Ist year
AUTUMN SEMESTER

MA-101	Mathematics-I	BS	4	3-1-0
PH-101	Physics-I	BS	5	3-1-2
EE-101	Electrical Science*	ESA	4	3-1-2/2
HS-101	English (Basic/Advanced)*	HS	4	3-0-2
CH-101	Fundamentals of Bio-Tech*	ESA	2	2-0-0
ME-101	Basic Mechanical Engg.	ESA	3	2-0-2
CE-101	Engineering Graphics I	ESA	3	1-0-3
CY-101	Chemistry*	BS	5	3-1-2
IC-101	Computer Systems & Programming*	ESA	4	3-0-2

SPRING SEMESTER

MA-102	Mathematics-II	BS	4	3-1-0
PH-102	Physics-II	BS	5	3-1-2
EC-102	Electronics	ESA	4	3-1-0
ME-102	Engineering Graphics II	ESA	3	1-0-3
IC-101	Computer Systems & Programming*	ESA	4	3-0-2
HS-101	English (Basic/Advanced)*	HS	4	3-0-2
EE-101	Electrical Science*	ESA	4	3-1-2/2
CH-101	Fundamentals of Bio-Tech*	ESA	2	2-0-0
CY-101	Chemistry*	BS	5	3-1-2

Department of Computer Engineering
Malaviya National Institute of Technology
Curricular Structure **BTech (Computer Engg.)**

2nd Year
AUTUMN SEMESTER

	Teaching Scheme					Contact Hrs/W			Exam Du		Relative Weightage					
S.No.	Subject Code	Course Title	Subject Area	Pr	Credit	Lecture	Tutorial	Practical	Theory	Practical	CWS	PRS	MTE	ETE	PRE	CH
1	IC-201	Mathematics III	BS		4	3	1	0	3	-	25	-	25	50	-	4
2	CP-201	Logic System Design	DC	EC-102	4	3	0	2	3	-	-	30	20	50	-	6
3	CP-203	Data Structures	DC	IC-101	5	3	1	2	3	-	10	20	20	50	-	6
4	CP-205	Discrete Structures	DC		4	3	1	0	3	-	20	-	30	50	-	4
5	CP-207	Electronic Circuits and Design	ESA	EC-102	4	3	0	2	3	-	-	30	20	50	-	5
6		Institute Elective I	IE		4	3	1	0	3	-	25	-	25	50	-	4
					25	**18**	**4**	**6**								
																29

SPRING SEMESTER

				Pr	Cr											CH
1	IC-202	Social Science & Economics	HS		4	3	1	0			25	-	25	50	-	4
2	CP-202	Principles of Programming Languages	DC	CP-203	4	3	0	2	3	-	-	30	20	50	-	5
3	CP-204	Microprocessor & Interfaces	DC	CP-201	4	3	0	2	3	-	-	30	20	50	-	5
4	CP-206	Object Oriented Design	DC	IC-101, CP-203	4	3	0	2	3	-	-	30	20	50	-	6
5	CP-208	Principles of Communication Engineering	ESA	EC-102	4	3	1	0	3	-	20	-	30	50	-	4
6		Institute Elective II	IE		4	3	1	0	3	-	25	-	25	50	-	4
					24	**18**	**3**	**6**								
Creative Arts /Sports/NSS/Hindi			ECA		2											**28**
Discipline			ECA		2	**Total Cre**			**53**							

Department of Computer Engineering
Malaviya National Institute of Technology
Curricular Structure **BTech (Computer Engg.)**

3rd Year
AUTUMN SEMESTER

	Teaching Scheme					Contact Hrs/W			Exam Du		Relative Weightage					
S.No.	Subject Code	Course Title	Subject Area	Pr	Credit	Lecture	Tutorial	Practical	Theory	Practical	CWS	PRS	MTE	ETE	PRE	CH
1	CP-301	Computer Architecture	DC	CP-201	4	3	1	0	3	-	20	-	30	50	-	4
2	CP-303	Data Base Management Systems	DC		4	3	0	2	3	-	-	30	20	50	-	6
3	CP-305	Software Engineering	DC		4	3	1	0	3	-	20	-	30	50	-	4
4	CP-307	Design and Analysis of Algorithms	DC	CP-203	4	3	0	2	3	-	-	30	20	50	-	6
5	CP-309	Computer Networks	DC		4	3	0	2	3	-	-	30	20	50	-	2
6	CP-311	Group Discussion and Viva Voce	DC		2	0	2	0	-	-	-	-	-	-	100	4
7		Institute Elective III	IE		4	3	1	0	3	-	25	-	25	50	-	
																4
					26	**18**	**5**	**6**								**30**

SPRING SEMESTER

																CH
1	IC-301	Technical Communication	HS		4	2	2	0	2	-	25	-	25	50	-	5
2	CP-302	Operating System	DC	CP-203	4	3	0	2	3	-	-	30	20	50	-	5
3	CP-304	Digital Signal Processing	ESA		4	3	1	0	3	-	20	-	30	50	-	4
4	CP-306	Theory of Computation	DC	CP-203	4	3	1	0	3	-	20	-	30	50	-	4
5	CP-308	Computer Graphics	DC		4	3	0	2	3	-	-	30	20	50	-	5
6	CP-310	Scripting Language	DC		1	0	0	2	-	-	-	100	-	-	-	2
7		Department Elective I	DE		4	3	1	0	3	-	20	-	30	50	-	
					25	**17**	**5**	**6**								3
Creative Arts /Sports/NSS/Hindi			ECA		0	**Total Cre 53**										2
Discipline			ECA		2											**30**

Department Elective I

CP-322	Optimization Techniques	DE	
CP-324	Combinatorics	DE	
CP-326	Advanced Microprocessors	DE	CP-204
CP-328	Neural Networks	DE	
CP-330	Mathematical Programming	DE	
CP-332	Information Theory and Coding	DE	
			CP-306
			CP-301
			CP-301

Department of Computer Engineering
Malaviya National Institute of Technology
Curricular Structure **BTech (Computer Engg.)**

Final Year
AUTUMN SEMESTER

	Teaching Scheme					Contact Hrs/W			Exam Du		Relative Weightage					
S.No.	Subject Code	Course Title	Subject Area	Pr	Credit	Lecture	Tutorial	Practical	Theory	Practical	CWS	PRS	MTE	ETE	PRE	CH
1	CP-401	Principles of Compiler Design	DC	CP-308	4	3	0	2	3	-	-	30	20	50	-	5
2	CP-403	AI and Expert Systems	DC		4	3	0	2	3	-	-	30	20	50	-	5
3	CP-405	Introduction to VLSI Design	DC		4	3	0	2	3	-	-	30	20	50	-	5
4	CP-407	Real Time Systems	DC	CP-204, CP-301	4	3	0	2	3	-	-	30	20	50	-	4
5		Department Elective II	DE		4	3	0	2	3	-	-	30	20	50	-	5
6		Department Elective III	DE		4	3	0	2	3	-	-	30	20	50	-	4
7		Industrial Field/Training	DC		2	-	-	-	-	-	-	-	-	-	100	
					26	**18**	**0**	**12**								**28**

SPRING SEMESTER

																CH
1	IC-401	Industrial Management	HS		4	3	1	0	2	-	25	-	25	50	-	5
2	CP-402	Major Project	DC		12	0	2	6	-	-	20	-	20	-	60	5
3		Department Elective IV	DE		4	3	0	2	3	-	-	30	20	50	-	4
4		Department Elective V	DE		4	3	0	2	3	-	-	30	20	50	-	5
5																2
6																
					24	**9**	**3**	**10**								
Creative Arts /Sports/NSS/Hindi			ECA		0	**Total Cre**			**52**							**21**
Discipline			ECA		2											

Department Elctive II (Semester VII)

CP-421	Advanced Topics in Computer Graphics	DE	CP-206
CP-423	Advanced Topics in Networking	DE	CP-301
CP-425	Distributed Data Bases	DE	CP-304
CP-427	VHDL	DE	CP-303
CP-429	Simulation and Modelling	DE	

Department Elctive III (Semester VII)

			CP-304, CP-425
CP-441	Embedded Systems	DE	
CP-443	Cryptography	DE	CP-429
CP-445	Advaned Data Structures and Algorithms	DE	CP-303, CP-427
CP-447	Image Processing and Pattern Recognition	DE	
CP-449	Biometrics	DE	

Department Elctive IV (Semester VIII)

CP-420	Advanced Topics in	DE
CP-422	Parallel and Distribut	DE
CP-424	Computer Human Int	DE
CP-426	Software Project M	DE
CP-428	Advanced Topics in	DE

Department Elctive V (Semester VIII)

CP-440	Robotics	DE
CP-442	Behavioural Synthesi	DE
CP-444	Multimedia Systems	DE
CP-446	Mobile Computing	DE
CP-448	Advanced Computer	DE

Department of Compı Department of Computer Engineering
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BTech (Computer Teaching Scheme **BTech (Computer Engg.)**

	Credits	Lecture	Tutorial	Practical	HS	BS	HS	ESA	DC	DE	IE	D+n+S/C	TOTAL
First year	54				4	23	4	23				2+2+2	56
Semester III	25	18	4	6		4		4	13		4	-	25
Semester IV	24	18	3	6	4		4	4	12		4	2+0+2	28
Semester V	26	18	5	6					22		4	-	26
Semester VI	25	17	5	6	4		4	4	13	4		2+0+0	27
Semester VII	26	18	0	12					18	8		-	26
Semester VIII	24	9	3	10	4		12		12	8		2+0+0	26
Total	**204**				**16**	**27**	**24**	**35**	**90**	**20**	**12**	8+2+4	214
													214

1st year
AUTUMN SEMESTER

MA-101	Mathematics-I	BS	4	3-1-0
PH-101	Physics-I	BS	5	3-1-2
EE-101	Electrical Science*	ESA	4	3-1-2/2
HS-101	English (Basic/Advanced)*	HS	4	3-0-2
CH-101	Fundamentals of Bio-Tech*	ESA	2	2-0-0
ME-101	Basic Mechanical Engg.	ESA	3	2-0-2
CE-101	Engineering Graphics I	ESA	3	1-0-3
CY-101	Chemistry*	BS	5	3-1-2
IC-101	Computer Systems & Programming*	ESA	4	3-0-2

SPRING SEMESTER

MA-102	Mathematics-II	BS	4	3-1-0
PH-102	Physics-II	BS	5	3-1-2
EC-102	Electronics	ESA	4	3-1-0
ME-102	Engineering Graphics II	ESA	3	1-0-3
IC-101	Computer Systems & Programming*	ESA	4	3-0-2
HS-101	English (Basic/Advanced)*	HS	4	3-0-2
EE-101	Electrical Science*	ESA	4	3-1-2/2
CH-101	Fundamentals of Bio-Tech*	ESA	2	2-0-0
CY-101	Chemistry*	BS	5	3-1-2

2nd Year
AUTUMN SEMESTER

	Teaching Scheme					**Contact Hrs/Week**			**Exam Duration**		**Relative Weightage**					
S.No.	**Subject Code**	**Course Title**	**Subject Area**	**Pr**	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**	**CH**
1	IC-201	Mathematics III	BS		4	3	1	0	3	-	25	-	25	50	-	4
2	IT-201	Digital Electronics	DC	EC-102	4	3	0	2	3	-	-	30	20	50	-	6
3	IT-203	Data Structures & Algorithms	DC	IC-101	5	3	1	2	3	-	10	20	20	50	-	6
4	IT-205	Mathematical Foundations of IT	DC		4	3	1	0	3	-	20	-	30	50	-	4
5	IT-207	Electronic Devices and Circuits	ESA	EC-102	4	3	0	2	3	-	-	30	20	50	-	5
6		Institute Elective I	IE		4	3	1	0	3	-	25	-	25	50	-	4
					25	**18**	**4**	**6**								

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IT-201 Digital Electronics

Credits: 4 (3-0-2)

Number Systems and Codes
Introduction to positional number system, signed magnitude numbers, floating point numbers, binary arithmetic: addition, subtraction, multiplication and division, Base conversion, conversion formulas with examples, one's and two's compliment arithmetic,
Computer codes – BCD codes, gray codes, excess-3 codes, parity checks, Hamming and alphanumeric codes.

Digital Logic Families
Qualitative introduction to digital ICs, TTL, Schottky TTL, ECL, MOS Logic, CMOS Logic, Tri-state logic: Characteristics and properties.

Combinational Logic Design
Introduction, standard representations for logical functions, Karnaugh map representation, simplification of logical functions using K-map, minimization of logical functions specified in minterms/maxterms or Truth Table, minimization of logical functions not specified in minterms/maxterms, Don't care conditions, design examples, Ex-or and Ex-nor simplification of K-maps, five and six-variable K-maps, QM method, MEV method.

Combinational Logic Design using MSI circuits
Introduction, multiplexers and their use in combinational logic design, demultiplexers/decoders and their use in combinational logic design, adders and their use as subtractors, digital comparators, parity generators/checkers, code converters, priority encoders, 7-segment decoder/driver.

Synchronous Sequential Circuits
Introduction, FSM model, memory elements and their excitation functions. Synthesis of synchronous sequential circuits, capabilities and limitation of FSM, state equivalence and minimization, simplification of incompletely specified machines.

Asynchronous Sequential Circuits
Fundamental mode circuits synthesis, state assignment, pulse mode circuits.

A to D and D to A Converters
Introduction, Study of different types of analog to digital and digital to analog converters, their resolution, conversion time, sensitivity accuracy and other parameters. Study of some commercially available ADC and DAC chips.

Books/References:

1. R.P. Jain: Modern Digital Electronics, TMH.
2. Z Kohavi: Switching and Finite Automata Theory, TMH
3. M.M. Mano: Digital Logic Design, PHI.

IT-203 Data Structures and Algorithms

Credits: 5 (3-1-2)

Static/Linear: Various Implementation of linear data structures – arrays, strings. Searching and Sorting methods.
Dynamic/Non-linear: List as dynamic strauctures, single v/s double, generalized lists, garbage collection.
Stack: Implementation, expression evaluation using stacks, stacks and recursion.
Queue: Implementation and applications of queue.
Tree: Implementation, binary and multiway tree, tree traversal, BST and heap
Graph: Representation of graphs, BFS, DFS.
Algorithms: Techniques, Complexity, Shortest path, MST, Matrix inversion, String matching – KMP, Dynamic programming – Matrix multiplication.
Text/ Refernces:

1. Kruse R.L., *Data Structure and Program Design*, PHI.
2. Rivest, Cormen, *Introduction to Algorithms*, MIT Press
3. Horowitz and Sahni: *Data Structure in C++* , Glagotia
4. Ellis Horowitz, Sartaj Sahni, *Fundamentals of Data Structures*
5. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, *Data Structures Using C*

IT-205 Mathematical Foundations of IT

Credits 4 (3-1-0)

Set Theory: Basic notation and examples, Venn diagrams. Union, intersection and complement, Disjoint sets. Subsets, Laws of set theory. Principle of duality, Pairs, tuples, cartesian products. Powersets, Finite and infinite sequences

Functions: Extensional view. Equality of functions. Intensional view, Domain and range. Partial functions. Typed view, Composition and application, Identity and inverse functions, Polynomials. Exponential and log functions. Graphs of functions, Equivalence relations.

Number Systems: Natural numbers. Counting. Cardinality of finite sets. Laws, Mathematical induction. Prime numbers. Fundamental theorem of arithmetic. Well-ordering principle. Number bases. Modulo arithmetic. Integers. Laws of arithmetic. Integer powers and logarithms. Recurrence relations

Field Theory: Rings and fields, Application in coding, Discrete logarithms, Primitive root, Polynomial representation of binary strings. Variable lengths codes and Huffman's algorithm.

Texts/References:

1) Velleman DJ, *How To Prove It: A Structured Approach*, Cambridge University Press 1994
2) Aho and Ullman, *Foundations of Computer Science*, Addison Wesley 1992
3) Grossman P, *Discrete Mathematics for Computing*, Macmillan 1995
4) Ross KA & Wright CRB, *Discrete Mathematics*, Prentice-Hall 1999
5) Johnsonbaugh R, *Discrete Mathematics*, Macmillan 1986
6) Biggs N L, *Discrete Mathematics*, Oxford 1985
7) Wiitala, *Discrete Mathematics*, McGraw Hill 1987
8) Truss J, *Discrete Mathematics for Computer Scientists*, Addison Wesley 1999

IT-207 Electronic Devices and Circuits

Credits: 4 (3-0-2)

Introduction: Concepts of Fermi level, band structure of insulators, Metals & Semiconductors, mobility, conductivity, doping, continuity equation, injected minority carrier injection.

Transistor Characteristics: the junction transistor, transistor current component, the transistor as an amplifier, transistor construction, the common base configuration, the common emitter configuration, the CE cut of region, the CE saturation region, typical transistor junction voltage values, common-emitter current gain, the common collector configuration, analytical expressions for transistors characteristics, maximum voltage rating, the photo transistor.

Transistor Biasing & Thermal Stabilization: the operating point, bias stability, self-bias or emitter bias, stabilization against variation in I_{co}, V_{BE}, and ®, bias compensation, biasing techniques, for linear integrated circuits, thermistor and sensitor compensation, thermal runway, thermal stability.

The transistor at low frequencies: graphical analysis of the CE configuration, two-port devices and the hybrid model, transistor hybrid model, the h-parameter, conversion formulas for the parameters of the three transistor configuration, analysis of a transistor amplifier circuit using h- parameters, the emitter follower, comparison of transistor amplifier configuration, linear analysis of a transistor circuit, cascading transistor amplifiers, simplified calculations for common-collector configuration, the common-emitter amplifier with an emitter resistance, high input resistance transistor circuits.

Field Effect Transistors: The junction field effect transistor, the pinch-off voltage, the JEFT volt-ampere characteristics, the FET small signal model, the metal-oxide-semiconductor FET (MOSFET), the low frequency common source and common drain amplifiers, the FET as a voltage variable resistors (VVR).

Introduction to semiconductor devices: Construction and working principles of UJT, SCR, thyristor, diac, triac, phototransistor, HBT.

Text/References:

1. Integrated Electronics, Millman Halkias, TMH.
2. Solid state Electronics Devices, Stretman, PHI.
3. Microelectronic Circuits, Sedra Smith, Oxford Press, India.

IT-202 Principles of Information Technology

Credits: 4 (3-0-2)

Interpretation and understanding of information, need and role of information technology in business and organisation.
Information system: Basic elements, data, information, knowledge, infrastructure and types and its development.
Information technology infrastructure: Computer Hardware, computer software, Telecommunications: Practical uses of communication & connectivity, telephone related communication. Fax & voice mail, video/voice communication: video conferenceing, picture phones, online information services, the intranet and internet, introduction to web technologies, shared resources: workgroup computing, electronic data interchange & extranets, communication technology, tele-computing, virtual offices and mobile workspace.
Organization data and information: Basics of data arrangement and access, data knowledge & decision support, DBMS – An overview, data warehouses, data mining, electronic commerce. Benefits of information revolution, information technology: Ethics, impact and security.

Text/References:

1. Turban, Rainer : *Introduction to Information Technology*.
2. Dennis P. Curtin, Kim Foley: *Information Technology*.
3. Henry C. Lucas: *Information Technology for Management*.
4. Brain K. Williams, Stacey C. Sawyer: *Using Information Technology*.

IT-204 Microprocessor based System Design

Credits: 4 (3-0-2)

8086 Microprocessor: Introduction 8086 based microcomputer system.
Block diagram, pins and their description, demuliplexing of buses, control signal and flags.
Instruction and timing: instruction classification, instruction formats,instruction timings and status,
addressing modes,and interrupts.
Software model: instruction set, data transfer instruction, arithmetic logic & branch operations:
Program diretives, String manipulation.
Control loop Techniques: IF then Else, While loop, For loop techniques in 8086 assembly language programming
Interfacing peripherals: Descriptions, programming and interfacing of 8255, 8257, 8253, 8259A with 8086.
Basic Idea of Following Bus Standard: RS232C, IEEE-4888.
Introduction to 80386,80486 and pentium processors.Multitasking, Task Switching and protection in 80386.

Text/References:

1. Douglas V. Hall : Microprocessors and Interfacing, McGraw Hill
2. Gaonkar ; 8085 Programming, Penram Press
3 Uffenback;80x86 family, design,programming and interfacing , pearson edu.
4 bray; Intel Microprocessors, tmh
5 Intel MANUALS

IT-206 Internet Programming in Java

Credits: 4 (3-0-2)

Introduction: Internet, Java as a tool for internet applications, Byte Code and its advantages.
Object Oriented Programming and Design: Review of Abstraction, Objects and other basics, Encapsulation, Information hiding, Method, Signature, Classes and Instances, Polymorphism, Inheritance, Exceptions and Exception Handling with reference to object modeling, Coupling and Cohesion in object oriented software. Object Oriented Design – Process, Exploration and Analysis.
Java Programming Basics: Fundamentals: Variables and assignments, Input and Output, Data Types and Expressions, Flow of control, Local variables, Overloading Parameter passing, this pointer,
Java Object Oriented Concepts: Objects and Classes: Use of file for I/O, Formatting output with stream functions, Character I/O, Inheritance, Public and private members, Constructors for initializations, Derived classes, Flow of Control
Java Data Structures and Advanced Topics
Arrays – Programming with arrays, arrays of classes, arrays as function arguments, Strings, Multidimensional arrays, Arrays of strings, vectors, Base classes.
Introduction to Java Applets

Books/References

1. Herbert Schildt: JAVA 2 - The Complete Reference, TMH, Delhi
2. U.K. Chakraborty and D.G. Dastidar: Software and Systems - An Introduction, Wheeler Publishing, Delhi.
3. Joseph O'Neil and Herb Schildt: Teach Yourself JAVA, TMH, Delhi.
4. Elliotte Rusty Harold, Java Network Programming, 2nd Edition, O'Reilly and Associates.

IT-208 Communication Systems

Credits 4 (3-1-0)

Review of Representation of Signals: Fourier series, Fourier transform and its properties, spectral systems, transmission of signals through linear systems, ideal low-pass and high-pass filters, band-pass signals, spectral density and power spectral density.

Analog Communication: Amplitude modulation- SSB, DSB, Vestigial side bands, frequency modulation and phase modulation, Comparison of these techniques in respect of SNR, AM and FM receivers, Pulse time modulation

Multiplexing – TDMA, FDMA, CDMA, spread spectrum modulation.

Digital Communication: Pulse digital modulation, PCM, differential PCM, delta and adaptive delta modulation.

Digital passband transmission: ASK, FSK, QPSK, m-ary shift keying.

Line codes: On-off (RZ/NRZ), Polar and Bipolar,

Basics of Satellite communication and mobile communications.

Texts/References:

1) Communication Systems, Simon Haykin, John Wiley.
2) Communication Systems Engineering, Prakis & Salehi, Pearson Education.
3) Analog and Digital Communications, B.P. Lathi.
4) Modern Digital & Analog Communications, B.P. Lathi, Wiley Eastern.
5) Communication Systems, Taub and Schilling.

IT-301 Computer Organization

Credits 4 (3-1-0)

1. Introduction

Basic Machine Principle, Structure and representation of real world data, Von-Newman Model and stored program concept, Subroutine, Branching & Macro facility.

2. Processor Design

Processor Organization, Information representation and Number format, Instruction cycle and Instruction format, Addressing modes, Arithmetic operation, timed point addition, subtraction, multiplication and division, ALU design and floating point arithmetic, Parallel processing – Performance consideration, Pipeline processor and Multiunit processor.

3. Control Design

Instruction sequencing and Interpretation, Hardware Control design method, Multiplier control unit and CPU control unit, Microprogrammed Control, Minimizing Instruction Size, Microprogrammed computer.

4. Memory organization

Memory device characteristic, Random access and serial access memories, Virtual memory – memory hierarchies, Main Memory allocation & replacement policies, Segments, pages and file organization, High speed memories – Interlocked, cache and associative memory.

5. System Organization

Local and long distance communication, Programmed I/O, DMA and interrupts, I/O processors & CPU – I/O interaction, Multiprocessor Introduction.

Books/References

1. J.P. Hayes: Computer Architecture and Organization, 3rd Ed. TMH, 1999.
2. C.W. Gear: Computer organization and Programming, TMH.
3. T.C. Bartee: Digital Computer Fundamental, TMH.
4. M.M. Mano: Computer System Architecture, PHI.
5. A. S. Tanenbaum: Computer System Organization, PHI.

IT-303 Data Modelling and Design

Credits: 4 (3-0-2)

Design: Conceptual design, Three tier architecture, ER Diagram – entity (strong and weak), Data aggregation, specialization, generalization.
Data models: Relational, Network, Hierarchical and Object Oriented.
Normalization: Constraints – integrity and domain, Primary key, Super key, foreign key, Alternate key, candidate key, normal forms 1NF, 2NF, 3NF, BCNF, 4NF.
SQL: DDL and DML, Relational Algebra. Applications. SQL Quries, Triggers and views, Constraints assertions.
Data Organization: Sequential, indexed random and hashed files. Inverted and multilist structures, B trees, B+ trees, Query Optimisation, Join Algorithm, Statistics and Cost Base optimisation.
DBMS internals: Transaction Processing, concurrency control, and recovery management. Transaction model properties and state serialisability . Lock base protocols, two phase locking.

Text/References:

1. Almasri and S.B. Navathe: *Fundamentals of Database Systems*, Addison Wesley.
2. Kevine Kline, SQL in Nutshell, O'Reilly & Associates.
3. Raghu Ramakrishnan, Johannes Gehrke Database Management Systems, McGraw Hill.
4. H.F. Korth, Silberschatz, Sudarshan: *Database Systems Concepts*, McGraw Hill
5. C.J. Date: *Data Base Design*, Addison Wesley
6. Hansen and Hansen : *DBM and Design*, PHI

IT-305 System Analysis and Design

Credits 4 (3-1-0)

System concept : Definition and characteristics , elements and boundaries , types of system development lifecycle , recognition of needs , feasibility study , prototyping , role of system analyst .
System planning and tools like DFD , data dictionary , decision trees, structured analysis and decision tables . Feasibility study and reports, Object Oriented Analysis and Data Modeling.
System Design methodology , structured design , from driven methodology ,IPO charts, structured walkthrough, input output from design , requirement and classification of forms , layout considerations form control, object oriented Design Concepts and methods.
Text/Reference :-

1. Awad : System Analysis and design
2. pressman :software Engineering
3. Salzinger Jackson ,Burd: System Analysis and Desingn Course Technology.

IT-307 Data Compression

Credits: 4 (3-0-2)

Compression: Need, Lossless v/s lossy compression, review of information theory, prefix codes, uniquely decodable code.
Huffman coding – minimum variance, optimal, non-binary, extended, adaptive. Applications and limitations of Huffman codes.
Run length encoding, Arithmetic coding, Predictive coding – Burrows-Wheeler transform, Delta modulation, Adaptive delta modulation
Lossy Compression Techniques – JPEG and its application
Error detection and correction: Parity, 1,2,n dimensions, Hamming codes, p-out-of-q codes
Dictionary based compression - Lempel-Ziv-Welch, LZ77 and LZ-78
Quantization – Scalar and Vector Quanitization.

Texts/References:

1) Khalid Sayood, Introduction to Data Compression, Morgan Kauffman
2) Greg A. Harris, Darrel R. Hankerson, Peter D. Jr. Johnson, Introduction to Information Theory and Data Compression, Second Edition, Chapman and Hall.
3) Saloman, Data Compression, Springer Verlag.
4) Nelson, The Data Compression book, Hungry Minds.

IT-309 Data Networks

Credits: 4 (3-0-2)

Definition of a Communications Network
Concept of a node; Nodes connected by links to form networks; Names & Addresses; the idea of "address resolution"

Types of Network
Understanding of operation and examples of use.

- Point-to-point Connections
  Fixed configuration; dedicated capacity
- Circuit-switched Networks
  Circuit setup; reserved capacity; (e.g. telephony)
- Message-switched Networks
  Circuit set-up; store and forward; message headers; (e.g. telex)
- Packet-switched Networks
  Packet headers; pipelining; datagram networks; (e.g. Internet)

Types of Equipment

- End Systems (ES) (e.g. client or server)
- Intermediate Systems (IS) (e.g. router, bridge)

Types of Packet-Switched Network

- Wide Area Networks (WANs)
- Internet Service Providers (ISPs)
- Local Area Networks (LANs)
  Differences in ownership, speed, cost, number of nodes

Types of Communication

- Client and Server Communication (e.g. DNS, arp, ping)
- Broadcast, Unicast and Multicast modes
- Simplex, Duplex and Half-Duplex Information Flow

Open System Interconnection
Definition of OSI; Reasons for using the Reference Model

- Protocol Layers
- The Seven Layers of the OSI Reference Model
  Knowledge of the seven layers and their BASIC functions, particularly of the four lowest layers.
- Communications between layers
  - Protocols
  - Peer to Peer Communication between Remote Layers
  - Service Access Points
  - Service Primitives and Communication Between Adjacent Layers
- Encapsulation of PDUs
  Addition of headers on transmission; Removal on reception
- Segmentation & reassembly by protocol layers

TCP/IP Networks and protocol stack.

Text/References:

1. Computer Network and Internet, D.Comer, Pearson
2. Computer Networks: A top down approach, Kurose and Ross, Pearson.
3. Data Networks: Bertsekas and Gallager, PhI.

IT-302 System Software

Credits: 4 (3-0-2)

Translators: Introduction to compilers, translators, and interpreters, compilation process.
Assemblers: Two pass, one pass assemblers, macro processors.
Editors and Debuggers: Design and implementation.
Linkers and Loaders: Relocation, static and dynamic linking.
Compilers: Lexical, syntax, semantic analysis, LL v/s LR Parser, Predictive parsing, Symbol table management, Intermediate code generation, Brief overview of code optimization.
Operating System: OS as a resource manager, I/O management – disk scheduling, CPU management – scheduling, Process management - deadlocks, Memory management – virtual memory, paging, segmentation.

Text & References:

1. System Software and Operating Systems, Dhamdhere.
2. System Programming : Donovon.
3. Holub, Compiler Design in C, PHI.

IT-304 Signals and Systems

Credits 4 (3-1-0)

Review of signal description
Review of Fourier and Laplace transforms
Spectrograms; frequency modulation
Sampling and aliasing
The z-transform
Filters: Transfer functions, FIR filters, IIR filters
Spectral analysis: DFT for periodic signals, DFT for non-periodic signals
Texts/References:

1) J H McClellan, R W Schafer & M A Yoder, *DSP First: a Multimedia Approach*, Prentice-Hall International 1998
2) A V Oppenheim , R W Schafer & J R Back, *Discrete-time Digital Signal Processing*, Prentice Hall Int 1999. Third major revision of classic text
3) A V Oppenheim , A S Willsky & S H Nawab, *Signals and Systems*, Prentice Hall Int 1996. Includes companion book with Matlab examples
4) N K Sinha, *Linear systems*, John Wiley 1991
5) J G Proakis and D G Hanolakis, *Digital Signal Processing*, Maxwell Macmillan Int 1992

IT-306 VLSI Algorithms

Credits 4 (3-0-2)

Introduction: The VLSI Design Problem. Design Domains. Design Actions Algorithmic and System Design. Structural and Logic Design.Transistor-level Design. Layout Design. Verification Methods

Algorithmic Graph Theory and Computational Complexity: Data Structures for the Representation of Graphs. Computational Complexity. Depth-first Search. Breadth-first Search Dijkstra's Shortest-path Algorithm Prim's Algorithm for Minimum Spanning Trees

Tractability Issues: Combinatorial Optimization Problems Decision Problems Complexity Classes NP-completeness and NP-hardness

Combinatorial Optimization: The Unit-size Placement Problem.Backtracking and Branch-and-bound. Dynamic Programming Linear and Integer Linear Programming.Local Search Simulated Annealing Tabu Search Genetic Algorithms

Design Problems and Algorithms: Layout Compaction Design Rules Symbolic Layout Applications of Compaction Informal Problem Formulation Graph-theoretical Formulation Maximum-distance Constraints Algorithms for Constraint-graph Compaction Longest-path Algorithm for DAGs The Longest Path in Graphs with Cycles The Liao- Wong Algorithm The Bellman-Ford Algorithm

Placement and Partitioning: Circuit Representation Wire-length Estimation Types of Placement Problem Constructive Placement Iterative Improvement Partitioning The Kernighan-Lin Partitioning Algorithm

Floorplanning: Floorplanning Concepts Terminology and Floorplan Representation Optimization Problems in Floorplanning Shape Functions and Floorplan Sizing

Routing: Types of Local Routing Problems Area Routing Channel Routing Channel Routing Models The Vertical Constraint Graph Horizontal Constraints and the Left-edge Algorithm Channel Routing Algorithms Introduction to Global Routing Standard-cell Layout Building-block Layout and Channel Ordering Algorithms for Global Routing Efficient Rectilinear Steiner-tree Construction Local Transformations for Global Routing

Simulation: General VLSI Simulation Gate-level Modeling and Simulation Signal Modeling Gate Modeling Delay Modeling Connectivity Modeling Compiler-driven Simulation Event-driven Simulation Switch-level Modeling and Simulation Connectivity and Signal Modeling Simulation Mechanisms

Logic Synthesis and Verification: Introduction to Combinational Logic Synthesis Basic Issues and Terminology Binary-decision Diagrams ROBDD Principles ROBDD Implementation and Construction ROBDD Manipulation Variable Ordering Applications to Verification Applications to Combinatorial Optimization Two-level Logic Synthesis Heuristic Based on ROBDDs

Text/References:

1. Sabih H. Gerez, *Algorithms for VLSI Design Automation,* John Wiley & Sons
2. Introduction to Algorithms, Rivest, Korman et.al.,Pearson.

IT-308 Multimedia Techniques

Credits: 4 (3-0-2)

1. **Basics of multimedia technology**

Computers, Communication and Entertainment; Multimedia -An introduction; Framework for multimedia systems; multimedia devices, CD-Audio, CD-ROM,CD-I; presentation devices and the user interface; multimedia presentation and authoring; professional development tools; LANs & multimedia ;Internet, World Wide Web(World Wide Web) & multimedia ;distribution network-ATM & ADSL; multimedia servers & databases; vector graphics; 3-D graphics programs; animation techniques; shading; anti-aliasing; morphing ;video on demand

2. **Image Compression & Standards**

Making still images; editing and capturing images; scanning images; computer color models; color palettes; vector drawing; 3-D drawing and rendering; JPEG-objectives and architecture; JPEG-DCT encoding and quantization, JPEG statistical coding; JPEG predictive lossless coding; JPEG performance; Overview of other image file formats as GIF, TIFF, BMP, PNG etc.

3. **Audio & Video**

Digital representation of sound; time domain sampled representation; method of encoding the analog signals; subband coding; Fourier method; transmission of digital sound; digital audio signal processing; stereophonic & quadraphonic signal processing; editing sampled sound; MPEG Audio; audio compression & decompression; brief survey of speech recognition and generation; audio synthesis; Musical Instrument Digital Interface (MIDI); digital video and image compression; MPEG motion video compression standard; DVI technology; time-based media representation and delivery.

4. **Virtual Reality**

Applications of multimedia, Intelligent multimedia system, Desktop Virtual Reality (VR), VR operating System, Virtual environment displays and orientation tracking; visually coupled system requirements; intelligent VR software systems.

Applications of environments in various fields viz. Entertainment, manufacturing, business, education, etc.

Books/References

1. Villamil & Molina, Multimedia : An Introduction, PHI.
2. Lozano, Multimedia : Sound & Video, PHI.
3. Villamil & Molina, Multimedia : Production, Planning and Delivery, PHI.
4. Sinclair, Multimedia on the PC, BPB.
5. Tay Vaughan, Multimedia :Making it work, TMH

IT-322 Operations Research

Credits 4 (3-1-0)

Project Management: Network models of Engineering projects, scheduling and monitoring of projects CPM and PERT methods.
Queueing Theory: Review of necessary probability functions, Dynamics of a queueing system, Mathematical Models of a simple queue, Use and limitations of analytical approach.
Discrete Event Simulation: Discrete event simulation as a modelling technique, activity flow diagrams and examples.
Decision Analysis: Use of Decisions Trees for more complex situations including those that require Bayes Theorem to revise probabilities.
Case Study: Inventory Models

Texts/References:

1) Michael Pidd, *Computer Simulation in Management Science,* Wiley.
2) Anderson, Sweeney and Williams, *An Introduction to Management Science,* West Publishing Co., (also an accompanying study guide).
3) *System simulation*, Gorden G., Prentice Hall of India
4) *Discrete Event Simulation,* Banks
5) *System simulation*, Narsing Deo, McGraw Hill.
6) *Simulation modeling and analysis*, Law and Kelton, McGraw Hill.

IT-324 Management Information System

Credits 4 (3-1-0)

Introduction to management information system
Hardware and software used for information systems, transaction processing, office automation.
Decision making process, concepts of information, humans as information processors, system concepts, organisational structure and management concepts.
Support for planning and controlling.
Organisation and management of the information resources function.

Text/ References :

1. *Management Information and System*, Davis and Olson, Mcgraw Hill.

IT-326 Natural Language Processing

Credits 4 (3-1-0)

Introduction
Origin, imposition, representation, role of knowledge, use of prolog for Natural Language Processing (NLP), Finite State Transition Networks(FSTN), notation, representation and traversal of FSTN in Prolog, Finite State Transducers(FST), implementation in Prolog, limitation of SM.

Recursive and Augmented Transition Networks (RTN)
Modeling recursion, representation, traversal, implementation in Prolog, push down transducers, implementation, advantage and limitations of RTN, augmented transition networks.

Grammar and Parsing
Grammar as knowledge representation, words, rules, structures, representation in Prolog, subcategorization, definite clause grammars, classes of grammars and languages, top down and bottom up parsing, comparison strategies, BFS and DFS, storing intermediate results, ambiguity, determinism and lookahead.

Well formed Sub-string tables and Charts
Well formed substring tables, active charts, rules of chart parsing, initialization, rule invocation, house keeping, implementation of top down and bottom up chart parsers, search strategy, alternative rule invocation, implementing flexible control, efficiency.

Features and the Lexicon
Feature theoretic syntax, feature structures as graphs, feature structures in Prolog, subsumption and unification, the status o rules, implementing PATR in Prolog, chart parsing with feature-based grammars, representation of lexical knowledge, implementing a lexicon in Prolog, DAGs versus terms

Semantics
Compositionality, meaning as reference, translation to a meaning representation language, computational semantics as feature instantiation, transitive verbs and quantification, ambiguity, preferences and timing, building semantic checking in to the grammar.

Question answering and Inference
Question answering, evaluating DBQ formulae, standard logical inference, implementing forwards inference in Prolog, the pathological nature of logical inference, primitives and canonical forms, classes and inheritance, plausible inference and defaults

Books/References

1) Gerald Gazdar and Chris Mellish: Natural Language Processing in Prolog, Addison Wesley
2) Allen James: Natural Language Understanding, Benjamin Cummins
3) Briscoe, Edward J., Boguraev and Branimir K.: Computation Lexicography for Natural Language Processing, Longman/Wiley
4) Schwartz, Steven C.: Applied Natural Language Processing, Petrocelli
5) Winograd, Terry: Understanding Natural Language, Academic Press.

IT-328 e-Commerce

Credits 4 (3-1-0)

Introduction and concepts: networks and commercial transactions, the Internet environment, online commerce solutions. A generic business model for e-commerce.
Security technologies: Introduction to cryptography, key distribution and clarification.
Architecture for e-commerce: online commerce environment, servers and commercial environments, strategies, techniques and tools.
Electronic payment methods: Secure online transaction models, digital payment system, cyber cash, digital currencies.
Protocol for the public transport of private information: security protocols, secure socket layer.
Open issues: legal and technical issues.

Text & References:

1. Electronic e-commerce II Edition: Pete Loshin, Paul A Murphy, Jaico book.
2. The Business of e-commerce: Paul May, Cambridge University Press.

IT-330 Graph Theory

Credits 4 (3-1-0)

Intoroduction to graphs.
Review of DFS. Applications of DFS – Topological Sort, Connected components, Articultaion Points.
Euler graphs, detection of cycles in graph.
Max-flow Min-cut theorem. Algorithms for computing maximum flows in graphs. Algorithms for computing the minimum cut in a graph.
Edge and vertex connectivity of graphs and menger's theorem. Maximum matching, Planar graphs and algorithms for checking for planarity. Edge and vertex coloring of graphs.
Independent sets and perfect graphs.

Texts/References:

1. Rivest, Cormen – Introduction to Algorithms
2. West, Graph Theory
3. Narsingh Deo:*Graph Theory with Application to Engineering and Computer Science*, Prentice-Hall.
4. Narsingh Deo: Combinatorial Algorithms: Theory and Practice, Prentice-Hall.

IT-332 Information Theory and Coding

Credits 4 (3-1-0)

Mathematical Theory of Foundation Of Information Theory in Communication system.
Measures of Information- Self information, Mutual Information, Average Information, entropy and its properties.
Source Model and Coding, channels Model and Coding. Problems of unique decipherable Codes,
condition of Instantaneous codes, Code word length, Kraft Inequality. Noiseless Coding Theorem.
Construction of codes: Shannon Fano, Shannon Binary and Huffman codes.
Discrete Memory less channels: Classification of channels, calculation of channel capacity. Decoding scheme- the ideal observer. The fundamental theorem of Information theory.
Error Correcting Codes: Minimum distance principle. Relation between distance and error correcting properties of codes, The Hamming bound. Parity check Coding. Bounds on the error correcting ability of Parity Check Codes.

Text /References

1. *Information theory and Reliable Communication* by R.G.Gallager
2. *Information Theory* by Robert Ash
3. *An Introduction to Information Theory* by F. M. Reza
4. *Error correcting codes* by W.W. Peterson and E. J. Weldon

IT-401 GUI Programming

Credits: 4 (3-0-2)

Architecture of GUI Applications: Model-GUI Separation, N-Tier Architectures, GUI as Frontend to Transactions (Forms-based GUIs)
GUI Design Patterns: Modal Dialog, Inspector (Properties of Selected Element), Wizard (Step-by-Step), Palette/Roll-Up, Explorer (Tree/Table Combination)
Windowing Systems: Microsoft Windows, X Window, MacOS
GUI Frameworks: Java Swing, Microsoft Foundation Classes
Components: Java Beans, ActiveX Controls
Development Environments & GUI Builders: Principles, Application, Restrictions, Evaluation

Texts/References:

1. B. Scneiderman, Designing the User Interface, Addison Wesl;ey, III ed.
2. Susan Weinschenk, GUI Design Essentials.
3. Barfield L, *The User Interface: Concepts & Design*, Addison Wesley, 1993
4. Cox K & Walker D, *User Interface Design*, Prentice Hall, 1993
5. Preece, Rodgers, Sharp, Benion, Holland and Carey, Human Computer Interaction, Addison Wesley
6. Dix A, Finlay J, Abowd G and Beale R, *Human-Computer Interaction* , 3rd Edition. Prentice Hall, 2003
7. Preece J, Rogers Y, Sharp H *Interaction Design: beyond human-computer interaction*, Wiley, 2002.

IT-403 AI and Neural Networks

Credits: 4 (3-0-2)

Overview of AI, Problems, Problem space and searching techniques, Definition production system, Control strategies, Heuristic search techniques.
Knowledge representation: Representation, mappings, approaches and issues, Predicate logic, prepositional logic, Resolution, Procedural and declarative knowledge, forward and backward reasoning, Matching, Semantic nets.
Learning and learning systems: Introduction to Hopfield networks, introduction to neural networks, learning in neural networks, applications of neural networks, Recurrent network.,
Back propogation Algorithm.
Introduction to AI languages: PROLOG and LISP.

Text & References:

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
2. Introduction to AI & Expert System: Dan W. Patterson, PHI.

IT-405 Information System Security

Credits: 4 (3-0-2)

Security issues in information systems. Public v/s private key.
Mathematical preliminaries: Discrete Logarithms, Galois Fields, one-way hash functions.
Case Study: DES, IDEA, RSA,
Key management, Key exchange.
Related issues: Privacy, Authentication, Signatures, Deniability.
Introduction to hacking.

Text & References:

1. Stallings, Cryptography and Network Security: Principles and Practice, Pearson Education Asia. ISBN 981-403-589-0.
2. B Schneier, Applied Cryptography, Wiley. ISBN 0-471-11709-9
3. B Schneier, Practical Cryptography, Wiley. ISBN 0-471-11709-9

IT-407 Wireless Technologies

Credits: 4 (3-0-2)

Issues in wireless networks, wireless multiple access protocols, cellular wireless networks, channel allocation in cellular system, wireless 802.11 LAN, HyperLAN, type of wireless networks.
Wireless network layer, Ad-hoc network, tunneling and encapsulation, routing protocol, global state routing, dynamic state routing, fisheye routing, ad-hoc on-demand distance vector routing, destination sequence distance vector routing, dynamic source routing.
Wireless transport layer problems, solutions & protocols. Wireless application protocol, goals, issues, architecture, wireless datagram protocol, wireless transport layer security, wireless transaction protocol, wireless session protocol, wireless application environment.
Introduction to Blue tooth, GSM, GPRS & CDMA technologies.

Text & References:

1. Mobile communications Jochen Schiller, Pearson
2. 802.11 wireless networks Matthew S.Gast, O'REILLY.
3. Wireless LANs: Davis & McGuffin, McGraw Hill
4. Mobile Communications Handbook by Jerry D. Gybson
5. Mobile Communications Handbook by Raymond Steel
6. Research papers and Internet material.

IT-421 3D Computer Graphics

Credits: 4 (3-0-2)

Review of 2-D techniques: World coordinates, 2D transformatios, Anti-aliasing

3-D techniques: Transformations in 3D
Visible surface determination
Illumination and shading models
Texture mapping
Ray tracing
Fractals
case studies

Texts/References

1) J D Foley, A Van Dam, S K Feiner, J F Hughes and R L Phillips, *Introduction to Computer Graphics*, Addison-Wesley, 1994
2) D Hearn and M S Baker, *Computer Graphics*, 2nd Ed, Prentice-Hall, 1994
3) J D Foley and A Van Dam, *Computer Graphics, Principles and Practice*, 2nd Ed in C, Addison Wesley, 1996
4) A Watts, *Fundamentals of Three-Dimensional Computer Graphics*, Addison Wesley, 1989

IT-423 Network Services and Management

Credits: 4 (3-0-2)

Overview of Internet Technologies, Issues in next generation Internet - Routing, Multicasting, Packet Scheduling, Quality of Service etc. Admission control in Internet: Effective bandwidth, Differentiated services, Policy-based networking, Real time communications over Internet, Internet telephony, Voice over IP, Integrated services. Web QoS, Intelligent caching, Traffic measurement and characterization.

Structure and protocols for Network management, agents. Directory services and protocols.

Text/References:

1. Computer Networks: A Top Down Approach, Kurose and Ross, Pearson.
2. SNMP, SNMPv2, SNMPv3, and RMON 1 and 2, W. Stallings, Pearson.
3. The practice of system and network administration, T.Limocelli, Pearson.

IT-425 Data Mining and Warehousing

Credits: 4 (3-0-2)

Introduction to Decision Support Systems, Data Warehouse and Online Analytical Processing. Data Warehouse Architecture: System Processes, Process Architecture: Load Warehouse, Query, Detailed and Summarized Information.
Design: Data Base Schema Facts, Dimensions and Attributes.
Introduction to Data Base and Metadata.
Data Warehouse Implementation.
Data Mining : Introduction and need.
Data Processing : Data Cleaning, Data Integration and Transformation, Data Reduction.
Data Mining Primitives : Descriptive and Predicative Data Mining, Language DMQL and its Preliminary Clauses.
Data Mining Methods: Association – Single and Multilevel, Characterization and Comparison, Regression Analysis, Classification and Predication.
Data Mining Algorithms: Clustering, Association, Regression, Decision Trees.
OLAP : OLAP Architecture, ROLAP, and MOLAP.
Application and Trends in Data Mining.

Text & References:

1. Data Warehousing in the Real World – Anahory and Murray, Pearson Education.
2. Data Mining – Concepts and Techniques – Jiawai Han and Micheline Kamber.
3. Building the Data Warehouse – WH Inmon, Wiley.

IT-427 Digital Hardware Design

Credits: 4 (3-0-2)

Asynchronous State Machines: Analysis and design of fundamental mode circuits.
Hardware Description Languages: VHDL, Verilog
Register Transfer-Level Design: Controller/datapath partitioning
Built in Test: Principles, structures, signature analysis

Texts/References:

1) Zwolinski M, *Digital Design with VHDL,* Addison Wesley Longman 2000.
2) Rushton A, *VHDL for Logic Synthesis,* John Wiley, 1998.
3) Abramovici M, Breuer M A and Friedman A D, *Digital System Testing and Testable Design,(Revised Printing)* IEEE Press, 1990
4) Wilkins B R, *Testing Digital Circuits,* Chapman and Hall, 1990
5) Wakerly J F, *Digital Design Principles and Practices,* 2nd Edn, Prentice-Hall, 1994
6) De Micheli G, *Synthesis and Optimization of Digital Circuits,* McGraw-Hill, 1994

IT-429 Performance Analysis of Computer Systems

Credits: 4 (3-0-2)

Performance evaluation methods, Evaluation Metrices, Analytical v/s simulation modeling, performance measurement and benchmarking, Workload modeling, random variables, commonly used distributions, Stochastic Processes
Markov chains, Birth and Death Processes, Markov chain models of Computer systems, Steady-state and transient analysis
Queuing models, M/M systems and their steady state analysis, Single server and multi-server queues, open and closed queuing networks
Petri Net based Performance Modeling : Classical Petri Nets, Timed Petri Nets, Discrete Petri Nets, Modeling multiprocessor systems
Discrete event simulation – Simulation languages, random number generation and testing, model verification and validation, analysis of simulation results, confidence intervals, variance reduction techniques, Case studies of analytical and simulation studies of computer systems

Text/References :

1. Raj Jain, The Art of Computer System Performance Analysis, John Wiley
2. K.S.Trivedi, Probability and Statistics with Reliability, Queuing and Computer Science Applications, PHI
3. Law and Kelton, Simulation Modeling and Analysis, Mcgraw Hill
4. Kant, Introduction to Computer System Performance Evaluation, Mcgraw Hill

IT-441 Embedded Systems and Appliances

Credits: 4 (3-0-2)

Embedded Systems: Introduction, hardware/software co-design, issues in deciding where to split the problem., examples of embedded systems, sensors and interfacing techniques.
Real-time OS and concepts: introducing the problem domain an d tools, RTOS services/capabilities (in contrast with traditional OS), Resource Management/scheduling paradigms: static priorities, static schedules, dynamic scheduling, best effort, current best practice in scheduling (eg Rate Monotonic vs. static schedules), Real-world issues: blocking, unpredictability, interrupts, caching, examples of OSs for embedded systems (RT Linux/ VRT), selected case studies.
Programming Languages for Embedded Systems: tools for building embedded systems - with case studies. Esterel is good for control applications / Handel-C is good for casting algorithms into re-configurable hardware, Embedded Software Development Methodology. Embedded microcontrollers architecture. Appliances having embedded software and internet enables services and devices.

Text/References:

1. Programming for embedded systems, Prasad, Wiley.
2. Embedded microprocessor systems: Real World Design, S. Ball.
3. Embedded Systems Design: An Introduction to Processes, Tools and Techniques by Arnold S. Berger

IT-443 Automata Theory

Credits: 4 (3-0-2)

1) Introduction

Introduction to Finite State Machine, Binary counter, parity bit generator, Moore and Mealy FSMs, Equivalence, Isomorphism, Reduction of States, Regular Languages, Regular expressions, The memory required to recognize a language, Distinguishing one string from another, unions, Intersections and Complements, NFA, NFA with – transitions, Criterion for Regularity, Minimal Finite Automata, The pumping lemma, decision, problems, Finite automata, Nondeterminism and Kleen's Theorem, Regular and Non-regular languages.

2) Context-Free Language

Context – Free Grammars, Definition of CFG, example of familiar languages, unions, concatenations and closures of CFLs, Derivation Tree, Ambiguity, unambiguous CFG for algebraic expressions, Simplified forms and normal forms. Push down automata, definition, deterministic PDA, PDA to CFG and Vice Versa, Parsing. Context Free and Non Context Free Languages, Pumping lemma for CFG, Intersection and complements of CFL, Decision Problems involving CFL.

3) Turing Machines

Definition, Turing Machining as Language acceptors, combining TM, computing Partial Function with TM. Recursively Enumerable and Recursive Languages, Multitape TM, Nondeterministic TM, Universal TM, Other Grammars, Unrestricted grammars and TM, Unsolvable problems, Unsolvable Decision Problems, Halting Problem, Rice's Theorem and more unsolvable problems, Post's correspondence Problem, Unsolvable problems involving CFLs, Regular Grammars, context Sensitive grammars, Linear –Bounded Automata, Chomsky Hierarchy.

4) Computability

Primitive Recursive Functions, Primitive Recursive Predicates and some bounded operations, unbounded minimization and recursive functions, Godel Numbering, Non-numeric-functions. Growth rates of functions, Time and space complexity of TM, complexity Classes. P and NP. Polynomial-Time. Reductions and NP-Completeness, Cook's Theorem, other NP-Complete Problems. Computable Functions, Measuring and classifying complexity. Tractable and intractable problems.

Books/Reerences:

1) John C. Martin: Introduction to Languages and the Theory of Computation, MGH.
2) Lewis & Papadimitriou: Elements of the Theory of Computation, PHI.
3) Daniel I.A. Cohen: Introduction to Computer Theory: John Wiley.
4) J.E. Hopcroft and J.D. Ullman: Introduction to Automata Theory Languages and Computation, Narosa.

IT-445 Speech Processing

Credits: 4 (3-0-2)

The speech chain: current capabilities in synthesis and recognition. Acoustic phonetics. Vocal tract physiology: voiced excitation, unvoiced excitation (bursts, frication).
Acoustics of uniform tubes, of two- and three-tube models. Comparison to speech data.
Synthesis: Formant synthesis (series, parallel), Articulatory synthesis, Concatenative Synthesis, Text-to-Speech (normalisation, linguistic units, rules)
Articulatory parameters, shape-to-sound transformation, vocal tract imaging, revising the acoustic model.
Letter-sound relations, phonology; prosody, intelligibility, quality assessment.
Ear physiology. Auditory perception. Speech perception.
Recognition: Template matching. (Training, distance measures, dynamic time warping), Stochastic models. (Hidden Markov models, Baum-Welch and Forward-Backward algorithms).
Large-Vocabulary Recognition. (Phonemic baseforms, language models), Artificial Neural Networks. (Overview, hybrid systems).
Assessing recognition performance; improving recognition performance; knowledge-based approaches, auditory models.

Texts/References

J N Holmes and W. Holmes, *Speech Synthesis and Recognition*, 2nd ed., Taylor and Francis, 2001.

1. B. Gold and N. Morgan, *Speech and Audio Signal Processing,* Wiley and Sons, 2000.
2. D. G. Childers, *Speech Processing and Synthesis Toolboxes,* Wiley and Sons, 2000.
3. J. R. Deller, J. R. Proakis, J. H. L. Hansen, *Discrete-Time Processing of Speech Signals*, Prentice-Hall 1993.
4. P. B. Denes and E. N. Pinson, *The Speech Chain*, W. H. Freeman & Co 1993.
5. S Furui, *Digital Speech Processing, Synthesis and Recognition*, Marcel Dekker Inc 1989.
6. D O'Shaughnessy, *Speech Communications: Human & Machine*, IEEE Press 1999.
7. L R Rabiner and R W Schafer, *Digital Processing of Speech Signals*, Prentice-Hall 1978.
8. K. N. Stevens, *Acoustic Phonetics*, MIT

IT-447 Image Analysis and Classification

Credits: 4 (3-0-2)

Introduction: Image Processing Fourier Transform and Z-Transform, Causality and stability, Toeplitz and Circulant Matrices, orthogonal and unitary Matrices and Kroenker product, Markov Processes, KL Transform, Mean square Estimates and Orthogonal Principles.
Image sampling and quantization, Band Limited Image Sampling Versus Replication, Reconstruction of Image from samples Sampling Theorem, Image Quantization Uniform Optimal Quantizer, Properties of Mean Square Quantizer, Commander Design Visual Quantization
Image Transforms: Two Dimensional Orthogonal and Unitary Transforms and their properties. One Dimensional and Two Dimensional DFT Cosine and Sine Transforms Hadamard, Slant, HARR Transforms and their properties, Wavelet transform, Hough Tranform.
Image Processing: Image smoothing, Sharpening, enhancement, thinning.
Image Analysis: Spatial feature extraction, Edge detection and boundary extraction Boundary, region and moment representations structures, Texture, Image Segmentation.
Image Classification: Bayes classifier, k-NN, neural network classification. Clustering techniques, template matching, image convolution.

Books/References

1. Anil Jain: Digital Image Processing
2. Gonzalez Woods: Image Processing

IT-449 Bioinformatics

Credits: 4 (3-0-2)

What is bio-informatics? Significance. Role of computing in bio-informatics.
Techniques for bio-informatics computing – Application of probabilistic, statistical and machine learning approach to bioinformatics computing,
Modeling – Markov chains,
Review of Data mining and visualization, review of pattern matching techniques, Search engines and their application to bioinformatics.
DNA – structure, DNA matching.
From genes to genomes.
Future scope of bio-informatcis.

1) Bryan Bergerson, *Bioinformatics Computing*, Perason Education.
2) Pierre Baldi, *Bioinformatics: The Machine Learning Approach, Second Edition (Adaptive Computation and Machine Learning)*, MIT Press
3) David W. Mount, *Bioinformatics: Sequence and Genome Analysis*, Cold Spring Harbor Laboratory
4) Warren J. Ewens & Gregory R. Grant, *Statistical Methods in Bioinformatics*, Springer Verlag
5) Andreas D. Baxevanis & B. F. Francis Ouellette, *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*, Wiley Interscience

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IT-420 Distributed Systems

Credits: 4 (3-0-2)

Introduction: What is a distributed systems? Goals. Hardware and software concepts, design issues.
Issues in Coomunication: Client-server and RPC.
Synchronization: Clock synchronization, mutual exclusion, deadlocks.
Load Balancing: Process allocation and algorithms for load balancing. Scheduling.
Fault Tolerance: Issues and solutions.
File Systems: Design and implementation. Case Study.
Shared Memory: Design and implementation. Case Study.

Text/References:

1. Tanenbaum and Steen: *Distributed Systems: Principles and Paradigms*, Pearson Education.
2. Nancy Lynch, *Distributed Algorithmss,* Morgan Kauffman.
3. Coulouris, Dollimore and Kindberg, *Distributed Systems: Concepts and Design*, Addison Wesley.
4. Mullender*: Distributed Systems*, Addison Wesley.
5. Tanenbaum: *Distributed Operating Systems,* Pearson Education.

IT-422 Client-Server Computing

Credits: 4 (3-0-2)

Evolution of PC, Introduction to LANs, PC LANs, and Mainframe Computers, PC connected to mainframes.
Distributed systems and databases. Client-server computing model, client server hardware and software needs, issues in client-server computing – shared access, connectivity and security.
Advantages of client-server computing. Case studies – UNIX, Windows NT.
Client-server applications: Database server networking, Gateway videos – conferencing and multimedia applications.
Client-server architectures: Segmentation, switched FDDI, peer-to-peer architecture.

Text & References:

1. Client-Server Computing, Robert O'Reilly, O'Reilly.

IT-424 Soft Computing

Credits: 4 (3-0-2)

Introduction: Background, uncertainty and impression, Statistics and Random Processes, Uncertainty in Information, Fuzzy sets and Membership, Chance versus Ambiguity, Classical Sets – Operations, Properties, mapping to classical sets to functions; Fuzzy Sets – Operations and Properties; Sets as points in Hypercubes.

Relations and Functions: Cartesian Product, Crisp relations – cardinality operations, properties, composition, Fuzzy Relations – Cardinality operations, properties, Fuzzy Cartesian Product and Composition, Noninteractive Fuzzy Sets, Tolerance and Equivalence Relations, Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations, Value Assignments, Cosine amplitude, Max-Min method, other similarity methods, Membership Functions – Features, Standard forms and biyearlies, Fuzzyfication, Membership value assignments, Intuitions, Inference, Rank Ordering, Angular Fuzzy sets, Neural Networks, Genetic Algorithm, Inductive Reasoning. Lambda-Cuts for Fuzzy Sets, Lambda-cuts for fuzzy relations, Defuzzification Methods.

Arithmetic and Logic: Extension Principle, Crisp functions, Mapping and Relations, Functions of Fuzzy Sets, Fuzzy Transform Practical Considerations, Fuzzy Numbers, Interval Analysis in Arithmetic, Approximate Methods of extension, Vertex Method, DSW Algorithm, Restricted DSW Algorithms, Comparisons, Fuzzy Vectors, Classical predicate logic, Tautologies, Contradictions, Equivalence, Exclusive Oral Exclusive Logical proofs, Deductive Proofs, Deductive Inferences, Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence and Logical Proofs, other forms of the implication operation, other forms of the composition operation.

Books/References

1) Timothy J Ross, Fuzzy Logic with Engineering Applications, MGH.
2) Klir and Yuan, Fuzzy Sets & Fuzzy Logic-Theory and Applications, PHI.
3) Klir & Folger, Fuzzy Sets, Uncertainty and Information, PHI.

IT-426 Software Testing and Verification

Credits: 4 (3-0-2)

Basic software testing principles - Software Quality, Software testing and test management.
Acceptance Testing: User acceptance testing, alpha and beta testing. Verification And Validation
Functional and Non-functional system testing
Static and dynamic testing, Black-box or functional testing, structural, white box or glass box testing.
Integration testing, component testing.
Software testing tools.

Books/References:
Recent papers from conferences and journals

IT-428 Data Engineering

Credits: 4 (3-0-2)

Overview of Relational DBMS and SQL.

Real-time Database: Implementation and issues. Concurrency control and locking. Recovery. Transaction management.

Distributed DBMS: Distribution Design Issues, Fragmentation and Allocation, Data Security, Architecture Models for Distributed Data Base System, Client - Server Systems, Peer-to-Peer Distributed Systems, Query Processing, Distributed Transactions, Concurrency Control, Reliability,

Advances: Introduction to Object-Oriented Databases, Spatial databases, Temporal databases, Databases in multimedia.

Text/References

1) Elmasri R and Navathe SB, *Fundamentals of Database Systems,* 3rd Edition, Addison Wesley,2000. This book covers most of the material on the course.
2) Connolly T, Begg C and Strachan A, *Database Systems,* 2nd Edition, Addison Wesley, 1999
3) Ceri Pelagatti *, Distributed Database: Principles and System* - (McGraw Hill)
4) Simon AR, *Strategic Database Technology: Management for the Year 2000*, Morgan Kaufmann, 1995
5) Gray J and Reuter A, *Transaction Processing: Concepts and Techniques*, Morgan Kaufmann, 1993
6) M. Tamer Ozsu, Patrick Valduriez, *Principles of Distributed Database Systems* - (Pearson Education)
7) David Bill, Jane Grimson *Distributed Data Base Systems* - (Addison - Wesely)
8) Date CJ, *An Introduction to Database Systems*, 7th Edition, Addison Wesley, 1999
9) Khashafian S and Baker AB, *Multimedia and Imaging Databases*, Morgan Kaufmann,1996
10) McFadden FR, Hofer JA and Prescott MB, *Modern Database Management* 5th Edition, Addison-Wesley 1999

IT-440 Computer Vision

Credits: 4 (3-0-2)

Feature Extraction and description: parametric and non-parametric feature extraction including advance Hough transform techniques and active contour models.
Image Interpretation: Syntactic and symbolic image interpretation and analysis.
Image Restoration: Weiner filter. Least mean squares and extensions and maximum entropy restoration.
3D Imaging: Calibration, epipolar constraint, coordinate systems. Active and passive ranging systems.
Morphology: Binary image processing and image geometry.

Texts/References:

1) Nixon, M S and Aguado, A S, *Feature Extraction and Image Processing* Butterworth Heinmann (Newnes), 2002, Book website http://www.ecs.soton.ac.uk/~msn/book
2) Sonka, M, Hlavac, V, and Boyle R., *Image Processing, Analysis and Machine Vision* (2nd Ed., Thompson, 1999)
3) Jain, R., Kasturi, R., and Schunck, B. G. *Machine Vision* (McGraw Hill, 1996)
4) D.H. Ballard and C.M. Brown, *Computer Vision*, Prentice Hall, 1982.
5) S.E. Umbaugh, Computer vision and Image Processing: A Practical Approach using CVIP tools, Prentice Hall PTR, 1998.
6) Blake, A., and Isard, M.m *Active Contours* (Springer, 1998)
7) Rabiner L R and Gold B, *Theory and Application of Digital Signal Processing* (Prentice Hall, 1975)
8) Jain A K, *Fundamentals of Digital Image Processing,* (Prentice Hall, 1989)
9) Teuber J, *Digital Image Processing* (Prentice Hall, 1992)

IT-442 High Level Synthesis

Credits: 4 (3-0-2)

Various abstraction levels of synthesis, Need of high level synthesis,
Overview of hardware description languages and
High level synthesis of digital systems: Advantages, Data Structures used, algorithms, DFG and CDFG.
Transformations in high-level synthesis, Transform based design space exploration.
Design Optimisation: Design space, constraints on optimization, heuristics, simulated annealing.
Scheduling – constrained, unconstrained, allocation and module binding. Trade-off in high level synthesis. Cost-function based optimization techniques.
BIST: Role and significance in high level synthesis.

Texts/References

1) Andrew Rushton, *VHDL for logic synthesis,* Wiley, ISBN 0-471-98352-X
2) Mark Zwolinski, *Digital system design with VHDL,* Prentice-Hall, ISBN 0-201-360362
3) Giovanni De Micheli, *Synthesis and optimisation of digital circuits,* McGraw Hill, ISBN 0-07016333-2
4) Sabih Gerez, *Algorithms for VLSI design automation,* , Wiley, ISBN 0-471-98489-2
5) John P Elliott, *Understanding behvioural synthesis,* , Kluwer, ISBN 0-7923-8542-X

IT-440 Web based Application Development

Credits: 4 (3-0-2)

Intoroduction to Internet and Intranet, The Server/Client Architecture of the World Wide Web, HTML, DHTML.
Forms: HTML tags and production of HTML forms, Types of data that can be accepted by web forms, Getting the data back - canned solutions and transition to CGI.
CGI: Introduction to CGI, CGI processing using csh, Perl – an introduction, Decoding a form step-by-step using Perl and CGI.
Database design using mySQL
Java Scripting, Overview of Javascript and Dynamic HTML, Javascript as a language, Javascript in action - check the fields of a form for blanks.
PHP Programming
Active Server Pages
Web Information System : porting database applications to web, uploading, document management and web technologies, security issues
Interactive web based application design

Text/References :

1. John Desborough, Intranet Web Development, New Riders
2. Patrik Naughton, The Complete Reference Java, Tata Mcgraw Hill
3. Communications of the ACM, July 1998-Volume 41, Number 7
4. Stephen R. Schach, Software Engineering with Java, Tata Mcgraw Hill

IT-446 Critical System design

Credits: 4 (3-0-2)

Introduction to time critical systems, Applications, Design Issues, Characterization and classification of time-critical systems and tasks, release time, deadlines & timing constraints, reference model, priority assignment & scheduling, clock driven approach, weighted round robin approach, priority driven approaches, resources & resource access control, assumption on resources & their uses, protocols. Scheduling flexible computations and tasks with temporal distance constraints. Introduction to clock synchronization.
Case studies.

Text & References:

1. J.W.S.Liu: Real-Time Systems, Pearson Education Asia
2. P.A.Laplante: Real-time Systems Design and Analysis, An Engineer's Handbook, IEEE Press
3. S.T.Lavi, A.K.Agrawala: Real-time system Design, McGraw Hill
4. P.D.Laurence, K.Mauch: Real-time Microcomputer system design, An introduction, McGraw Hill

IT-448 Parallel Computing

Credits: 4 (3-0-2)

1. Introduction

Parallel processing terminology, Pipelining Vs Data parallelism, Control parallelism, Scalability, Control parallel approach, Data parallel approach, Data parallel approach with I/O

2. PRAM Algorithm

Parallel reduction ,Prefix sums, List ranking, Preorder tree traversal, Merging two sorted lists, Graph coloring, Reducing the number of processors, Problems defying fast solutions on PRAMS

3. Parallel Programming Languages

Programming parallel processes, Example and application, C* programmers model, Language features, Sample program, OCCAM, programmer's model, Language constructs, Sample program, C-LINDA, Programmers model, Language constructs, Sample program

4. Mapping and Scheduling

Mapping data to processors on processor arrays and multicomputers, Dynamic Load Balancing on multicomputers, Static scheduling on UMA multiprocessors, Deadlock.

5. Elementary Parallel Algorithms

Classifying MIMD algorithms, Reduction, Hypercube SIMD model, Shuffle-Exchange SIMD model, 2-D Mesh SIMD model, UMA Multiprocessor model, Broadcast, Prefix sums

6. Matrix Multiplication

Sequential matrix multiplication, Algorithms for processor array, Algorithms for multiprocessors, Algorithms for multicomputers

7. Sorting

Enumeration sort, lower bound on parallel sorting, Odd-even transposition sort. Bitonic merge, Quick sort based algorithms, Random read and random write.

Books/References

1. Michael Quinn: Parallel Computing-Theory and Practice, MGH.
2. Ed. Afonso Ferreira and Jose' D. P. Rolin, Parallel Algorithms for irregular problems - State of the art, Kluwer Academic Publishers.
3. Selim G. Akl, The Design and Analysis of Parallel Algorithms, PH International.
4. Brassard and Bratley, Fundamentals of Algorithms, PHI, New Delhi