

## INFORMATION TECHNOLOGY

### 3<sup>rd</sup> Semester

Sl. No	Course Name	Course code	Class Load/Week			Credit	Class load/week
			L	T	P		
1.	Mathematics – III	MA301	3	1	0	4	4
3.	Programming & Data Structure	IT 301	4	0	0	4	4
4.	Digital Logic & Circuit Design	IT 302	4	0	0	4	4
2.	Discrete Mathematics & Graph theory	IT 303	3	1	0	4	4
5.	Signals, System & Circuits	IT304	3	1	0	4	4
	Theory Sub-total		17	3	NIL	20	20
6.	Programming & Data structure lab	IT 351	0	0	3	2	3
7.	Digital Logic & Circuit Design Lab	IT 352	0	0	3	2	3
	Sessional Sub-total		NIL	NIL	6	4	6
	<b>3<sup>rd</sup> Semester Total</b>					<b>24</b>	<b>26</b>

### 4<sup>th</sup> Semester

Sl. No	Course Name	Course code	Class Load/Week			Credit	Class load/Week
			L	T	P		
1.	Intro. to Mgmt. & Industrial Sociology	HU3401	4	0	0	4	4
2.	Computer Organisation & Architecture	IT401	3	1	0	3	3
3.	Communication Systems	IT402	3	0	0	3	3
4.	Computer Graphics	IT403	3	0	0	3	3
5.	Formal Language and Automata	IT404	3	0	0	3	3
	Theory Sub-total		15	4	NIL	16	16
6.	Computer Graphics Lab.	IT453	0	0	3	2	3
7.	Computer Org. & Architecture Lab.	IT451	0	0	3	2	3
8.	Communication system lab	IT 452	0	0	3	2	3
9.	Modelling and Simulation Lab.	IT455	0	0	3	2	3
	Sessional Sub-total		NIL	NIL	12	8	12
	<b>4<sup>th</sup> Semester Total</b>					<b>24</b>	<b>28</b>

## 5th Semester IT

Sl. No	Course Name	Course code	Class Load/Week			Credit	Class load/week
			L	T	P		
1.	Microprocessor	IT501	3	0	0	3	3
3.	Operating System	IT 502	3	1	0	4	4
4.	Database Management System	IT 503	3	1	0	4	4
2.	Departmental Elective - I	IT 521/X	3	0	0	3	3
5.	Open Elective	IT531/X	3	0	0	3	3
	Theory Sub-total		15	3	NIL	17	17
6.	Microprocessor lab	IT 551	0	0	3	2	3
7.	Operating System Lab	IT 552	0	0	3	2	3
8.	Database Management System lab	IT553	0	0	3	2	3
9.	Mini Project I	IT 571	0	0	2	2	2
	Sessional Sub-total		NIL	NIL	11	8	11
	<b>5<sup>th</sup> Semester Total</b>					<b>25</b>	<b>28</b>

### Open Elective:

Multimedia Systems

### Elective I:

1. Object oriented programming
2. Telecommunication & Traffic Engg.

## 6<sup>th</sup>Semester IT

Sl. No	Course Name	Course code	Class Load/Week			Credit	Class load/Week
			L	T	P		
1.	Intro. to Mgmt. & Industrial Sociology	HU3401	4	0	0	4	4
2.	Design & Analysis of Algorithm	IT601	3	1	0	4	4
3.	Compiler Design	IT602	3	1	0	4	4
4.	Computer Networks	IT603	3	0	0	3	3
5.	Departmental Elective -II	IT 621/X	3	1	0	4	4
	Theory Sub-total		16	3	NIL	19	19
6.	Design & Analysis of Algorithm Lab.	IT651	0	0	3	2	2
7.	Compiler Design Lab.	IT652	0	0	3	2	2
8.	Computer Networks Lab.	IT653	0	0	3	2	2
9.	Grand viva	IT 691				2	
	Sessional Sub-total		NIL	NIL	9	8	6
	<b>6th Semester Total</b>					<b>27</b>	<b>25</b>

### Elective II:

1. System Programming
2. Advance computer architecture
3. Mobile Communication
4. Distributed database

## 7<sup>th</sup> Semester

Sl. No	Course Name	Course code	Class Load/Week			Credit	Class load/week
			L	T	P		
1.	Software Engineering	IT701	3	1	0	4	4
2.	Internet & Web Technology	IT 702	4	0	0	4	4
3.	Open Elective II	IT 731/X	3	0	0	3	3
4.	Departmental Elective III	IT 721/X	3	0	0	3	3
	Theory Sub-total		13	1	NIL	14	14
6.	S/W Engineering LAB	IT 751	0	0	3	2	3
7.	Internet & WEB Technology Lab.	IT 752	0	0	3	2	3
8.	Project I				3	2	3
	Sessional Sub-total		NIL	NIL	9	6	9
	<b>7<sup>th</sup> Semester Total</b>					<b>20</b>	<b>23</b>

Open Elective II:

1. DSP
2. Computational Geometry

Elective III:

- a) Graph algorithms
- b) Information and Coding Theory
- c) Distributed and Parallel Systems
- d) Data mining and data warehousing

## 8<sup>th</sup> Semester

Sl. No	Course Name	Course code	Class Load/Week			Credit	Class load/Week
			L	T	P		
1.	Accountancy &F.Mgmt.	HU7801	3	0	0	3	3
2.	Information & Systems Security	IT801	3	1	0	3	4
3.	Artificial Intelligence	IT802	3	0	0	3	3
4.	Image Proc. & Pattern Recognition	IT803	3	0	0	3	3
	Theory Sub-total		12	1	NIL	12	13
6.	Information & Systems Security LAB	IT851	0	0	3	2	3
7.	Image Proc. & Pattern Recognition Lab	IT853	0	0	3	2	3
8.	Project II	IT871	0	0	6	3	6
8.	Grand Viva	IT872	0	0	0	2	0
	Sessional Sub-total		NIL	NIL	12	9	12
	<b>8<sup>th</sup> Semester Total</b>					<b>24</b>	<b>25</b>

# Detailed Syllabus

## 3<sup>rd</sup> Semester

### MATHEMATICS-III (MA 301)

Weekly contact: 4- 0 - 0 (L-T-S)

Full Marks: 100(Credit-4)

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Probability</b> : Intuitive Notion, Classical definition of probability, Combinatorial applications, Axiomatic approach to probability theory, Univariate probability distributions – discrete and continuous. Standard distributions: Binomial, Poisson, Geometric, Hypergeometric, Exponential, Normal, Uniform and Gamma. Bivariate distributions : concepts of joint and conditional distributions, Mathematical expectation, variance and covariance, Correlation coefficient, Tchebycheff's inequality. Concept of convergence in probability. Laws of Large Numbers (Statement only). Sample Distributions : $\chi^2$ , t and F	14
2.	<b>Statistics</b> : Concept of Statistics, Elements of the theory of Point Estimation: Unbiasedness and Mean Squared Error-Bias-variance decomposition. Minimum Variance Unbiased Estimators. Maximum Likelihood Estimation. Consistent Estimators. Interval Estimation: Confidence interval for mean of a normal population. Correlation and Regression. Simple linear regression model.	9
3.	<b>Laplace Transform:</b> Definition, Laplace transform of elementary functions, basic operational properties, Inverse Laplace transform, Convolution Theorem, Applications to initial value problems involving Ordinary Differential Equations.	6
4.	<b>Linear Programming Problem</b> : Basic solution, reduction of basic solution to basic feasible solution, convex combination, convex set, extreme points, hyperplanes, slack and surplus variables, Simplex Method, Charnes' Big-M method , Two Phase method.	10
	<b>Total</b>	39

# PROGRAMMING & DATA STRUCTURES ( IT 301)

Weekly contact: 3 – 1 – 0 (L – T – S)

Full Marks: 100

Prerequisite: Concepts of C Language

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Introduction:</b> Functions; arrays; introduction to pointers; structures; dynamic allocation; linked structures; time and space requirements.	6
2.	<b>Stack:</b> Introduction, Array Implementation Multiple Stacks, Applications and use of Stacks: Conversion from Infix to Postfix, Evaluation of Postfix Expressions, Prefix Notation, etc.	6
3.	<b>Queue:</b> Introduction, Linear Queue, Circular Queue, De-queue, Priority Queue, Array Implementations of Queues, Applications of Queues, General Lists.	4
4.	<b>Linked Lists:</b> Introduction, pointer and Implementation, Linear Linked Lists, Circular Linked Lists, Doubly Linked Lists, Doubly circular, Implementation of Linked Lists, Linked Stacks and Queues, Application of Linked List: Polynomials, High precision Arithmetic, Josephus Problem, etc.	8
5.	<b>Recursion:</b> Recursion Algorithm, Type of Different Recursion Algorithms, Removal of Recursion.	2
6.	<b>Binary Trees:</b> Tree Terminology, Binary Tree, Binary Tree Representation, Binary Tree Traversals, Threaded Binary Tree, Binary Search Tree Concepts and Implementation. AVL Tree.	10
7	<b>Search Methods:</b> Linear search, Binary search, Complexities of the searching algorithms.	4
8	<b>Sorting:</b> Introduction to sorting and Comparison of Sorting Techniques.	4
	<b>Total:</b>	<b>44</b>

## References:

1. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
2. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
3. Goodrich, Michael T. & Roberto Tamassia, Algorithm Design, Wiley Singapore.
4. Cormen, Thomas H., Leiserson, Charles E., Rivest, Ronald L., & Stein, Clifford. Introduction to Algorithms.

## DIGITAL LOGIC AND CIRCUIT DESIGN (IT 302)

Weekly contact: 3 – 1 – 0 (L – T – S)

Prerequisite: None

Full Marks: 100

Sl. No.	Module Name and Topics	No. of Classes
1.	Number systems and Codes: Number representation and Computer arithmetic (fixed and floating point), Codes	1
2.	Boolean Algebra and Minimization Techniques: Boolean Logic operations, Basic laws, De Morgan's theorems, SOP/POS, K-map, Quine-McCluskey or Tabular method of minimization	3
3.	Logic Gates: Logic Gates (OR, AND, NOT, NAND, NOR, Universal building blocks, XOR, XNOR), Mixed Logic, Multilevel Gating networks, Multilevel output gate networks	2
4.	Logic Families: Digital Integrated Circuits, Introduction to logic families, CMOS logic	2
5.	Combinational Circuits: Multiplexers, Demultiplexers, Decoders, Application to Liquid Crystal Display (LCD), Encoders, Parity Generator/Checker, Code converters, Magnitude comparators, Applications	6
6.	Arithmetic Circuits: Half adder, Full adder, Half subtractor, Full subtractor, Parallel binary adder, Controlled Inverter, 4-bit parallel adder/subtractor, Fast adder, Serial adder, Serial subtractor using 2's complement, 4-bit serial adder/subtractor, BCD adder, Binary multiplier, Binary divider	6
7.	Flip-Flops: Latches, Flip-Flops (Clocked SR, JK, D, T), Triggerring of Flip-flops, Asynchronous inputs in flip-flops, Master-slave flip-flops, Realization of one flip-flop using other, Flip-flop ICs, Applications	6
8.	Counters: Asynchronous (Ripple or Serial) counters: Ripple counter with decoded outputs, Ripple counter with modulus, Counter ICs, Asynchronous UP/DOWN counter, Propagation delay in ripple counters, Synchronous (Parallel) counter: Synchronous counter with ripple carry, Synchronous UP/DOWN counter, Applications	3
9.	Registers: Universal shift registers, Shift register counters, Sequence generator	2
10.	Memory devices: Classification, Basic memory structure, ROM, RAM, Memory decoding, Memory expansion, PLD	3
11.	D/A and A/D converters: Analog and digital data conversions, Specifications of D/A converter, Basic D/A conversion techniques (weighted resistor, R-2R ladder type etc.), MDAC, Sampling process, A/D converters, Different A/D converters (Successive approximation, Single slope, Dual slope)	4
12.	Applications of Digital Circuits: Frequency counter, Dot matrix display system, Digital multimeter etc.	2
	<b>Total:</b>	<b>40</b>

**References:**

Logic and Computer Design Fundamentals: by Mano, Kime: Pearson  
 Modern Digital Electronics: by Jain: TMH  
 Digital Design: by Mano  
 Digital Fundamentals: by Floyd, Jain: Pearson  
 Digital Circuits and Design: by Salivahanan, Arivazhagan: Vikas  
 Digital Principles and applications (5<sup>th</sup> Edition) : Leach & Malvino  
 Digital Computer Electronics : Malvino

**DISCRETE MATHEMATICS AND GRAPH THEORY (IT 303)****Weekly contact: 3 – 1 – 0 (L – T – S )****Full Marks: 100****Prerequisite: Preliminary concepts of Sets**

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Logic and Proofs:</b> Propositions, Conditional propositions and Logical Equivalence, Predicate calculus, quantifiers, Normalization of well-formed-formulas, Method of proofs, mathematical induction.	8
2.	<b>Language of Mathematics:</b> Sets, sequences and strings, Number systems, Relations, Equivalence relations, Matrices of relations, partial order sets, well order sets, quasi order sets, lattice. Application to relational Databases, Functions, Inverse and composition of functions, one-to-one correspondence.	6
3.	<b>Algebraic structures:</b> Algebraic structures with one binary operation - semigroups, monoids and groups. Free and cyclic monoids and groups, permutation groups, normal subgroups. Algebraic structures with two binary operations - rings, integral domains and fields. Boolean algebra and Boolean ring.	8
4.	<b>Counting methods:</b> Basic principles of counting (Inclusion- exclusion, addition and multiplication rules), permutations and combinations, algorithms for generating permutations and combinations, binomial coefficients and combinatorial identities, The pigeonhole principle. Introduction to Polya's theory of counting.	8
5.	<b>Recurrence relations:</b> Introduction, recursively defined sequences, solving recurrence relations: the characteristic polynomial and generating functions. Applications to analysis of algorithms.	6
6.	<b>Graph theory:</b> Introduction to graphs and their basic properties: degree, paths and cycles, subgraphs, isomorphism, Euler and Hamiltonian paths and cycles, representation of graphs, connected graphs, planar graphs. Basic graph searching algorithms: BFS and DFS. Basics of tree and spanning tree.	8
7	<b>Coloring of Graph:</b> graph coloring basics, chromatic number, 4-color problem.	4
<b>Total:</b>		<b>48</b>

**References:**

1. Discrete Mathematics and its Applications by Kenneth H Rosen, PHI
2. Discrete MATHEMATICS FOR Computer Scientists, J L Mott, A Kandel, and T P Baker
3. Concrete Mathematics: A Foundation for Computer Science, by Ronald Graham, Donald Knuth, and Oren Patashnik
4. Graph Theory With Applications To Engineering And Computer Science, NarsinghDeo, Tata McGraw Hill
5. Graph Theory, F Harary, Narosa



## IT-303: SIGNALS, SYSTEMS AND CIRCUITS

Weekly contact: 3 – 1 – 0 (L – T – S) Prerequisite: Vector space, probability and statistics Full Marks: 100

Objective:

To be familiar with the Time and Frequency domain analysis of continuous and discrete signals.

To study the behavior of Linear Time Invariant System. Laplace transforms, properties and Transient Analysis of the System.

To be familiar with sampling, digitization and reconstruction of Analog Signals

To be familiar with Random signals, properties, auto and cross-correlation, power spectral density

Sl. No.	Module Name and Topics	No. of Classes
1.	Introduction to signals: classification and representation, concepts of linear vector space and orthogonal signal representation.	4
2.	Fourier series, Fourier transform and its properties	6
3.	Parseval's theorem, Bandwidth of signals, duality of time and frequency representations of signals.	2
4.	Discrete time signal: sampling, digitization and reconstruction of analog signals.	6
5.	Introduction to random signals and their properties: random variables and processes for characterization and analysis of message signal and noise	6
6.	Random process, classification of random processes, geometric representation of random process, Gaussian random process, auto and cross-correlation, power spectral density.	10
7	Introduction to system and classification, discrete time system, signal distortion in transmission, distortionless conditions. linear time invariant (LTI) system, impulse response, convolution, transfer function, Bandwidth of systems. System response to random signals.	8
8	System realization as simple electrical circuit: Laplace transform and its properties, inverse Laplace transform, application of Laplace transform for analysis of RC, RL and RLC circuits, transient and steady state response.	6
<b>Total</b>		<b>48</b>

### References:

- 1) Modern Analog and Digital Communication Systems, 4<sup>th</sup> Edition-B. P. Lathi & Z. Ding, Oxford University Press
- 2) S. Haykin, Communication Systems- John Wiley
- 3) Linear Systems and Signals, B. P. Lathi, Oxford
- 4) Probability and Random Processes with Applications to Signal Processing- H. Stark, J. W. Woods, Pearson Education Asia
- 5) A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
- 6) S. Haykin & B.V.Veen, Signals and Systems- John Wiley

## PROGRAMMING & DATA STRUCTURE LABORATORY (IT351)

Weekly contact: 0 – 0 –3 (L – T – S)

Full Marks: 100

Prerequisite: Concepts of C Language

Module Number	Topics	No. of Classes
	Program related to	
1.	pointer, array, structure and union	6
2.	Stack and Queue	6
3.	Linked Lists	6
4.	Recursion and Binary Tree	12
5.	Search Methods	6
6.	Sorting	6
	Total:	42

### References:

1. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
2. Ellis Horowitz, SatrajSahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
3. Goodrich, Michael T. & Roberto Tamassia, Algorithm Design, Wiley Singapore.
4. Cormen, Thomash H., Leiserson, Charles E., Rivest, Ronald L., & Stein, Clifford. Introduction to Algorithms.

**Detailed Syllabus**  
**4<sup>th</sup> Semester**

# COMPUTER ORGANIZATION AND ARCHITECTURE (IT 401)

Weekly contact: 3 – 1 – 0 (L – T – S)

Full Marks: 100

Prerequisite: (Digital Logic and Circuit Design(IT 302))

Sl. No.	Module Name and Topics	No. Of Classes
1.	<b>Computer function and Interconnection:</b> Computer Components, Computer function, Interconnection structures, Bus interconnection, PCI	2
2.	<b>Central Processing Unit:</b>  <b>Computer Arithmetic:</b> ALU, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic.	2
3.	<b>Instruction Sets:</b> Machine instruction characteristics, types of operands, Types of operations, Assembly language, Addressing, Instruction formats.	4
4.	<b>Processor Design and Datapath:</b> Processor role, processor design goals, processor design process, datapath organization, main memory interface, local storage/register file, datapath for simple instructions, floating point unit datapath, advanced processors and datapaths.	6
5.	<b>Processor design and control unit:</b> Role of control unit, reset sequence, interrupt recognition and servicing, abnormal situation handling, instruction cycle and decisions involved, hardwired control unit, microprogrammed control unit.	6
6.	<b>Memory:</b> Overview of computer memory system, memory parameters, classification of memory, main memory allocation, static RAM IC, Dynamic RAM, ROM logic, multiple memory decoding.	4
7.	<b>Cache:</b> Cache memory principles, elements of cache design, Cache organization.	2
8.	<b>Internal memory:</b> Semiconductor main memory, error correction, advanced DRAM organization.	2
9.	<b>External memory:</b> Magnetic disk, RAID, optical memory, magnetic tape.	2
10.	<b>Input/Output:</b> External devices, I/O modules, Programmed I/O, Interrupt driven I/O, DMA, I/O channels and processors, External interface: Firewire, Infiniband, and USB.	4
11.	<b>Concurrency in Pipelining and Vector processing:</b> Performance enhancement strategies, classification of parallelism, multiple functional units, pipelining, vector computing, array processor.	6
	<b>Total:</b>	<b>40</b>

## Suggested Reading:

1. Computer Architecture and Organization Design Principles and Applications: B. Govindarajalu: TMH
2. Computer Organization and Architecture Designing for Performance: William Stallings: Pearson
3. Computer Architecture A Quantitative Approach: John L. Hennessy and David A. Patterson: ELSEVIER
4. Computer Systems Architecture A Networking Approach: Rob Williams: 2<sup>nd</sup> Ed: PEARSON
5. Computer Organization and Design The Hardware Software Interface ARM Edition: David A. Patterson and John L. Hennessy: MK

## COMMUNICATION SYSTEMS (IT 402)

Weekly contact: 3-1-0

Full marks: 100

Sl no.	Topic	Class hours
1	Introduction to communication systems	2
2	Basedand and carrier signal representation, concepts, PSD, Sampling theorem	4
3	Analog modulation and demodulation techniques, AM, FM, PM, their comparisons	4
4	SNR vs. Bandwidth. Preemphasis, deemphasis.	2
5	Waveform coding, PCM, DPCM, Delta modulation, Performance studies	6
6	Base band shaping for data transmission, line coding, Calculation of power spectral density	4
7	Nyquist criterion for zero ISI and eye pattern, Equalizer, repeaters	6
8	Digital modulation techniques, coherent and non-coherent detection. ASK, FSK, PSK. MPSK, BER performance study. M-ary signal representation, PSD and bit error rate calculation.	8
9	Introduction to spread spectrum communication, jamming effect, DSSS, FHSS, THSS, process gain, demodulation techniques	4

### References:

1. Modern Digital and Analog Communication System; B.P. Lathi
2. Principles of Communication Systems; Taub. Schilling
3. Communication Systems; A.B. Carlson
4. Digital and Analog communication Systems; K. Sam Sanmugam
5. Communication Systems, Simon Haykin

## COMPUTER GRAPHICS(IT-403)

Section Number with name	Topics with Lecture Number	No. of Classes
<b>Section 1 Introduction to Computer Graphics:</b>	<b>Lecture 1:</b> Overview of Computer Graphics Computer Graphics Applications and Software	1
	Lecture 2: Basic graphics I/O devices, overview of Raster and vector graphics display working principle of CRT based display device,	2
	Lecture 3: LCD display device. Introduction to frame buffer, Colour Look Up Table etc..	2
<b>Section 2 Scan conversion – lines, circles and Ellipses; Filling polygons and clipping algorithms</b>	Lecture 4: Scan Converting Lines: DDA, Bresenham, Mid-point algorithms and Problems of Aliasing Scan Converting Circles and Ellipse	5
	Filling Polygons: Lecture 5: Flood fill, boundary fill, scan line fill,	2
	Lecture 6: Line clipping algorithms: Cyrus-Beck, Cohen-Sutherland Liang-Barsky	3
	Lecture 7: Polygon Clipping algorithms: Sutherland Hodgman and WeilerArtherton algorithm	2
<b>Section 3 Graphics Programming using OPENGL:</b>	<b>Lecture 8</b> Why OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL – GL, GLU & GLUT 3D viewing pipeline, viewing matrix specifications Few examples and demos of OpenGL programs	4
<b>Section 4 Two-Dimensional Transformations:</b>	<b>Lecture 9:</b> Transformations and Matrices Transformation Conventions Basic 2D Transformations	2
	Lecture 10: Homogeneous Coordinates and Matrix Representation of 2D Transformations	1

	Lecture 11: Combined Transformations,	2
	Lecture 12: Window-to-Viewport Transformations.	2
<b>Section 5 Three-Dimensional Transformations and Projections:</b>	<b>Lecture 13:</b> Introduction, Basic transformation matrices in Three-Dimensional Space	2
	Lecture 14: Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane	2
	Lecture 15: Projections: Orthogonal, axonometric, and oblique.	3
<b>Section 6 Visible-Surface Determination:</b>	<b>Lecture 16:</b> Techniques for efficient Visible-Surface Algorithms, Categories of algorithms	1
	Lecture 17: Back face removal, The z-Buffer Algorithm, Scan-line method,	2
	Lecture 18: Painter's algorithms (depth sorting), Area sub-division methods:BSP trees, Visible-Surface Ray Tracing.	2
<b>Section 7 Plane Curves and Surfaces:</b>	<b>Lecture 19:</b> Curve Representation, Representation of Space Curves:Cubic Splines, Bezier Curves, B-spline Curves.	3

#### References:

1. Computer Graphics Principles & Practice by James D. Foley, Andries van Dam, Steven K. Feiner and John F. Hughes, 2<sup>nd</sup> Edition in C.
2. Computer Graphics with OpenGL (3/e), D. D. Hearn and M. P. Baker
3. Mathematical Elements for Computer Graphics by Rogers and Adams, McGraw Hill.
4. Computer Graphics (First Indian Edition), Peter Shirley and Steve Marschner, Cengage Learning Reprint of A. K. Peters
5. Computer Graphics Using OpenGL. F.S. Hill and S. M. Kelley, Pearson Education, 2009.
6. Interactive Computer Graphics: A Top-Down Approach with OpenGL. Edward Angel, Addison-Wesley
7. OpenGL Programming Guide. Jackie Neider et al., Addison-Wesley
8. OpenGL Reference Manual. Addison-Wesley

## Formal language and Automata Theory: IT 404

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Language and Grammar:</b> definition, Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages	4
2.	<b>Finite State Machines:</b> Definition, concept of sequential circuits, state table and state assignments, capability and limitations of FSM, state equivalence & minimization.	6
3.	<b>Finite automata:</b> Definition, Characteristics, Transitional system, deterministic finite automata (DFA), Nondeterministic finite automata (NFA) , equivalence of DFA and NFA, Dead state, Finite Automata with output, Mealy machine and Moore machine, Conversion of one machine to another, Minimization of finite automata. Mihill-Nerode theorem, Two way finite automata, Application and limitation.	8
3.	<b>Regular Expression:</b> regular sets and regular expressions, regular grammars and equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, $\epsilon$ -closure and conversion of NFA with $\epsilon$ move to equivalent DFA, pumping lemma for Regular expression, closure properties of regular expression, Application of RE.	8
4.	<b>Context-free languages and pushdown automata:</b> Left and right linear grammars. Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, parse trees, ambiguity in CFG, inherent ambiguity, closure properties of CFL, pumping lemma for CFL, CFG and RE, Application Pushdown Automata(PDA), language recognized by PDA, deterministic PDA, equivalence of PDA and CFL.	12
6.	<b>Context-sensitive languages:</b> Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	2
7	<b>Turing machines:</b> The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, concept of undecidability. Variation of Turing machine-Multi tape, multi head, two way infinite tape. Turing machine as an integer function.	8
	<b>Total:</b>	<b>48</b>



**References:**

1. “Introduction to Automata Theory, Languages & Computation”, Hopcroft JE. and Ullman JD., Narosa.
2. “Elements of the theory of Computation”, Lewis H. R. and Papadimitrou C. H., P.H.I.
3. “Introduction to Languages and Theory of Computation”, Martin, McGraw Hill.
4. J. E. Hopcroft, J. D. Ullman and R. Motwani: Introduction to Automata Theory, Languages and Computation, Addison-Wesley, California, 2001.
5. “An Introduction to Formal Languages and Automata”, Linz Peter, Narosa.
6. “Switching & Finite Automata”, Kohavi ZVI, Tata McGraw Hill.
7. “Theory of Computer Science”, K.L.P. Mishra & N. Chandrasekharan, PHI

**Laboratories****Modelling and Simulation Lab (IT 455)****Prerequisite:**

Basic Mathematics, Programming.

**Detailed Syllabus:**

Module Number	Topics	Class Load
1	Introduction to R, Octave, MATLAB,	3
2	Basic Mathematical Modeling; Vector and Matrix Analysis; Complex Analysis	3
3	Random Number Generation;	3
4	Solving Differential Equations; Simulating probabilistic Events; Bernoulli Trials	3
5	Curve and Surface Fitting; Optimization	3
6	Statistical Tests and Significance Analysis, Linear programming	3
7	Stochastic Models; Markov Models; Monte-Carlo Simulation; Growth Processes; Queuing Models	6
<b>Total</b>		21

**Suggested Books:**

1. Edward A. Bender. An Introduction to Mathematical Modeling. Dover Publications.
2. A. C. Fowler. Mathematical Models in Applied Sciences. Cambridge University Press.
3. Mark M. Meerschaert. Mathematical Modeling. Academic Press.
4. S.M. Ross. Simulation, Academic Press.
5. A. M. Law and W. D. Kelton. Simulation Modeling and Analysis, Tata McGraw-Hill.

### Signal system and communication Lab (IT 452)

Module Number	Topics	Class Load
1	Experiments on various types of signals, time domain, frequency domain analysis	6
2	Continuous and discrete time domain signal analysis	3
3	Experiments on modulation techniques	6
4	Ideas on basic communication systems building blocks	3
5	Experiments based on Communication Systems theory.	3
<b>Total</b>		21

### Computer Graphics Lab (IT 453)

Module Number	Topics	Class Load
1	Study of Graphics Card and related hardware	3
2	Overview of OpenGL	3
3	Programming for generating lines, curves and rendered surfaces;	9
4	Geometric transformations and clipping;	3
5	Modeling of objects	3
6	Computer animation	3
<b>Total</b>		24

## Computer Organization and Architecture lab (IT 451)

Module Number	Topics	Class Load
1	Know your Computer and its Organization, Hands on demonstration of assembling and disassembling of PC.	3
2	Hands on experience with different components of computers of different generations, Basic troubleshooting with everyday usage of computer	3
3	Introduction to VHDL and Xilinx ISE, Tutorial on VHDL as Hardware Description Language, Tutorial with hands on demonstration in Xilinx ISE Design Tool (Programming Language: VHDL), Build your own Computing Units	3
4	Experiments on different combinational design blocks and simulation using VHDL under ISE environment. Experiments on different sequential design blocks and simulation using VHDL under ISE environment.	6
5	Experiments on designing different computing units for processing, memory, and IO interfacing.	3
6	Mini project (Group activity)  A small project related to Computing Unit design and Simulation.	3
7	Verify and Test your design  Verification and test of simulated and synthesized design using FPGA Prototype Boards.	3
<b>Total</b>		21

# Detailed Syllabus

## 5<sup>th</sup> Semester

### Microprocessors (IT 501)

Weekly contact: 3 – 0 – 0 (L – T – S)

Full Marks: 100

Prerequisite(s): Digital Logic & Circuit Design (IT-302), Computer Organization and Architecture (IT-401)

Sl. No.	Module Name and Topics	No. of Classes
1.	Introduction to 8085 CPU :- Pin description and features, architecture-register organization	2
2.	8085 Addressing modes, Instruction set, Instruction cycle, machine cycle, Timing diagram.	4
3.	8085 Assembly Language Programming	6
4.	Hardware Interfacing with memory, peripheral chips (IO mapped IO & Memory mapped IO), Interrupts and DMA.	4
5.	16 bit processors: 8086 architecture, memory organization and Interrupt processing.	6
6.	8086 Addressing modes, instruction set and Assembly Language programming with 8086.	10
8.	Overview of ARM RISC Architecture and its application development.	4
<b>Total:</b>		<b>36</b>

### References

1. Microprocessor Architecture, Programming, and Applications with the 8085: Ramesh Gaonkar (Penram International Publishing (India) Pvt. Ltd)
2. The Intel Microprocessors - Architecture, Programming, and Interfacing- BARRY B. BREY (Pearson – Prentice Hall)
3. Microprocessors & Interfacing: Programming & Hardware, - Douglas V. Hall, (Tata McGraw Hill)
4. Advanced Microprocessors and Peripherals - Ajoy Kumar Ray and K M Bhurchandi (TMH)
5. ARM System On Chip Architecture – Steve Furber (ARM Edition).
6. Microprocessors and Microcontrollers- N Senthil Kumar, M Saravanan, and S Jeevananthan, Oxford University Program

## OPERATING SYSTEMS (IT-502)

Weekly contact: 3 – 1– 0 (L – T – P)

Full Marks: 100

**Prerequisite(s):** Programming and Data Structure (IT-301), Computer Organization and Architecture (IT-401)

Sl. No.	Module Name and Topics	No. of Classes
1.Introduction	Operating System, Overview, Evolution of Operating Systems, Basic architectural concepts, concepts of batch-processing, multiprocessing, multiprogramming, timesharing, real-time operations; interrupt handler	4
2.Concept of a Process	States, operations with examples from UNIX (fork, exec) and/or Windows. Process scheduling, interprocess communication, UNIX signals.	4
3.Threads	Multithreaded model, scheduler activations, examples of threaded programs.	2
4.Scheduling	CPU scheduling— short term, medium term and long term scheduling, non-preemptive and preemptive algorithms;	6
5.Process Synchronization	critical sections, classical two process and n-process solutions, hardware primitives for synchronization, semaphores, monitors, Classical problems in synchronization	8
6.Deadlocks	Modeling, characterization, prevention and avoidance, detection and recovery.	5
7.Memory Management	Partitioning, paging, concepts of virtual memory, demand-paging, page replacement algorithms, working set theory, load control, segmentation, segmentation and demand-paging, Case studies, Windows. Current Hardware support for paging: e.g., Pentium/ MIPS processor etc.	8
8.Device Management	Scheduling algorithms -FCFS, shortest-seeK-time-first, SCAN, C-SCAN, LOOK, C-LOOK algorithms, Device drivers, concept of driver routines.	3
9.Information Management	File concept, file support, directory structures, symbolic file directory, basic file directory, logical file system, physical file system, access methods, file protection, file allocation strategies.	6
10.Case Study	UNIX/Linux, Windows, and Android.	2
Total		46

### References:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, John Wiley,
2. William Stallings, Operating Systems: Internals and Design Principles. Prentice-Hall
3. AS Tanenbaum, Modern Operating Systems, 3rd Ed., Pearson
4. AS Tanenbaum, AS Woodhull, Operating Systems Design and Implementation, Prentice Hall

5. M. J. Bach. Design of the Unix Operating System, Prentice Hall of India
6. Harvey M. Deitel (Author), Paul Deitel (Author), David R. Choffnes (Author), Operating Systems , Pearson

### DATABASE MANAGEMENT SYSTEM (IT-503)

**Weekly contact: 3L+ 1T**

**Full Marks: 100**

**Prerequisite(s):** Programming and Data Structure (IT-301), Discrete Mathematics and Graph Theory (IT-303)

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction Database, Database Management Systems, Database Systems versus File Systems, View of Data, Database Languages, Database Users	4
2	Components of a Database Management System, Data Independence, Network, Relational, Hierarchical, Object Oriented Data Models	4
3	The Entity Relationship Model Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagrams, Extended E-R Features, Relational Model - Structures of Relational Databases, Integrity Constraints, ER to Relational model	6
4	Relational Query Languages Relational Algebra, Relational Calculus, SQL and QBE.	4
5	Relational Database Design Functional Dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.	6
6	Storage Strategies Ordered, Unordered File, Hashing, Indexing, Single-Level, Multi-level Indexes, B tree and B+ tree	4
7	Query Processing Evaluation of Relational Algebra Expressions, Implementation of SELECT, JOIN, PROJECT Operations, Query Optimization Algorithms.	4
8	Transaction Processing Transaction concept, Schedule, Conflict & View serializabilty, Concurrency Control, Lock base and Timestamp based Protocols, Multiversion and Optimistic Concurrency Control schemes.	8
9	Recovery Causes of failures, Immediate and Deferred Update, Shadow paging	2
10	Advanced Topics Introduction to Web Databases, Distributed Databases, Data Warehouse and Data Mining.	2

**References:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill.
2. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson.
3. C. J. Date, "An Introduction to Database System", Pearson.
4. Ivan Bayross, "SQL, PL/SQL: The Programming Language of Oracle" BPB Publications.

**Elective I****Object Oriented Programming (IT521/1)**

L-T-P 3-0-0

Full Marks: 100

**Prerequisite(s):** Programming and Data Structure (IT-301)

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction: OOP vs POP, Features of OOP, Advantages	4
2	Class & Object Access Specifier, Accessing class members: Function, Type Cast Operator, Return by reference, Inline Function, Object as function argument, Array of Object, Friend Function	8
3.	Constructor and Destructor: Characteristics of constructor, Default Constructor, Parameterized Constructor, Copy Constructor, Dynamic Initialization of Object, Dynamic constructor, Destructor	6
4.	Operator Overloading : Definition, Process , Overloading Unary , binary operator	4
5	Type Conversion: Conversion from basic type to class type and vice versa, Conversion from one Class to another Class Type, conversion using constructor	2
6	Inheritance: Introduction, Types of inheritances, Abstract class	4
7	Pointer, Virtual Function and Polymorphism: Polymorphism, Pointer to Objects, Array of objects using pointer, Array of pointers to objects, this pointer, Pointer to base class, pointer to derived object, Virtual Function	4
8	Exception Handling: Introduction, Types of Exception, Exception Handling Mechanism, Throwing Mechanism, Catching mechanism	4
9	Template and namespace: Class template, Function Template, Concept of namespace	2
	Total	38

**References:**

1. Booch, Jacobson, Rumbaugh, Object Oriented analysis and design with application, Pearson.
2. Bjarne Stroustrup, *The C++ Programming Language*, Addison Wesley
3. Robert Lafore, Object-Oriented Programming in C++, Sams Publishing
4. Stanley B. Lippman, Josée Lajoie, Barbara E. Moo C++ Primer,
5. E . Balaguruswami, Object Oriented Programming C++. TMH.
6. Steve Oualline, Practical C++ Programming O'Reilly & Associates, Inc.

**TELECOMMUNICATION AND TRAFFIC ENGINEERING [IT –521/2]**

3-0-0 (L-T-P)

Full Marks: 100

**Prerequisite(s):** Digital logic and Circuit Design (IT-302), Communication Systems (IT-402)

Sl. No.	Module Name and Topics	No. of Classes
1.	Introduction: Telecommunication systems, elements of Tele traffic	2
2.	Traffic models, Erlang's formulae	4
3.	Telephone networks: Signaling, DTMF techniques, transmission, digital transmission requirements.	4
4.	Switching : Switching Algebra Electronics switching, generic switch, Blocking, non-blocking switching network, types of switching networks, Clos criterion	4
6.	Switching systems: SD/TD/STS networks. Hybrid time and space division switching	4
7.	PSTN, Cellular Mobile Telephone System- Cell concepts, architecture, hardware procedures, GSM standard, call management	4
8.	Cellular Mobile Telephone System- GSM handover, authentication	2
9.	Data transfer Techniques in computer network: Data networks, Packet/Circuit Switching, ISDN	2
10.	Advanced data communications: ATM concept and functionality, Services- FAX, Cable TV, Video on demand.	6
	Total classes	32



**References:**

1. J. E. Flood, "Telecommunications, Switching, Traffic and Networks", Prentice Hall.
2. Thiagarajan Viswanathan, "Telecommunication Switching Systems and Networks", Prentice Hall India.
3. Mobile and Wireless Network, Ulyss Black.
4. Wireless Communications and Networks, William Stallings.
5. Mobile Communications, J. Schiller, Addison-Wesley.
6. William Stallings, Data and Computer Communications, Pearson.
7. Computer Networks by Andrew S. Tanenbaum, Pearson Education.
8. B. Forouzan, "Data Communication and Networking", McGraw-Hill.

**Open Elective (IT 531/1)****Multimedia Systems**

L-T-P 3 – 0 – 0

Full Marks: 100

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction to Multimedia , Elements of Multimedia, Properties of multimedia system, Categories, Features, Application, Convergence of Multimedia System	2
2	Image: Raster and Vector, Types of image, Digital image representation, Color model, Image negation, change of dynamic range, Histogram, File system (TIFF, BMP, PCX, GIF etc.), System Architecture  Compression: Advantages, disadvantages, Spatial and temporal redundancies, Lossless and Lossy compression, DPCM, Lampel-Ziv, Huffman coding, Arithmetic coding, GIF, JPEG.	8
3	Audio: Sound wave, Physical characteristic, Musical note, Components of Audio System, Microphone:moving coil, condenser, Amplifier :class A Class B, Speaker, Synthesizer, MIDI. Sound card, Digital Audio processing.	6
4	Video: Luminance & Chrominance, Luma and Chroma, Chroma Sub-sampling, Television Systems PAL, NTSC, Video Nomenclature HDTV, EDTV, Video Quality and Performance Measurements, Digital Video Processing Video capture, Video processing AVO/AVI file formats.	4

5	MPEG standard Hypertext, hyper media. Virtual Reality and multimedia.	2
7.	Animation: Key frame and Tweening, Cell Animation, Rotoscoping, Stop-Motion Animation, Motion Cycling, Computer Based Animation, Path based animation, Client pull and server push,	2
7	Multimedia devices- Display devices, Optical Devices, CCD, Camera, DVD, Scanners	2
8	Multimedia Database-Image Representation, Segmentation, Similarity based retrieval, Image retrieval by color, Shape & texture, indexing – K-d-tree, R-tree, Video Content, Quad tree, Quarrying, Video Segmentation, Indexing.	6
	Total:	32

**References:**

- 1) R. Steinmetz, K. Nahrstedt, "Multimedia Systems", Springer Science & Business Media.
- 2) J.F.K, Buford, Multimedia Systems, ACM Press.
- 3) Sloane, Multimedia Communication, McGraw Hill.
- 4) Boyle, Design for Multimedia Learning Prentice Hall.
- 5) B Prabhakaran, Kluwer, Multimedia Database Management Systems, Springer.

## Laboratories

### Microprocessors Lab (IT 551)

Weekly contact: 0–0–3 (L – T – S)

Full Marks: 100

Module Number	Topics	Class Load
1	Familiarization with 8085 trainer kits and hands on experience.	3
2	8085 Assembly Programming on small applications using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).	3
3	Peripheral Programming using (i) 8255 PPI on the electronic systems, (ii) 8 bit latch (e.g., 74LS373), (iii) I/O modules (ADC, Speed control of mini DC motor using DAC, Keyboard, Multi-digit Display with multiplexing, Stepper motor).	6
4	Familiarization with 8086 trainer kits and hands on experience.	6
5	8086 Assembly Programming on small applications using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).	6
<b>Total</b>		<b>24</b>

### Operating Systems Lab (IT 552)

Weekly contact: 0–0–3 (L – T – S)

Full marks 100

Module Number	Topics	Class Load
1	Understanding the time sharing, multiprogramming nature of the operating system	3
2	Interprocess communication using shared memory and message passing	3
3	Thread related programs: scheduling of threads, master-slave model	6
4	Simulation of different scheduling algorithms	6
5	Solving different classical problems of synchronization using semaphores and monitors	3

6	Analysing the cache/memory behavior of systems (memory mountain etc.), File operation	3
<b>Total</b>		24

### Database Management System lab (IT 553)

Weekly contact: 0-0-3 (L-T-S)

Full marks 100

<b>Module Number</b>	<b>Topics</b>	<b>Class Load</b>
1	Creation of Tables using Integrity Constraints in SQL	3
2	Execution of DML statements and Queries in SQL for Small Application.	6
3	PL/SQL Programming for Small Application.	6
4	Programming using Function, Procedure, Cursor and Trigger.	6
5	SQL Application Programming using JDBC/PHP.	3
<b>Total</b>		24

# Detailed Syllabus

## 6<sup>th</sup> Semester

### Design and Analysis of Algorithms (IT 601)

3-0-0 (L-T-P)

F.M.: 100

**Prerequisite(s):** Programming and Data Structures (IT-301)

Sl. No.	Module Name and Topics	No. of Classes
1.	Models of Computation; Algorithms and Complexity; Best case, worst case and average case; asymptotic notations	6
2.	Sorting and searching; search trees; balanced trees; hashing	6
3.	Advanced data structure: Red-Black trees, Fibonacci heaps, data structure for disjoint sets	4
4.	Lower bound theory	2
5.	Optimization problems; Dynamic programming and Greedy method; theoretical foundation of greedy methods	4
6.	Amortized analysis	2
7.	Introduction to graph; BFS and DFS, connected components, spanning trees, shortest paths, max flow	6
8.	Randomized algorithms: identity testing, primality and min-cut	4
9.	Number theoretic algorithms	6
10.	Introduction to complexity classes: P, NP and NP completeness	2
	Total	42

#### References:

1. T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Prentice Hall of India, New Delhi.
2. A. Aho, J. Hopcroft and J. Ullman, The Design and Analysis of Computer Algorithms, A. W. L, International Student Edition, Singapore.
3. D. E. Knuth, The Art of Computer Programming, Narosa/Addison-Wesley, New Delhi/London.
4. E. Horowitz and S. Sahni, Fundamental of Computer Algorithms, Galgotia Pub. /Pitman, New Delhi/London.
5. Jon Kleinberg and ÉvaTardos, Algorithm Design, Pearson Education.

## COMPILER DESIGN (IT 602)

3-0-0 (L-T-P)

F.M.: 100

Prerequisite(s): Formal language and Automata Theory (IT-404)

Sl. No.	Module Name and Topics	No. of Classes
1.	Introduction: Compiler, phases and passes, finite state machines and regular expression sand their applications to lexical analysis, NFA, DFA, conversion, Token, Pattern and Lexeme, LEX compiler	06
2.		04
3.		08
4.	Formal grammars, and their application to syntax analysis, BNF notation, ambiguity, Removal of left recursion and left factoring	04
5.	Bottom-up and top-down parsers, LL(1)parser, operator precedence parsing, simple precedence, recursive descent and predictive parsers, LR(k) parsers,	06
6.	parse table generation, YACC.	02
7.	Syntax directed translation: Quadruples, triples, 3-address code,	03
8.	codegeneration for standard constructswith top-down and bottom-up parsers, translation of procedure calls, record structuring.	03
		02
9.	Code optimization: DAG analysis, data flow analysis, copy propagation, elimination of global sub-expressions, constant folding	
	Run time system: storage organization, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation.	
	Intermediate code generation: intermediate representations, control flow, Boolean expressions and procedure calls.	
	Code generation: Problems in code generation, code generator, register assignment and allocation problems, usage count, code generation from DAG, peephole optimization.	
	Symbol table: runtime storage administration, error detection and recovery; Lexical, syntactic and semantic errors, case studies with real life compilers.	
	Total	38

**References:**

1. A. V. Aho, R. Sethi and J. Ullman, *Compilers: Principles, Techniques and Tools*, Addison-Wesley.
2. Steven S. Muchnick, *Advanced Compiler Design and Implementation*, Morgan Kaufmann Publishers.
3. David Galles, *Modern Compiler Design*, Pearson Education.
4. C. Fischer and R. LeBlanc, *Crafting a Compiler*, Benjamin Cummings.
5. A. Appel, *Modern Compiler Implementation in C*, Cambridge Univ. Press, London.
6. C. Fischer and R. LeBlanc, *Crafting a Compiler in C*, Benjamin Cummings.





### Computer Networks (IT 603)

**3-1-0 (L-T-P)**

**F.M.:100**

**Prerequisite(s):** Communication Systems (IT 402), Programming and Data Structures (IT-301)

SI No	Module Name and Topics	No. of Classes
	Introduction: Computer networks and their types; a brief history of networking; data switching techniques; an introduction to virtual circuit switched networks and datagram networks; need of layered architecture; ISO-OSI and TCP/IP architecture; task of layers	6
2.	Media: Transmission media; bit rate, baud rate and bandwidth; bit encoding techniques; Network topology	2
3.	Data Link Layer: Data link layer (DLL) design issues; Error detection and correction; Flow control; Example DLL protocols – HDLC and PPP; Need of MAC sub-layer; ALOHA and CSMA protocols; Ethernet LAN; HUB, bridge and switch; Switched LAN; An introduction to Token ring LAN and FDDI; DQDB	8
	Wireless LAN	2
4.	Network Layer: Need of network layer; Routing algorithms and protocols – RIP, OSPF, BGP; router; routing in Internet; need of logical address; X.25 network, ARPANET and ERNET;	4
5.	internetworking; network layer in Internet – IP, ICMP, IGMP, ARP, RARP, DHCP; NAT and CIDR; IPv6	8
6.	Transport Layer: Design issues of transport layer; socket address; congestion control; TCP and UDP	6
	Application Layer	8
	Introduction to application layer protocols; SMTP, FTP, HTTP; network management and security	
		44

**References:**

1. Peterson and Davie, "Computer Networks, A Systems Approach", Morgan Kaufmann.
2. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall.

3. J. Kurose and K. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education.
4. W. Stallings, Data and Computer Communications, Prentice-Hall, Inc.
5. D. E. Comer and R. E. Droms, Computer Networks and Internets, Addison-Wesley, Inc.,
6. Behrouz A. Forouzan, Computer Networks, TMH.

**Elective II (IT 621/X)**  
**SYSTEM PROGRAMMING (IT-621/1)**

(L-T-P: 3-0-0)

Full marks – 100

**Prerequisite(s):** Programming and Data Structures (IT-301), Computer Organization and Architecture (IT-401), Microprocessors (IT-501)

Module Number	Topics	Lecture hour
Module 1	<b>Introduction: (5L)</b> System Software and Application Software SIC Machine architecture with programming examples	1 2
2	<b>Assembler:(8L)</b> <b>Assembler Functions</b> A Simple SIC Assembler Assembler design algorithm and data structure (Two Pass) <b>Machine Dependent Features</b> Instruction formats and addressing modes Program Relocation <b>Independent Assembler Features</b> Literals Symbol-defining statements Expressions Program Blocks Control Sections and Program Linking <b>Assembler Design Options</b> One pass assembler Multi-pass assembler	2 2 3 1
3	<b>Loader: (8L)</b> Loader Functions Machine-Dependent Features Machine Independent Features Design Options	2 2 2 2
4	<b>Linker: (4L)</b> Linker Functions Machine-dependent Features Machine Independent Features Design Options	1 1 1 1
5	<b>Macro Processor: (5L)</b>	

	Macro Processor Functions	1
	Machine-Independent Features	2
	Design Options	2
6	<b>Device driver basics:(8L)</b> Design and anatomy of UNIX device driver Types of device drivers General design of UNIX device drivers	2 4
<b>Total Lectures</b>		34

### References:

1. System Software: An Introduction to System Programming, L. L. Beck and D. Manjula, Pearson Education India.
2. System Programming, Srimanta Pal, Oxford University Press, India.
3. Introduction to System Software, Santanu Chattopadhyaya, Prentice Hall India.
4. System Programming and Operating Systems, D. M. Dhamdhare, Tata McGraw Hill
5. Writing UNIX Device Drivers, G. Pajari, Pearson Education Asia.

### Advanced Computer Architecture (IT 621/2)

**Weekly contact: 3 – 0 – 0 (L – T – S)**

**Full Marks: 100**

**Prerequisite(s):** 1. Digital Logic and Circuit Design (IT 302), 2. Computer Organization and Architecture (IT 401) 3. Microprocessors (IT 501)

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Parallel Computer Models, Programs, and Networks:</b> Introduction to parallel computing, Evolution, Parallelism in Uniprocessor Systems, Multiprocessors and Multicomputers, Multivector and SIMD, Classification of Parallel Architectures, Scalability, Performance metrics and measurement. Conditions of Parallelism, Hardware and Software parallelism, Program partitioning and scheduling.	6
2.	<b>System Interconnect Architectures:</b> Network properties, Static vs dynamic interconnection network, Multiprocessor network topologies, interprocessor communication network, structure and comparison of different parallel computers.	6
3.	<b>Processor types:</b> ISA, overview of CISC, RISC, Superscalar, VLIW, vector, and symbolic processors, case study of CISC and RISC.	4
4.	<b>Memory architecture and system design:</b> Memory coherence, locality of reference, virtual memory technology, backplane bus, arbitration, cache addressing and performance issues,	6

	interleaved memory, multi-core architecture and cache coherence problems, Centralized shared-memory architecture, synchronization, memory consistency, Distributed shared-memory architecture.	
5.	<b>Pipelining:</b> Linear and non-linear pipelining, classification, General pipeline design, Instruction pipeline design, Arithmetic pipeline design, pipeline hazards.	6
6.	<b>Parallel Architectures:</b> Limitations of scalar pipelines, Instruction level parallelism, superscalar architecture, dynamic pipelines, superscalar techniques, performance evaluation of superscalar architectures, VLIW architecture, data-level parallelism, thread-level parallelism, Simultaneous multi-threaded (SMT) architectures, Vector and symbolic processors; Case studies of contemporary microprocessors.	8
7.	<b>Advanced trends:</b> Multithreaded architectures, Cluster computing architectures, Grid computing architectures, Multi-core architectures, Operating system issues, OPENMP and MPI.	2

Total

38

**References:**

1. David A Patterson, John L Hennessy- Computer Organization and Design – The HW/SW Interface (The Morgan Kaufmann Series in Computer Architecture and Design).
2. David A Patterson, John L Hennessy- Computer Architecture-A Quantitative Approach- (The Morgan Kaufmann Series in Computer Architecture and Design).
3. Kai Hwang- Advanced Computer Architecture (Parallelism, Scalability, Programmability).
4. J.P. Shen and M.H. Lipasti, Modern Processor Design (McGraw Hill).
5. Rajiv Chopra, Advanced Computer Architecture (A Practical Approach), S. Chand & Company Pvt. Ltd.

## Mobile Communication (IT 621/3)

(L-T-P: 3-0-0)

Full Marks:100

**Prerequisite(s):** Communication Systems (IT-402), Signals Systems & Circuits (IT-303)

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Introduction:</b> Introduction to mobile and radio communication, radio communication principles, ideas on transmitters, receivers, medium of signal propagation	2
2.	<b>Cellular concept:</b> Frequency assignment, frequency reuse, concept of cell splitting, System capacity and interference	4
3.	<b>Mobile radio propagation:</b> Multipath signal propagation model and signal fading in mobile environment, large scale path loss	4
4.	<b>Mobile radio propagation:</b> Small scale fading and multipath effect, Doppler effect	2
5.	Receiver techniques for fading dispersive channels: Channel equalization, adaptive equalization, diversity techniques.	2
6.	Communication channel, antenna link design: uplink, downlink, G/T ratio, C/N, performance	4
7.	<b>Multiple access schemes in mobile communication:</b> TDMA, FDMA, CDMA, OFDM, Spread Spectrum Transmission and Reception.	4
8.	<b>GSM Architecture:</b> Mobility management, Handover in cellular systems , Soft handover, hard handover, Security, international roaming for GSM, Mobile Number portability, SMS in GSM, VoIP service for Mobile Networks, GPRS architecture	6
9.	<b>WLAN:</b> architecture Ideas on mobile ad-hoc networking, protocols	6
<b>Total</b>		<b>34</b>

### References:

1. T. S. Rappaport, "Wireless Communication: Principles and Practice", PHI
2. Jochen Schiller, "Mobile Communications", PHI.
3. Jochen Burkhardt, Pervasive Computing: Technology and Architecture of Mobile Internet Applications, Addison Wesley Professional
4. T. Pratt, C. Bostian, "Satellite Communication", John Wiley Co.
5. William Stallings, "Wireless Communications and Networks", Pearson Education.

## Elective - II: Distributed Database (IT 621/4)

Weekly contact: 3 – 0 – 0 (L – T – P)

Full Marks: 100

Prerequisite(s): Operating Systems (IT 502), Database Management Systems (IT 503).

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction Distributed Data Processing, Concepts of Distributed Database Systems	2
2	Distributed DBMS Architecture Transparency Issues, ANSI/SPARC standard, Global/Local/External/Internal Schemas, Architectural Models (including Client/Server Models)	4
3	Distributed Database Design Distributed Design Issues, Top-down and Bottom-up Patterns, Fragmentation, Allocation, Replication of Fragments, Optimality, Heuristics, Integrity Constraints	6
4	Distributed Query Processing Layers of Query Processing, Query Decomposition and Data Localization, Normalization, Elimination of Redundancy, Rewriting, Reduction for Horizontal and Vertical Fragmentation	6
5	Distributed Query Optimization Centralized Query Optimization, Join Ordering, Distributed Query Optimization Algorithms (INGRES, System R, Hill Climbing, etc.)	6
6	Distributed Transaction Management and Concurrency Control Properties and Types of Transactions, Serializability Theory, Concurrency Control Algorithms, Execution Schedules, Locking based Algorithms, Timestamp Ordering Algorithms, Deadlock Management	6
7	Distributed DBMS Reliability Local Recovery Management, Distributed Reliability Protocols, 2PC Protocol	4
8	Case Study	2
Total		36

### References:

7. Tamer Oszu and Patrick Valduriez, *Principles of Distributed Database Systems*, Prentice-Hall.
8. Bharat K. Bhargava (Ed.), *Concurrency Control and Reliability in Distributed Systems*, Van Nostrand Reinhold Publishers.
9. Jim Gray and Andreas Reuter, *Transaction Processing: Concepts and Techniques*, Morgan Kaufmann.

## **Laboratories**

### **Design & Analysis of Algorithm Lab (IT 651)**

**(L-T-P: 0-0-3)**

**Full Marks: 50**

1. Study of time requirements of searching and sorting algorithms; Tally the experimental time requirement with the theoretical time complexity; Understanding of problem size
2. Text file compression using Huffman coding
3. Implementation of graph algorithms; Study of data structures' roles in developing efficient algorithms (in connection with graph algorithms)
4. Role of randomness in computing
5. Implementation of some of the number theoretic algorithms

### **Compiler Design Lab (IT 652)**

**(L-T-P: 0-0-3)**

**Full Marks: 50**

1. Understanding and implementation of LEX programming
2. Generating Tokens from a given program.
3. Programming to compute FIRST and FOLLOW
4. LL(1) parsing Table Construction, String parsing using LL(1) grammar
5. YACC programming
6. Design of a small compiler.

### **Computer Networks Lab (IT 653)**

**(L-T-P: 0-0-3)**

**Full Marks: 50**

1. Setting up of LAN
2. Internetworking using a router
3. Understanding and implementation of basic socket programming
4. Network analysis using raw sockets
5. Writing client server programs under various scenarios
6. Study and analysis of congestion control in a real scenario
7. Implementation of denial of service and other attacks

**Detailed Syllabus**  
**7<sup>th</sup> Semester**



## Software Engineering (IT 701)

Weekly contact: 3 – 0 – 0 (L – T – P)

Full Marks: 100

Prerequisites: Database Management Systems (IT 503).

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction Software Basics, Layers of a Software	2
2	Software Process Models Conventional Models. Evolutionary Model, Spiral model, Concurrent Development Model, Specialized Models ,Agile Models	6
3	Software Requirements Analysis and Specification Information Gathering, Requirement and Feasibility Analysis, Quality of an SRS, Formal Requirements Specification	4
4	Software Modeling Scenario-based Models, Data-based Models, Class-based Models, Behavioral Models, Flow-oriented Models	4
5	Software Design Function-oriented Software Design, Object-oriented Design Approach,Quality of Design, Architectural Design, User Interface Design, Component-level Design, Pattern-based Design, WebApp Design	4
6	Coding Standards and Principles Programming Styles, Program Verification, Quality of a Program	2
7	Software Testing Methods Black Box and White Box Testing Approach, Mutation Testing Approach, Unit Testing, Integration Testing and System Testing Concepts	6
8	Project Management Planning and Managing a Project, Work Breakdown, Critical Path	2
9	Software Maintenance and Quality Assurance Forward Engineering and Reverse Engineering Concepts, Software Configuration Management, Software Quality and Reliability: SEI CMM and ISO-9001	4
10	Case Study	2
Total		36

References:

10. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, Tata McGraw-Hill, Seventh Edition, 2010.
11. Ian Sommerville, *Software Engineering*, Ninth Edition, Pearson Education, 2010.
12. Pankaj Jalote, *An Integrated Approach to Software Engineering*, Third Edition, Springer, 2005.
13. Paul C. Jorgensen, *Software Testing: A Craftsman's Approach*, Fourth Edition, CRC Press, 2014.
14. Rajib Mall, *Software Engineering*, TMH

## Internet and Web Technology (IT 702)

**3-0-0 (L-T-P)**

**F.M.: 100**

**Prerequisite(s):** Computer Networks (IT 603)

Sl. No.	Module Name and Topics	No. of Classes
1.	Review of TCP/IP Protocol Stack: IPv4, IPv6, TCP, UDP, ARP, ICMP, SMTP etc.	4
2.	Internet as a Distributed System, Transparency and Openness in Internet, RFCs	4
3.	Naming in Internet, Name servers	2
4.	World Wide Web as a Distributed Document Based System, Client-Server Architecture in Web, Browser	2
5.	Document Model: Markup languages, Document types, Designing Website	6
6.	Communication: HTTP, Web Clients and Servers, Proxies, URL	6
7.	JAVA – a language of Internet, Client-side and Server-side Programming	6
8.	Internet bot, Web crawler and Search engines	4
9.	Introduction to Internet of Things and web security	4
10	Recent trends in Web Technology	2
	Total	40

### References:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education
2. Andrew S. Tannenbaum and Maarten van Steen. *Distributed Systems: Principles and Paradigms*. Prentice Hall, 2<sup>nd</sup> Edition
3. Bruce Croft, Donal Metzler and Trevor Strohman. *Search Engines: Information Retrieval in Practice*. Pearson Education
4. Godbole and Kahate, *Web Technology*, TMH

## Open Elective II (IT 721/X)

Digital Signal Processing (Elective)  
3-0-0 (L-T-P)

(IT 721/1)

F.M.: 100

Prerequisite: Signals ,System and circuits, Digital Electronics.

Sl. No.	Module Name and Topics	No. of Classes
1.	Introduction to digital signal processing-its benefits and applications, Sampling and quantization -analog to digital conversion (ADC), Digital to analog conversion (DAC)	2
2	Mathematical operations on discrete-time signals, linear time invariant systems, causality, stability, difference equations, frequency response, discrete Fourier series, , Implementation of discrete-time systems	4
3	Z–transform - definition, properties of Z-transform, system function, digital filter implementation from the system function, region of convergence in the Z plane, determining filter coefficients from the singularity locations, geometric evolution of Z transform in the Z plane, relationship between Fourier transform and Z transform, inverse Z transform.	6
4	Digital filter structures: system describing equations, filter categories, direct form I and II structures, cascade and parallel communication of second order systems	4
5	FIR filter design techniques: Fourier Transform Design, Windowing method, combining DFT and window method for designing FIR filter, frequency sampling method for designing FIR filter, Optimal Design method	6
6	IIR filter design techniques: Approximation theory, Impulse invariant and bilinear transformations, Frequency transformations, Computer aided design techniques	
7	Transform technique: Fourier transform, its properties, inverse Fourier transform, discrete Fourier transform, properties of DFT, circular convolution, computations for evaluating the DFT, decimation in time and decimation in frequency FFT algorithms, discrete Hilbert transform	

8	Introduction to adaptive filter-LMS FIR, Weiner filter theory; multi-rate filter design-Up-sampling, down-sampling, sub-band decomposition, Applications	4
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**Books:**

1. Digital Signal Processing, Principles, Algorithms and Applications- Proakis, Manolakis and Sharma, Pearson Education.
2. Digital Signal Processing by Alan V. Oppenheim and Ronald W. Schaffer, Prentice-Hall
3. Digital Signal Processing Fundamentals and Applications- Li Tan and Jean Jiang
4. Digital Signal Processing- A computer-Based Approach- Sanjit K. Maitra, TMH
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer Third Edition.

## Computational Geometry (IT 721/1)

**3-0-0 (L-T-P)**

**F.M.: 100**

**Prerequisite(s):** Concepts of Computer Graphics, Data Structures and Algorithms

Sl. No.	Module Name and Topics	No. of Classes
1.	Computational Geometry: Introduction, degeneracy and robustness, Application domains	3
2.	Orthogonal range searching (in brief): kd-tree, range tree, Lower Bounds on Algebraic tree model and Geometric data structures (DCEL)	6
3.	The Maximal Points Problem (closest pair and farthest pair), Geometric searching, Slab method, Range searching	3
4.	Point Location and Triangulation, triangulating monotone polygon	4
5.	Convex Hull, Different Paradigms, Voronoi Diagram and Delaunay Triangulation, and Quickhull	6
6.	Line segment intersection, Linear programming, Intersection of convex polygons, planes	5
7.	Clustering Point Sets using Quadrees and Applications	2
8.	Introduction using Basic Visibility Problems, visibility graph and edge and applications to robot path planning	3
9.	Shape Analysis and Shape Comparison	3
10	Intersection and union of rectangles and largest empty space recognition	2
11.	Some applications and case studies	3
	Total	40

**References:**

1. Computational Geometry Algorithms and Applications, Authors: de Berg, M., Cheong, O., van Kreveld, M., Overmars, M.
2. Computational Geometry, An Introduction, Authors: Preparata, Franco P., Shamos, Michael
3. Discrete and Computational Geometry, Satyan L. Devadoss & Joseph O'Rourke

## Elective III(IT 711/X)

### IT 711/1: Graph Algorithms

Weekly contact: 4 – 0 – 0 (L – T – S)

Full Marks: 100

Prerequisite: Discrete math and graph theory, Design analysis of algorithm

Sl. No.	Module Name and Topics	No. of classes
1.	Graph Traversal	3
2.	Minimum Spanning Tree	3
3.	Shortest Paths	4
4.	Network flows, Network Flow applications	4
5.	Graph matching on bipartite graph	4
6.	Eulerian and Hamiltonian Tours	4
7	Planar Graphs –Planarity Testing	4
8	Graph partitioning and its applications	4
9	Connected components and its applications	3
10	Graph isomorphism, Spectral graph theory, Sparse graph	3
	<b>Total:</b>	<b>36</b>

#### Books:

- Combinatorial Optimization, Theory and Algorithms (KV) by Bernhard Korte and Jen Vygen, Springer, 4th Edition (2008). (GMU's libraries have online versions of this book.)
- Networks, Crowds, and Markets: Reasoning about a Highly Connected World by David Easley and Jon Kleinberg, Cambridge University Press, (2010).
- Introduction to Graph Theory by Douglas B. West, 2nd Edition (2000). The 3rd Edition is coming. You may want to wait for the 3rd Edition.
- Combinatorial Optimization: Algorithms and Complexity by C. H. Papadimitriou and K. Steiglitz, Englewood Cliffs, Prentice Hall, c1982, Reprinted by Dover Books, (1998).

- Algorithm Design (KT) by Jon Kleinberg and Eva Tardos, Pearson Education, Inc. (2006). (You can find the sample chapters on the webpage.)
- Introduction to Algorithms by T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, The McGraw-Hill Companies, 2nd Edition (2001).

### **Elective - III: Information and Coding Theory (IT 711/2)**

**Weekly contact: 3 – 0 – 0 (L – T – P)**

**Full Marks: 100**

**Prerequisites:** Communication Systems (IT 402), Discrete math and graph theory

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction Data and Information, Communication Channels	2
2	Basics of Information Theory Entropy, Differential Entropy, Relative Entropy, Conditional Entropy, Mutual Information, Channel Capacity	6
3	Different Models of Sources, Channels and Noise Discrete Source, Continuous Source, Memoryless Source, Memoryless Channel, Binary Symmetric Channel, Gaussian Channel, Additive White Gaussian Noise	4
4	Source Coding and Channel Coding Asymptotic Equipartition Property, Source Coding Theorem, Channel Coding Theorem	4
5	Quantum Information Theory von Neumann Entropy, Quantum Relative Entropy, Quantum Joint Entropy, Quantum Conditional Entropy, Quantum Mutual Information	4
6	Coding Theory Block Codes, Cyclic Codes, CRC Codes, BCH and Reed-Solomon Codes, Golay Codes, Convolutional Codes, Majority Logic Decoding, Viterbi Decoding Algorithm, LDPC Codes, Polar Codes	10
7	Information theory and coding for physical layer security Wire-tap Channel, Slowly Fading Wire-tap Channel, Relay Channel, Untrusted Relay	2
Total		32

**References:**

1. Thomas M. Cover and Joy A. Thomas, *Elements of Information Theory*, John Wiley & Sons, Inc., Second Edition, 2006.
2. Todd K. Moon, *Error Correction Coding: Mathematical Methods and Algorithms*, John Wiley & Sons, Inc., New Jersey, 2005.
3. Ron M. Roth, *Introduction to Coding Theory*, Cambridge University Press, 2006.
4. Ranjan Bose, *Information Theory, Coding and Cryptography*, TMH

### **Distributed and Parallel Systems (IT 711/3)**

**3-0-0 (L-T-P)**

**F.M.: 100**

**Prerequisite(s):** Computer Organization & Architecture (IT 401), Operating Systems (IT 502), Computer Networks (IT 603)

Sl. No.	Module Name and Topics	No. of Classes
1.	Introduction to High Performance Computing: Distributed System models, Grid Computing, Cloud Computing, Cluster Computing, Super Computing, etc.	4
2.	Multicore Processors, Scalable Multiprocessors	4
3.	Distributed Systems and Middleware, Introduction to RPC and RMI, CORBA	4
4.	Distributed storage and File systems, case studies	4
5.	Concurrency and Consistency models, Shared memory and Distributed memory	4
6.	Computing Clouds, Service-Oriented Architecture	4
7.	Grid Computing Systems, Peer-to-peer computing and Overlay graphs	2
8.	Load balancing	4
9.	Fault tolerance	4
10	Security and Privacy	2
	Total	36

**References:**

1. Kai Hwang, Jack Dongarra and Geoffrey C. Fox. Distributed and Cloud Computing: Clusters, Grids, Clouds, and the Future Internet.
2. Andrew S. Tannenbaum and Maarten van Steen. Distributed Systems: Principles and Paradigms. Prentice Hall, 2<sup>nd</sup> Edition.
3. M. J. Quinn. *Parallel Computing: Theory and Practice*, McGraw Hill.

**Data mining and data warehousing (IT 711/4)**

**Weekly contact:** 3 – 0 – 0 (L – T – P)

**Full Marks:** 100

**Prerequisites:** Database Management Systems (IT 503), Design & Analysis of Algorithm (IT 601).

Sl. No.	Module Name and Topics	No. of Classes
1	Introduction Fundamentals of Data Mining & Functionalities	4
2	A Statistical Perspective on Data Mining Similarity Measures, Data Pre-processing, Data Cleaning, Data Integration and Transformation	2
3	Association Rule Mining Basic Algorithms, Parallel and Distributed Algorithms, Incremental Rules, Measuring the Quality of Rules	4
4	Supervised and Unsupervised Classification Basics, Standard Methods	6
5	Recommender Systems Mining Recommender Data, Matrix Decomposition Algorithms, Efficient Algorithms for Large Datasets, Modeling Systematic Effects	4
6	Mining Object, Spatial, Multimedia, Text and Web Data Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web, Social Impacts of Data Mining	4
7	Data Warehousing Business Intelligence, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, Efficient Methods for Data Cube Computation	6
8	OLAP Technology Development of Data Cube and OLAP Technology, Attribute-Oriented Induction, OLAP Guidelines, Multidimensional versus Multirelational OLAP, OLAP Tools and the Internet.	6
Total		36

### References:

1. Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques*, Morgan Kaufmann Publishers, 2nd Edition, 2006.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, Pearson Education.
3. David J. Hand, Heikki Mannila and Padhraic Smyth, *Principles of Data Mining*, MIT Press, 2001.
4. Sam Aanhory and Dennis Murray, *Data Warehousing in the Real World*, Pearson Education Asia.
5. Alex Berson and Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, Tata McGraw – Hill Edition, Tenth Reprint, 2007.

## Software Engineering Lab (IT 751)

Weekly contact: 3 – 0 – 0 (L – T – P)

Full Marks: 100

**Prerequisites:** Database Management Systems (IT 503).

Sl. No.	Module Name and Topics	No. of Classes
1	Developing Object-oriented Models	3
2	Preparing Activity and Swimlane Diagrams	3



3	Construction of ERD, DFD and CFD at different levels	3
4	Development of Process Activation Table	3
5	Preparing Use Case Diagram	3
6	Developing Activity and Sequence Diagrams	3
7	Analysis of Codes	3
8	Implementing Basis Path Testing, Condition Testing, Data Flow Testing, Loop Testing and Orthogonal Array Testing	9
9	Test Cases	3
Total		33

### References:

1. Rational Rose Enterprise, IBM.
2. GenMyMoel.
3. Computer Aided Software Engineering (CASE) tools.

## Internet & WEB Technology Lab.(IT 752)

**0-0-3(L-T-P)**

**F.M: 100**

Sl.No.	Topic	Lab hour
1	HTML	6
2	CSS	3
3	DHTML	3
4	JAVA script	6
5	XML	6
6	PHP with MySQL	9
Total		33

### Reference Book:

1. HTML & CSS: The Complete Reference, Fifth Edition, Book by Thomas Powell, Mc Graw Hill
2. JavaScript: The Good Parts, Book by Douglas Crockford, OREILLY
3. Learning JavaScript, Book by Shelley Powers, OREILLY
4. PHP and MySQL Web Development, Book by Luke Welling, PEARSON
5. Beginning XML Paperback, David Hunter, Jeff Rafter, Joe Fawcett, WROX

**Detailed Syllabus**  
**8<sup>th</sup> semester**

## Information and System Security [IT801]

3-1-0 (L-T-P)

F.M.: 100

Coverage	Lecture allotted
Introduction: History of Information security, Components of Information System, Security attacks, services, mechanisms.	2 Lectures
Cryptography: Encryption and Decryption, Cryptanalysis, Classical Encryption techniques, Block and Stream Ciphers, Attacks on Block ciphers.	4 Lectures
Block ciphers: Modes of operation, DES, AES, BlowFish, Variants of DES Stream ciphers: LFSR based stream ciphers, RC4.	6 Lectures
Introduction to Number Theory: Fermat's theorem, Euler's theorem, primality testing, Discrete logarithms.	2 Lectures
Asymmetric key Ciphers: Principles of public key cryptosystems, RSA, Rabin and ElGamal schemes, side channel attacks.	4 Lectures
Key Management: Symmetric key distribution, Diffie-Hellman algorithm, Public key distribution.	4 Lectures
Message Authentication: Message Authentication and Hash Functions, SHA-1, MD5, HMAC, Digital signature, Bio-hashing.	5 Lectures
Security at layers (Network, Transport, Application): IP Security: overview, architecture; authentication header and security payload encapsulation. <b>Transport Layer Security (TLS)</b> , Secure Socket Layer(SSL) protocol, Pretty Good Privacy(PGP), <b>Secure/Multipurpose Internet Mail Extensions</b> , Wireless Network Security.	6 Lectures
Media Security: Data hiding, Steganography & Steganalysis, Digital watermarking, Visual cryptography.	2 Lectures
Intruders,: Intrusion detection, password management, Malicious Programs, Virus and related threats, Countermeasures,	3 Lectures
Firewall Firewall Characteristics, Types of Firewalls, Firewall Configuration.	3 Lectures

## Artificial Intelligence (IT 832)

3-0-0 (L-T-P)

F.M.: 100

Coverage	Lecture allotted
Introduction: Overview of AI, agents & environment, Nature of environment, Different types of agents.	3 L
Problem solving: Problem, State space, Solving problems by searching, Uninformed and informed search, Breadth first search, Depth first search, Bi-directional search, Iterative deepening search	5 L
Heuristic search: Hill climbing, Best first search, Branch and bound, A* algorithm, Admissibility and monotonicity of A*, Iterative deepening A*, Simulated Annealing, Constraint satisfaction problem	8 L
Adversarial search: Games, Optimal decisions & strategies in games, Minimax algorithm, Alpha-Beta pruning.	3 L
Knowledge and Reasoning: Knowledge representation issues, Predicate Logic, First order logic and WFFs, Forward reasoning ,Unification, Resolution refutation in FOL, Backward reasoning, Structured knowledge representation, Semantic networks, Frames.	7 L
Introduction to logic programming : Basic knowledge of Prolog programming	4 L
Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Shafer theory	4 L
Planning: Components of a planning system, Forward and backward state space planning, Goal stack planning, Hierarchical planning.	4 L
Learning: Concept of learning , learning by induction , explanation-based Learning, introduction of neural networks.	2 L
Expert Systems: Expert system architectures, Expert system shells knowledge acquisition.	2 L

### Suggested Readings :

1. Ritch & Knight, Artificial Intelligence, TMH
2. Stuart Russel Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson
3. Patterson, . Introduction to Artificial Intelligence & Expert Systems, PHI
4. N. J. Nilsson. Artificial Intelligence : A New Synthesis, Elsevier India
5. Ivan Bratko, PRPLOG: Programming for Artificial Intelligence, Pearson

## Image Proc. & Pattern Recognition (IT 833)

3-0-0 (L-T-P)

F.M.: 100

Sl. No.	Module Name and Topics	No. of Classes
1.	<b>Introduction:</b> Image definitions. Image representation: monochrome and color models, image file formats; image digitization, sampling and quantization, image resolution. Image Enhancement & Feature Extraction, Image Analysis and pattern Recognition	4
2.	<b>Image processing tools:</b> Fourier, Hadamard-Walsh, Discrete cosine, wavelets and multiresolution analysis; mathematical morphology - binary morphology, dilation, erosion, opening and closing, duality relations	4
3.	Image Enhancement: Filters in spatial and frequency domains, histogram-based approaches, smoothing, edge enhancement and image sharpening filtering, Homomorphic filtering.	10
4.	<b>Image Restoration</b> - PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and constrained least square method.	6
5.	<b>Segmentation:</b> Pixel classification, Bi-level thresholding, multilevel thresholding, split and merge algorithm, region growing, texture and entropy-based methods.	6
6.	<b>Image compression:</b> requirements and types, Statistical and spatial compression techniques like RLE, PCM, Huffman coding etc. Transform coding algorithm-DCT, Concept of Hybrid coding, (Quantization and sampling, Uniform quantizer and non uniform quantizer, Concept of JPEG and MPEG standards)	4
7	Pattern Recognition: Introduction and overview of different approaches to PR, dimensionality reduction, regression techniques.	2
8	<b>Classification:</b> linear and non-linear classifier, Bayesian classification, parametric and non-parametric classification techniques, minimum distance classifiers, K-NN rules. Unsupervised learning and clustering.	8
<b>Total</b>		<b>44</b>

**Text Books:**

- 1) R. Gonzalez and R. Woods, 4<sup>th</sup> Edition-Digital Image Processing, Pearson Education
- 2) W. K. Pratt, Digital Image Processing, Wiley Interscience, New York
- 3) B. Chanda and D. Dutta Majumder, Digital Image Processing and Analysis, PHI
- 4) Nick Efford, Digital Image Processing, a practical introduction using Java, Pearson Education Asia
- 5) Gose, Jhonsonbaugh, Jost, Pattern Recognition and image analysis, PHI
- 6) R. Schalkoff-Pattern Recognition Statistical, Structural and Neural Approaches, Wiley India

**Reference Books:**

1: A. Rosenfeld and A.C. Kak –Digital Picture Processing, Vol.1 and Vol. 2, Academic Press, New York, 1982.

R. O. Duda and P. E. Hart, Pattern Classification AND Scene Analysis, Wiley-Interscience, New York, 1973.

Topic	Lab Hour
Assignment related to encryption and decryption	9
Assignment related to Caesar cipher	3
playfair matrix and playfair cipher	6
Assignment related to DES, AES and RC4 cipher	9
Assignment related to RSA cryptosystem	3
Assignment related to symmetric key distribution	3
Design of secure client server networking	6

**Information &  
Systems  
Security Lab  
(IT851)  
0-0-3(L-T-P)  
F.M: 100**

**Image Processing and Pattern Recognition Lab (IT853)**  
**0-0-3(L-T-P) F.M: 100**

Module I: Assignments-to write program on image enhancement using negation, log-inverse log, power law functions, dynamic range changing, thresholding operation, arithmetic and logical operations- addition, subtraction, AND, OR, NOT , histogram equalization and matching-global and local approach, enhancement using image statistics, noise cleaning, algorithms of edge preserving smoothing filtering , edge enhancement- image sharpening using Laplacian and gradient operations, frequency domain implementation of low-pass and high pass filtering.

Module II: Assignments- to write program to implement various geometric operations on digital images- image rotation using forward and backward mapping, translation, scaling and warping

Module III: Assignments- to write program for image segmentation, iterative thresholding, entropy maximization, region growing technique, split and merge technique

Module IV: Assignments- to write program on image restoration-inverse filtering, optimal notch filtering; Compression- Delta coding and JPEG compression

Module VI: Assignments-to write program on classifier design, nearest neighbor, k-means algorithms, Bayesian Classifier.