.Sc. Part - I Computer Science Syllabus
Restructured for Credit Based and Grading System

SEMESTER: I

Paper I: Principles of Compiler Design-I: PS**CS101**

Paper II: Digital Signal Processing-I: PS**CS102**

Paper II: Mobile Computing: PS**CS103**

Paper III: Data Warehousing and Mining: PS**CS104**

SEMESTER: II

Paper IV: Principles of Compiler Design-II: PS**CS201**

Paper V: Digital Signal Processing-II: PS**CS202**

Paper VI: Computer Simulation & Modelling: PS**CS203**

Paper VIII: Advanced Database Systems: PS**CS204**

SEMESTER I

Paper I: Principles of Compiler Design-I: PS**CS 101**

PSCS**101**	I	Introduction to Compilers	**4**
	II	Programming languages	
	III	Finite automata and lexical analysis	
	IV	The syntactic specification of Programming Languages and Basic Parsing Techniques	
	V	Automatic Construction of Efficient Parsers	

Paper II: Digital Signal Processing-I: PS**CS 102**

PSCS**102**	I	Theory of Discrete-Time Linear Systems	**4**
	II	The Theory and approximation of Finite Duration Impulse response digital filters	
	III	Theory and approximation of Infinite Impulse, Response digital filters	
	IV	Finite word length effects in digital filters	
	V	Spectrum Analysis and the Fast Fourier Transform	

Paper III : Mobile Computing: **CS 103**

PSCS**103**	I	Introduction, Wireless Transmission and Medium Access Control	**4**
	II	Telecommunication, Satellite and Broadcast Systems	
	III	Wireless LAN and ATM	
	IV	Mobile Network and Transport Layer	
	V	Support for Mobility	

Paper IV: Data Warehousing and Mining: **CS 104**

PSCS**104**	I	Introduction to Data warehousing	**4**
	II	Designing and maintaining Data warehouse	
	III	Introduction to Data Mining	
	IV	Data Mining Algorithms	
	V	Advanced topics	

Detail Syllabus

Semester I

Course Code	Title	Credits
PSCS 101	**Principles of Compiler Design-I [60 Lectures]**	**4**

Unit I: Introduction to Compilers:

Compilers and translators, Why do we need translators?, The structure of a compiler, Lexical analysis, Syntax analysis, Intermediate code generation, Optimization, Code generation, Book keeping, Error handling, Compiler writing tools **[08L]**

Unit II: Programming languages:

High-level programming languages, Definitions of programming languages, The lexical and syntactic structure of a language, Data elements, Data structures, Operators, Assignment, Statements, Program units, Data environments, Parameter transmission, Storage management **[05L]**

Unit III: Finite automata and lexical analysis:

The role of the lexical analyzer, A simple approach to the design of lexical analyzers, Regular expressions, Finite automata, From regular expressions to finite automata, Minimizing the number of states of a DFA,A language for specifying lexical analyzers, Implementation of a lexical analyzer **[16L]**

Unit IV: The syntactic specification of Programming Languages and Basic Parsing Techniques:

Context-free grammars, Derivations and parse trees, Capabilities of context-free grammars, Parsers, Shift-reduce parsing, Operator-precedence parsing, Top-down parsing, Predictive parsers **[15L]**

Unit V: Automatic Construction of Efficient Parsers:

LR parsers, The canonical collection of LR(0) items, Constructing SLR parsing tables, Constructing canonical LR parsing tables, Constructing LALR parsing tables, Using ambiguous grammars, An automatic parser generator, Implementation of LR parsing tables, Constructing LALR sets of items **[16L]**

References:

Principles of Compiler Design, Alfred V. Aho & Jeffrey D. Ullman

Course Code	Title	Credits
Course Code	Title	Credits
PSCS 102	**Digital Signal Processing –I [60 Lectures]**	**4**

Unit I: Theory of Discrete-Time Linear Systems

Sequences-Representation of arbitrary sequences-Linear time variant systems-causality, stability- difference equations-frequency response-first order systems-second order systems-Discrete Fourier series-relation between continuous and discrete Systems. The z Transform-the Relation between the z Transform and the Fourier transform of a sequence-Solution of differences equation using one sided transform-geometric evaluation of the Fourier Transform-Digital Filter Realizations-structures for all zero filters-the discrete Fourier transform – convolution of sequences-linear convolution of finite duration sequences-the discrete Hilbert transform. **[20L]**

Unit II: The Theory and approximation of Finite Duration Impulse response digital filters

Issues in Filter design-FIR filters Design techniques for Linear phase FIR filters-windowing-issues with windowing-frequency sampling-solution for optimization-linear programming-linear phase filters-Maximal ripple FIR Filters –Remez exchange algorithm- Multiple band optimal FIR Filters-Design of filters with simultaneous constrains on the time and frequency response.**[10L]**

Unit III: Theory and approximation of Infinite Impulse, Response digital filters

IIR filters-filter coefficient-Digital Filter Design –Mapping of differentials-Transformations-Direct design of digital filters-comparison between FIR filters and IIR filters**.[10L]**

Unit IV: Finite word length effects in digital filters

Analog to digital conversions-digital to analog conversions-types of Arithmetic in digital systems. Types of quantization in digital filters-Dynamic range Constraints-Realizations-ordering and pairing in cascade realizations-round of noise-fixed point analysis-Coefficient quantization – Limit cycle oscillations**.[10L]**

Unit V: Spectrum Analysis and the Fast Fourier Transform

Introduction to Radix-2 FFT's-data shuffling and bit reversal-FFT computer programming-Decimation –in-Frequency Algorithm –Computing an Inverse DFT by doing a Direct DFT-Radix2 Algorithm-Spectrum analysis at a single point in the z plane-spectrum analysis in FFT Analysis-Windows in spectrum Analysis-Bluestein's Algorithm-The chirp z transform algorithm- convolution and correlation using number theoretic transforms.**[10L]**

References:

1) Theory and application of Digital signal processing Lawrence R. Rabiner Bernard Gold-prentice hall of India.
2) Digital Signal Processing: Principles, Algorithms, and Applications by J. G. Proakis and D. G. Manolakis.
3) Digital Signal Processing: A Practical Guide for Engineers and Scientists, Steven Smith
4) Discrete-Time Signal Processing by A. V. Oppenheim and R. W. Schafer.
5) Understanding Digital Signal Processing by Richard G. Lyons.

PSCS 103	Mobile Computing [60 Lectures]	4

Unit I: **Introduction, Wireless Transmission and Medium Access Control**: Applications, A short history of wireless communication. Wireless Transmission: Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems. Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access. **(14 L)**

Unit II: Telecommunication, Satellite and Broadcast Systems: GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, security, New data services; DECT: System architecture, Protocol architecture; ETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode, Satellite Systems: History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover, Examples Broadcast Systems: Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting. **(12L)**

Unit III: Wireless LAN and ATM: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link management. Wireless ATM: Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN; Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol. **(13 L)**

Unit IV: Mobile Network and Transport Layers: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation , Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics, Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP. **(11 L)**

Unit V: Support for Mobility: File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures; Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML script, Wireless telephony application, Examples Stacks with Wap, Mobile databases, Mobile agents. **(10 L)**

References:

1. Jochen Schiller, .*Mobile communications.*, Addison wisely , Pearson Education
2. William Stallings, .*Wireless Communications and Networks*.
3. Rappaort, .*Wireless Communications* P*rincipals and Practices*.
4. YI Bing Lin , .*Wireless and Mobile Network Architectures*., John Wiley
5. P. Nicopolitidis , .*Wireless Networks*., John Wiley
6. K Pahlavan, P. Krishnamurthy, *Principles of Wireless Networks*.
7. M. Richharia , .*Mobile Satellite Communication: Principles and Trends*., Pearson Education

Course Code	Title	Credits
PSCS104	**Data Warehousing and Data Mining [60 Lectures]**	4

Unit I : Introduction to Data warehousing

1. Overview and Concepts: Need for data warehousing, Basic elements of data warehousing, Trends in data warehousing.
2. **Planning and Requirements**: Project planning and management, Collecting the requirements.
3. **Architecture And Infrastructure:** Architectural components, Infrastructure and metadata.

[10L]

Unit II: Designing and maintaining Data warehouse

1. **Data Design And Data Representation:** Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.
2. **Information Access And Delivery:** Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.
3. **Implementation And Maintenance:** Physical design process, data warehouse deployment, growth and maintenance.

[10L]

Unit III Introduction to Data mining

1. **Introduction:** Basics of data mining, related concepts, Data mining techniques. Data types: Nominal; Ordinal; Interval; Ratio, Data Issues: Missing values; Noisy values; Inconsistent values; redundant values. Data pre-processing and discretization.
2. **Knowledge Discovery:** KDD Process.
3. **Algorithms for Classification**

[15L]

Unit IV Data Mining Algorithms

1. Clustering.
2. Association rules.

[15L]

Unit V: Advanced topics

1. **Web Mining:** Web Content Mining, Web Structure Mining, Web Usage Mining.
2. **Advanced Topics:** Spatial mining, Temporal mining.
3. **Visualisation :** Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, Mining class comparisons:

[10L]

References:

(1) Paulraj Ponnian, "*Data Warehousing Fundamentals*", John Wiley.
(2) Ralph Kimball, "*The Data Warehouse Lifecycle toolkit*", John Wiley.
(3) Dunham, Margaret H, Data Mining: Introductory and Advanced Topics, Prentice Hall.
(4) Witten, Ian and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, Morgan Kaufmann.

Additional Reference Books:-

(1) W.H. Inmon, "*Building the Data Warehouses*", Wiley Dreamtech.
(2) R. Kimpall, "*The Data Warehouse Toolkit*", John Wiley.
(3) E.G. Mallach, "*Decision Support and Data Warehouse systems*", TMH.
(4) Han and Kamber, Data Mining: Concepts and Techniques, Second Edition, Morgan Kaufmann, 2006.

(5) Berry, Browne, Lecture Notes in Data Mining, World Scientific, 2006.
(6) Berry and Linoff, Data Mining Techniques, Second Edition, Wiley, 2004.
(7) Inmon, Building the Data Warehouse, Wiley, 1993.

PRACTICALS

At the end of First Semester there will be a practical examination based on Theory PSCS 101, PSCS 102, PSCS 103 and PSCs 104.

PSCS-P1	**Principles of Compiler Design using C/C++/Java** 1. Right linear grammar to left linear grammar 2. Conversion of NDFA to DFA 3. Implementation of Warshall Algorithm and Kleen Closure 4. Simple Precedence Matrix 5. Parsing using Simple Precedence Matrix 6. Linearising Simple Precedence Matrix 7. Parsing using Simple Precedence Function	**2**
PSCS-P2	**Digital Signal Processing using Matlab** 1. Basic Signals. 2. Frequency, Magnitude and Phase Response 3. Z – Transform 4. N – DFT 5. N-DFT Using Twiddle Matrix 6. Linear Convolution 7. Circular Convolution 8. Low – Pass FIR Filter 9. High – Pass FIR Filter 10. High-Pass and Low-Pass FIR Filter on various Inputs 11. Band-Pass and Band-stop FIR Filters 12. Analog Filters 13. Power Spectral Density 14. Remez Exchange Algorithm	**2**
PSCS-P3	**Mobile Applications using J2ME toolkit** 1. Create an application to draw simple text. 2. Create an application to draw simple text and perform various operations. 3. Create an application to handle multiple forms. 4. Create an application to demonstrate timers. 5. Create an application to demonstrate use of buffering (back and double). 6. Create an application to demonstrate bouncing ball in mobile application. 7. Create an application to demonstrate a simple Calculator. 8. Create an application to demonstrate different input boxes. 9. Create an application to demonstrate a dialog box. 10. Create an application to display the bitmap image. 11. Create an application to demonstrate various types of events. 12. Create an application for searching particular word in a text paragraph**.**	**2**
PSCS-P4	**Data warehousing and Data Mining** 1. Create OLAP cube using star and Snowflake schema. 2. Working with Measures in cube. 3. Firing queries on the cube by using MDX application 4. Data pre-processing and discretization 5. Classification problems 6. Clustering Analysis **7.** Association Rule Mining 8. Data visualization **Suggested Software:Data warehouse:** Microsoft SQL Server 2000.	**2**

	Data Mining: Practicals are conducted using Data mining 'workbench' software WEKA installed on Windows image. May be available under Linux. Freely downloadable from University of Waikato: http://www.cs.waikato.ac.nz/ml/weka/	

SEMESTER II

Paper V: Principles of Compiler Design-II: **CS 201**

PSCS201	I	Syntax-Directed Translation	**4**
	II	More about Translation Symbol Tables	
	III	Error detection and recovery	
	IV	Introduction to code, loop optimization and data-flow analysis	
	V	Code generation	

Paper VI: Digital Signal Processing-II: **CS 202**

PSCS202	I	An introduction to the theory of two dimensional signal processing and Digital hardware	**4**
	II	Special purpose hardware for digital filtering and signal generation	
	III	Special purpose hardware for FFT	
	IV	General Purpose hardware for signal Processing facilities	
	V	Application of Digital signal processing to Speech and Radar	

Paper VII: Computer Simulation & Modeling: **CS 203**

PSCS203	I	Introduction to Simulation, examples , Principles and Software	4
	II	Statistical and Queuing Models in Simulation	
	III	Random Number and Variate Generation	
	IV	Input Modeling and Verification and Validation of Simulation Model	
	V	Output Analysis for a single model, Comparison and Evaluation of Alternative System Design and Case Studies	

Paper VIII: Advanced database system: **CS 204**

PSCS204	I	Object Database Systems	4
	II	Parallel and Distributed Databases	
	III	Databases on the Web	

	IV	Active and Deductive Databases	
	V	Spatial and Temporal Databases	

Detail Syllabus
Semester II

Course Code	Title	Credits
PSCS201	**Principles of Compiler Design-II**	**4**

Unit I: Syntax-Directed Translation
Syntax-directed translation schemes, Implementation of syntax-directed translators, Intermediate code, Postfix notation, Parse trees and syntax trees, Three-address code, quadruples, and triples ,Translation of assignment statements, Boolean expressions, Statements that alter the flow of control, Postfix translations **[17L]**

Unit II: More about Translation and Symbol Tables
Array references in arithmetic expressions, Procedure calls, Declarations ,Case statements, Record structures, Symbol Tables:The contents of a symbol table, Data structures for symbol tables, Representing scope information, Implementation of block-structured languages, Storage allocation in FORTRAN, Storage allocation in block-structured languages **[12L]**

Unit III: Error detection and recovery
Errors, Lexical-phase errors, Syntactic-phase errors, Semantic errors **[03L]**

Unit VI: Introduction to code, loop optimization and data flow analysis
The principle sources of optimization, Loop optimization, The DAG representation of basic blocks, Global data-flow analysis ,loop optimization: Dominators, Reducible flow graphs, Depth-first search, Loop-invariant computations, Induction variable elimination ,Some other loop optimizations, Data-flow analysis, Reaching definitions again, Available expressions, Copy propagation, Backward flow problems, Very busy expressions and code hoisting, The four kinds of data-flow analysis problems. **[23L]**

Unit V: Code generation
Object programs, Problems in code generation, A machine model, A simple code generator, Register allocation and assignment, Code generation from DAG's
Peephole optimization **[05L]**

References:
Principles of Compiler Design, Alfred V. Aho & Jeffrey D. Ullman

Course Code	Title	Credits
PSCS202	**Digital Signal Processing -II**	**4**

Unit I: An introduction to the theory of two dimensional signal processing and Digital hardware:

Two-dimensional signals-systems-causality- seperability -stability-difference equations-Frequency Domain Techniques- Z Transforms-finite sequences-Two dimensional DFT-Two dimensional windows-Frequency sampling filters- frequency transformations from one to two dimensions. Digital Hardware: Design procedure for Digital Signal Processing Hardware- the major logic families- commercial logic packages- gates, multiplexers and decoders- Flip-Flops-arithmetic Units- dividers and floating point hardware. **[15L]**

Unit II: Special purpose hardware for digital filtering and signal generation: Direct form FIR hardware- parallelism for direct form FIR- Cascade FIR filters-IIR filters- Digital Touch Tone Receiver (TTR) - Digital time Division Multiplexing (TDM) to Frequency Division Multiplexing (FDM) translator partitioning of digital filters for IC Realization- Hardware realization of a Digital Frequency Synthesizer. **[10L]**

Unit III: Special purpose hardware for FFT : FFT indexing- bit reversal and digit reversal for fixed radices- Comparison of computations for radices- introduction to quantization effects in FFT Algorithms. Hardware for Radix 2 Algorithm- FFT Computation using Fast Scratch Memory.Radix 2 and Radix 4 Parallel structures using RAM's- Pipeline FFT- Comparison of Pipe line FFT's-overlapped FFT with random access memory-real time convolution via FFT using a single Ram and one AE. **[10L]**

Unit IV: General Purpose hardware for signal Processing facilities : Special and general purpose computers- input output problems for real time processing- methods of improving computer speed – parallel operations of memories, Arithmetic, control and instruction fetches- the Linco Laboratory Fast Digital Processor(FDP). Doing FFT in FDP- LSP2. **[10L]**

Unit V: Application of Digital signal processing to Speech and Radar:

Models of speech production-Short time spectrum analysis- speech analysis-synthesis System based on short time spectrum analysis- channel vocoder- analyzers-synthesizers- pitch detection and voiced unvoiced detections- homomorphic processing of speech, vocoder-formant Synthesis-Voiced –Unvoiced Detection- Voiced Fricative excitation network- Linear prediction of speech-Computer Voice Response system.

Radar: Radar principle and application radar systems and parameter- Signal design and ambiguity functions- Airborne Surveillance Radar for Air Traffic Control – Digital matched Filter for a high performance Radar. **[15L]**

References:

1) Theory and application of Digital signal processing Lawrence R. Rabiner Bernard Gold-prentice hall of India.
2) Digital Signal Processing and the Microcontroller by Dale Grover and John R. (Jack) Deller with illustrations by Jonathan Roth.

Course Code	Title	Credits
PSCS203	**Computer Simulation & Modeling [60 Lectures]**	**4**

Unit I: **Introduction to Simulation, examples , Principles and Software**

Introduction: System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation. Examples: Simulation of Queueing systems, Other examples of simulation. General Principles: Concepts of discrete event simulation, List processing. Simulation Software: History of simulation software, Desirable software features, General-purpose simulation packages, Object oriented simulation, Trends in simulation software. **[16L]**

Unit II : **Statistical and Queuing Models in Simulation:**

Statistical Models: Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution. Queueing Models: Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Steady state behavior of infinite population Markovian models, Steady state behavior finite population model, Network of Queues. **[16L]**

Unit III Random Number and Variate Generation:

Random Number: Properties of random numbers, Generation of pseudo random numbers, Techniques for generating random numbers, Tests for random numbers. Random Variate Generation: Inverse transform technique, Convolution method, Acceptance rejection techniques. **[12L]**

Unit IV : Input Modeling and Verification and Validation of Simulation Model Input Modeling: Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.Verification and Validation of Simulation Model: Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models. **[07L]**

Unit V : Output Analysis for a single model, Comparison and Evaluation of Alternative System Design and Case Studies

Output Analysis for a Single Model: Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation. Comparison and Evaluation of Alternative System Design: Comparison of two system design, Comparison of several system design, Meta modeling, Optimization via simulation. Case Studies: Simulation of manufacturing systems, Simulation of computer systems, Simulation of super market, Simulation of pert network. **[09L]**

References:

1. Jerry Banks, John Carson, Barry Nelson, David Nicol, .*Discrete Event System Simulation*. [3rd Edition]
2. Averill Law, W. David Kelton, .*Simulation Modeling and Analysis.*, McGRAWHILL Geffery Gordon, .*System Simulation.*, PHI
3. Bernard Zeigler, Herbert Praehofer, Tag Gon Kim, .*Theory of Modeling and Simulation.*, Academic Press Narsing Deo, .*System Simulation with Digital Computer*., PHI
4. Donald W. Body, .*System Analysis and Modeling.*, Academic Press Harcourt India
5. W David Kelton, Randall Sadowski, Deborah Sadowski, .*Simulation with Arena*., McGRAW-HILL.

Course Code	Title	Credits
PSCS204	**Advanced Databases**	**4**

Unit I Object Database Systems :

Object-Oriented data model, Strategies for developing OODBMS, Persistence programming languages, Object identity and structure, complex objects, Accessing an object, Persistence Schemes, Pointer swizzling techniques, Issues in OODBMS like transactions and concurrency, ODMG, Nested relations, Collections, Query processing and Optimization. **[15L]**

Unit II: Parallel and Distributed Databases :

Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. **[15L]**

Unit III: **Databases on the Web:**

Data versus Documents, Storing and Retrieving Data, Query Languages like Xquery, Storing and Retrieving Documents, Semi Structured Data Model, Indexes for text data. **[10L]**

Unit IV: Active and Deductive Databases :

Active databases: Languages for rule specification: Events, Conditions, Actions. Execution model: Rule execution, Conflicts resolution, Coupling modes and termination.

Deductive databases: Introduction to recursive queries, Datalog, Least model semantics, The fixed point operator, Safe datalog program, Stratification, Evaluating recursive queries. **[10L]**

Unit: V: **Spatial and Temporal Databases :**

Spatial Databases: Types of spatial data, R tree structure, Spatial query evaluation, Introduction to GIS, Comparison between spatial databases and GIS. Data structures in GIS.

Temporal Databases: Transaction time databases, Valid time databases:, Bi-temporal databases, Temporal queries.

Introduction to Mobile databases. [10L]

References:

1. Raghu Ramakrishnan, Johannes Gehrke, "*Database Management Systems*", McGraw-Hill
2. Elmasri and Navathe, "*Fundamentals of Database Systems*", Pearson Education

Additional References:

1. Korth, Silberchatz, Sudarshan , "*Database System Concepts*", McGraw-Hill.
2. Peter Rob and Coronel, "*Database Systems, Design, Implementation and Management*", Thomson Learning.
3. C.J.Date, Longman, "*Introduction To Database Systems*", Pearson Education

PRACTICALS

At the end of Second Semester there will be a practical examination based on Theory PSCS 201, PSCS 202, PSCS 203 and PSCS 204.

PSCS-P5	1. Conversion of Infix to Postfix notation 2. Conversion of Postfix to Infix notation 3. Generation of three address code 4. Quadruple 5. Triple 6. DAG representation 7. Code generation	**2**
PSCS-P6	1. Two – Dimensional Linear Convolution 2. Two – Dimensional Cross – Correlation and Auto – Correlation 3. Stability 4. Bit Reversal Algorithm 5. Radix 2 DIT FFT Algorithm	**2**
PSCS-P7	**Computer Simulation and Modeling** 1. Single Channel Queuing Model 2. Multi Channel Queuing Model 3. Inventory System 4. Discrete Distribution 5. Continuous Distribution 6. Random Number Generation 7. Random Number Test 8. Acceptance-Rejection Technique	**2**
PSCS-P8	**Advanced Databases Practical topics** 8. Object oriented databases 9. Distributed databases 10. XML databases 11. Spatial databases 12. Temporal databases 13. Active databases **Software recommended :** Oracle.	**2**