DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY

(ESTABLISHED AS A UNIVERSITY OF TECHNOLOGY IN THE STATE OF MAHARASHTRA)

(UNDER MAHARASHTRA ACT NO. XXIX OF 2014)

P.O. LONERE, DIST. RAIGAD,

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COURSE CURRICULUM

B.TECH. (INFORMATION TECHNOLOGY)

FROM 3RD SEMESTER -8TH SEMESTER

(WITH EFFECTIVE FROM JULY 2017)

PROGRAMME OBJECTIVES:

The program educational objectives for the B.Tech. program in Information Technology describes accomplishments that graduates are expected to attain within the four years of graduation. Graduates will be able to apply their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are:

1. PEO1: To enable graduates gain strong skills for employment in multidisciplinary domains driven by IT
2. PEO2: To enable graduates to pursue higher education and research
3. PEO3: To enable graduates to develop entrepreneurship and leadership skills
4. PEO4: To enable graduates to contribute to the society in accordance with highest standards of ethics
5. PEO5: To develop breakthrough solutions enabling transformations in a rapidly changing IT world

PROGRAMME OUTCOMES:

The graduates of this programme will be able to demonstrate:

1. PO1: An Understanding of IT architecture, software and hardware concepts, functionalities and applications
2. PO2: An Ability to design, develop and test computer programs involving various algorithms, methodology and programming languages
3. PO3: Competency of business domains and functional processes that employ IT systems and applications
4. PO4: Practical use of communication protocols and their applications in the field of internet and world wide web
5. PO5: Sound understanding of fundamentals of computer as the central enabling platform for information management in 21st century
6. PO6: An Ability to develop, integrate, maintain and innovate software applications deployed in various multi-disciplinary domains
7. PO7: Thought leadership to design and implement practical solutions for global industry needs.
8. PO8: An Acumen to embrace and adopt futuristic IT technological developments
9. PO9: Sound knowledge of entrepreneurship traits to succeed
10. PO10: Adoption of practices that are ethical ensuring transparency and accountability
11. PO11: Capability to provide solutions that are socially empowering and environment friendly
12. PO12: Effective communication and collaboration techniques with stakeholders to achieve best results

Second Year B.Tech. In Information Technology

Bachelor of Technology (Information Technology) - Second Year - Semester III															
Sr. No.	**Course Code**	**Title of the Course**	**Teaching Structure**			**Assessment Structure**						**Marks**	**Credits**	**Hours per week**
			L	**T**	**P**	**Mid Test**	**CA-1**	**CA-2**	**ESE**	**TW**	**PR**			
1	MA301	Engineering Mathematics -III	3	2	0	20	10	10	60	-	-	100	4	5
2	IT302	Switching Theory and Logic Design	3	0	0	20	10	10	60	-	-	100	3	3
3	IT302L	Switching Theory and Logic Design Lab	0	0	2	-	-	-	-	25	25	50	1	2
4	IT303	Microprocessors and Microcontroller	3	0	0	20	10	10	60	-	-	100	3	3
5	IT303L	Microprocessors and Microcontroller Lab	0	0	2	-	-	-	-	25	25	50	1	2
6	IT304	Object Oriented Paradigm with C++	3	0	0	20	10	10	60	-	-	100	3	3
7	IT304L	Object Oriented Paradigm with C++ Lab	0	0	2	-	-	-	-	25	25	50	1	2
8	BH01	Basic Human Rights	3	2	0	20	10	10	60	-	-	100	4	5
9	IT305	Institute Elective I	3	2	0	20	10	10	60	-	-	100	4	5
Summary of Semester Assessment Marks, Credit & Hours			**18**	**6**	**6**	**120**	**60**	**60**	**360**	**75**	**75**	**750**	**24**	**30**

List of Institute Electives I

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT305-01	NSS-1	Nil
2	IT305-02	Developmental Engineering	Nil
3	IT305-03	Engineering Physics II	Engineering Physics I

Bachelor of Technology (Information Technology) - Second Year - Semester IV															
Sr. No.	**Course Code**	**Title of the Course**	**Teaching Structure**			**Assessment Structure**						**Marks**	**Credits**	**Hours per week**
			L	**T**	**P**	**Mid Test**	**CA-1**	**CA-2**	**ESE**	**TW**	**PR**			
1	IT401	Data Communications	3	0	0	20	10	10	60	-	-	100	3	3
2	IT401L	Data Communications Lab	0	0	2	-	-	-	-	25	25	50	1	2
3	IT402	Data Structures and Applications	3	0	0	20	10	10	60	-	-	100	3	3
4	IT403	Programming in Java	3	0	0	20	10	10	60	-	-	100	3	3
5	IT402L	Data Structures and Applications Lab (in Java)	0	0	2	-	-	-	-	25	25	50	1	2
6	IT404	Computer Organization and Architecture	3	2	0	20	10	10	60	-	-	100	4	5
7	MA401	Numerical Methods	3	2	0	20	10	10	60	-	-	100	4	5
8	IT405	Institute Elective II	3	2	0	20	10	10	60	-	-	100	4	5
9	IT406L	Programming Lab (Phython)	0	0	2	-	-	-	-	25	25	50	1	2
Summary of Semester Assessment Marks, Credit & Hours			**18**	**6**	**6**	**120**	**60**	**60**	**360**	**75**	**75**	**750**	**24**	**30**

List of Institute Electives 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT405-01	NSS-2	Nil
2	IT405-02	Environmental Sciences	Nil
3	IT405-03	Engineering Chemistry II	Engineering Chemistry I

Course Title:	**Engineering Mathematics – III**	**Semester III**	
Course Code	**MA301**	**Course Type**	**Mandatory**
Pre-requisite	**Engineering Mathematics - II**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To provide in depth knowledge of complex numbers
2. To find the solution of differential equations
3. To find an in-depth knowledge of Fourier series analysis of periodic function

Course Outcomes:

After learning the course the students should be able:

1. Develop an ability to use characteristics of complex numbers in problem pertaining to electric circuits
2. To develop an acquaintance with the method of finding solution of differential equations
3. To develop an in depth knowledge of vector differentiation and vector integration
4. To develop Fourier series expansion of different periodic functions

Course Content:

UNIT I

Laplace Transform: Definition – Conditions for existence, Transforms of elementary functions, Properties of Laplace transforms - Linearity property, First shifting property, Second shifting property, Transforms of functions multiplied by TN, Scale change property, Transforms of functions divided by t, Transforms of integral of functions, Transforms of derivatives, Evaluation of integrals by using Laplace transform, Transforms of some special functions- Periodic function, Error function, Unit step function .

UNIT II

Inverse Laplace Transform: Introductory remarks , Inverse transforms of some elementary functions, General methods of finding inverse transforms, Partial fraction method and Convolution Theorem for finding inverse Laplace transforms, Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT III

Fourier Transform: Definitions – Integral transforms, Fourier integral theorem (without proof),Fourier sine and cosine integrals, Complex form of Fourier integrals, Fourier sine and cosine transforms, Properties of Fourier transforms, Convolution theorem for Fourier transforms, Application to boundary value problems.

UNIT IV

Series Solutions of Differential Equations and Special Functions: Validity of series solution, Series solutions about ordinary and singular point, Frobenius method, Series solution of Bessel equation, Recurrence relations for Bessel function, Generating function for Bessel function, Orthogonality of Bessel function.

UNIT V

Partial Differential Equations and Their Applications Formation of Partial differential equations, Solutions of Partial differential equations – Direct integration, Linear equations of first order (Lagrange's linear equations), Homogeneous linear equations with constant coefficients, Method of separation of variables – Application to find solutions of wave equation, One dimensional heat equation and Laplace equation.

UNIT VI

Calculus of Complex Functions Limit and continuity of f(z), Derivative of f(z) – Cauchy-Riemann equations, Analytic functions, Harmonic functions - Orthogonal system, Conformal transformations, complex integration – Cauchy's theorem, Integral formula, Residue theorem.

Text Books

1. B. S. Grewal, ***"Higher Engineering Mathematics"***, Khanna Publishers, New Delhi.
2. P. N. Wartikar, J. N. Wartikar, ***"A Text Book of Applied Mathematics (Vol I & II)"***, Pune Vidyarthi Griha Prakashan, Pune.
3. N. P. Bali, N. Ch. Narayana Iyengar, ***"A Text Book of Engineering Mathematics"***, Laxmi Publications (P) Ltd., New Delhi.
4. Dr. B. B. Singh, ***"A course in Engineering Mathematics (Vol II & III)"***, Synergy Knowledgeware, Mumbai.

Reference Books:

1. B. V. Ramana, ***"Higher Engineering Mathematics"***, Tata McGraw-Hill Publications, New Delhi.
2. Erwin Kreyszig, ***"Advanced Engineering Mathematics"***, John Wiley and Sons, New York.
3. Peter O' Neil, ***"A Text Book of Engineering Mathematics"***, Thomson Asia Pvt. Ltd., Singapore.
4. C. R. Wylie, L. C. Barrett, ***"Advanced Engineering Mathematics"***, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Course Title:	**Switching Theory and Logic Design**	**Semester III**	
Course Code	**IT302**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn numbering systems used in digital world and its representation, arithmetic operations, error detection and correction methods.
2. To learn Boolean algebra, logic gates, logic families, realization of Boolean expressions and minimization techniques.
3. To study the sequential logic circuits design used in synchronous and Asynchronous modes
4. To describe various programmable logic devices

Course Outcomes:

After learning the course the students should be able:

1. Illustrate theory of Boolean algebra & the underlying features of various numbering systems.
2. Design various combinational & sequential logic circuits.
3. Demonstrate working of flip-flop

Course Content:

UNIT I

Number Systems and Codes: Number systems: Binary, Octal, Hexadecimal number systems, Binary arithmetic, Codes: Binary code, Excess-3 code, Gray code, Error detection and correction codes.

UNIT II

Boolean Algebra and Logic Functions: Boolean algebra: Postulates and theorems, Logic functions, Minimization of boolean functions using algebra, Karnaugh map and Quine – McClusky methods, Realization using logic gates.

UNIT III

Logic Families: Logic families: Characteristics of logic families, TTL, CMOS, and ECL families.

UNIT IV

Combinational Functions: Realizing logical expressions using different logic gates, Design of combinational circuits using combinational ICs, Realization of adders and subtractors, Design of code converters, Comparators and decoders, Design of multiplexers, Demultiplexers.

UNIT V

Introduction to Sequential Circuits: Moore and mealy machines, Introduction to flip-flops like SR, JK, D and T with truth tables, Logic diagrams and timing relationships, Conversion of flip-flops, Excitation table, State tables, Realization of state stables.

UNIT VI

Programmable Logic Devices: Semiconductor memories, RAM, ROM, PLA, PAL, Memory System design.

Text Books

1. M. M. Mano, ***"Digital Logic and Computer Design"***, Prentice Hall of India Publication, 4th edition, 2006.
2. R.P. Jain, ***"Modern Digital Electronics"***, Tata McGraw Hill Publication, 4th edition, 2010.

Reference Books:

1. D. P. Leach, A. P. Malvino, G. Saha, ***"Digital Principles and Applications"***, Tata McGraw Hill Publication, 8th edition, 1993.
2. Comer, ***"Digital Logic & State Machine Design"***, Oxford Universities Press, 3rd edition, 2014.

Course Title:	**Switching Theory and Logic Design - Lab**	**Semester III**	
Course Code	**IT302L**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. Implement Flip-Flops, Multiplexer and De-multiplexer, Counters and arithmetic operations

Lab Experiments List:

1. Implementation of Boolean functions using Gates.
2. Implementation of following code conversions:
    a. Binary to gray
    b. Gray to binary
    c. Excess –3 to BCD
    d. BCD to Excess –3.
3. Implementation of half adder, full adder.
4. Implementation of half subtractor, full subtractor.
5. Implementation of K-map examples.
6. Implementation of Quine-Mc'Clusky examples.
7. Implementation of :
    a. 3 bit odd Parity Checker
    b. 4 bit odd Parity Checker
    c. 3 bit even Parity Checker
    d. 4 bit even Parity Checker
8. Implementation of Multiplexer and Demultiplexer.
9. Implementation of BCD adder using 4 bit adder IC.
10. Study of flip flops:
    a. RS flip-flop
    b. D flip-flop
    c. T flip-flop
    d. J-K flip-flop
11. Implementation of following counters:
    a. Synchronous counter
    b. Asynchronous counter
    c. Up / down counter
    d. Ring counter
    e. Johnson Counter

Course Title:	**Microprocessors and Microcontroller**	**Semester III**	
Course Code	**IT303**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand 8086 microprocessor Architecture
2. To understand design aspects of I/O and Memory Interfacing circuits
3. To acquaint with instruction set and logic required to build assembly language programs
4. To learn microcontroller architecture, its instruction set & interfaces

Course Outcomes:

After learning the course the students should be able:

1. To design and implement programs on 8086 microprocessor
2. To design I/O circuits and Memory Interfacing circuits
3. To exhibit knowhow on microcontroller interfaces & programming
4. To experiment with MCS51 and PIC18 microcontroller

Course Content:

UNIT I

Intel 8086/8088 Microprocessor Family: Architecture and organization of 8086/8088 microprocessor family, Instruction set, Assembly language programming, Introduction to mixed language programming using C and Assembly language, 8086 family minimum and maximum mode operation, Timing diagram for 8086 family, Detailed study of maximum mode connection: Study of 8288 bus controller, 8086 interrupt structure.

UNIT II

8086 Instruction Set and Programming: Addressing modes, Instruction Set, ALP, Mixed language programming, Stacks, Strings, Procedures, Macros, Timers, Counters and delay, Programming examples using DOS and BIOS Interrupts, Device Drivers Programming.

UNIT III

8086 Interrupt System: 8086 Interrupt structure, Types and applications: Study of Interrupt Controller 8259A and Interrupt Priority Management using 8259A.

UNIT IV

Memory System Design and I/O Interfacing: Interfacing SRAM, ROM and DRAM to 8086, Address decoding and Timing Considerations, I/O interfacing in 8086: Serial communication interface includes Synchronous and Asynchronous, Protocols, Parallel communication interface includes I/O Mapped I/O, Memory Mapped I/O, and Handshaking Signals, 8087 Math Co-processor: Study of architecture of 8087, Floating point co- processor, Data types supported by 8087, Host and co - processor interface, Assembly language Programming for 8086 - 8087 based systems.

UNIT V

Intel MCS 51 Family: Introduction to Single chip microcontrollers of Intel MCS 51 family, Architectural and operational features, Instruction set, CPU timing and machine cycles, Interrupt structure and priorities, Internal Timer / counters, Serial interface, Connection of external memory, Power saving modes, Interfacing of 8051 with EPROM, Programming for EPROM versions, 8051 variation.

UNIT VI

Introduction to the PIC18 Microcontroller: Overview of the PIC18 MCU, The PIC18 Memory Organization, The PIC18 CPU Register, The PIC18 Pipelining, PIC18 Instruction Format, Addressing Modes, A Sample of PIC18 Instruction, Overview of the 8-Bit MCU Market.

Text Books

1. Douglas Hall, ***"Microprocessors and Interfacing: Programming and Hardware"***, Tata McGraw-Hill, 2ND Edition.
2. Han-Way Huan, ***"An Introduction to Software and Hardware Interfacing"***, Delmar Cengage Learning, 2nd edition, 2006

Reference Books:

1. Peter Norton, ***"IBM PC, Assembly Language programming"***, BPB publication.
2. John Uffenback, ***"8086/8088 Interfacing, Programming and Design"***, Prentice Hall of India Publication.
3. A. K. Ray, K. M. Bhurchandi, ***"Advanced Microprocessors and Peripherals"***, Tata McGraw Hill, 2000.

Course Title:	**Microprocessors and Microcontroller Lab**	**Semester III**	
Course Code	**IT303**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Lab Experiments Objective:

1. To learn assembly language
2. To program microprocessor and controller for arithmetic operations
3. To interface microprocessor and controller with I/O devices

Lab Experiments List:

1. 8085 and 8086 kit familiarization and basic experiments
2. Arithmetic operation of 16 bit binary numbers
3. Programming exercise : sorting ,searching and string
4. Interfacing with A/D and D/A converters
5. Interfacing with stepper motors
6. Keyboard interfacing to 8086
7. 8255 interface to 8086
8. Assembly language programming of 8051
9. Timer programming of 8051,using interrupts
10. LCD interfacing to 8051 –project

Course Title:	**Object Oriented Paradigm with C++**	**Semester III**	
Course Code	**IT304**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. This course focuses on principles of object oriented programming paradigm. The course also includes practice of writing programs in C++ and Java

Course Outcomes:

After learning the course, the students should be able:

1. To draw the control flow of a program.
2. To understand the storage concepts in a simple program.
3. To program using basic concepts of OO languages i.e. objects, encapsulation, data hiding etc.
4. To program using advanced concepts of OO languages i.e. associations, packages, interfaces, exception handling etc.
5. To work with functional, Logic programming paradigms.

Course Content:

UNIT I

Elements of computer systems, DOS commands and Linux environment, Language processors, Algorithms, Flowcharts, Object-Oriented Programming Paradigm: Benefits, Applications. Object-Oriented Systems Development. Object-Oriented Analysis: Static and dynamic modeling, Object-Oriented Design: Class design and algorithm

UNIT II

Beginning with C++: Tokens, Data types, Operators, Expressions, and Control structures, Array, Functions, Structures and Unions. Class and Objects, specifying a class, Defining member functions, Private member functions, Static data and member functions, Arrays of objects, Friend functions.

UNIT III

Constructors and Destructors: Constructor, Parameterized constructors, multiple constructors in a class, Copy constructors, Dynamic constructors, Destructors. Programming for class diagram and relationship.

UNIT IV

Inheritance: Single inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes.

UNIT V

Polymorphism: Operator overloading, Function overloading. Virtual functions, pure virtual functions. Abstract class. Working with Files: Classes for file stream operations and I/O stream operation, Opening and closing a file, Detecting end-of-file, More about Open(): File Modes, Sequential input and output operations.

UNIT VI

Exception Handling: Fundamentals, types of exceptions, catching exceptions, multiple catching, nested try statements, uncaught exceptions, throw and throws, finally mechanism, built-in exceptions, creating exception subclasses, using exceptions.

Text Books

1. Robert Lafore, ***"Object Oriented Programming in C++"***, Pearson Education, 4th edition, 2008.

Reference Books:

1. J. R. Hubbard, ***"Programming with C++: Schaum's Outlines"***, Tata McGraw-Hill publication, 2005.
2. P. J. Deitel, H.M.Deitel, ***"C++ How to Program"***, Pearson Education, 9th edition, 2016.
3. E. Balagurusamy, ***"Object Oriented Programming with C++"***, Tata McGraw Hill Publication, 6th edition, 2013
4. John Uffenback, ***"8086/8088 Interfacing, Programming and Design"***, Prentice Hall of India Publication.

Course Title:	**Object Oriented Paradigm with C++ - Lab**	**Semester III**	
Course Code	**IT304L**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. Programming using C++ / Java

Lab Experiments List:

1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power () that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main () function that gets values from the user to test this function.
2. A point on the two-dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:
    a. Enter coordinates for P1: 3 4
    b. Enter coordinates for P2: 5 7
    c. Coordinates of P1 + P2 are: 8, 11
3. Create the equivalent of a four-function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally, it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be Y or N . Some sample interaction with the program might look like this:
    a. Enter first number, operator, second number: 10/ 3
    b. Answer = 3.333333
    c. Do another (Y/ N)? Y
    d. Enter first number, operator, second number 12 + 100
    e. Answer = 112
    f. Do another (Y/ N)? N
4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:
    a. Enter your area code, exchange, and number: 415 555 1212
    b. My number is (212) 767-8900
    c. Your number is (415) 555-1212

5. Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display.
6. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions: constructor with no arguments (default), constructor with two arguments, void reduce () that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
    a. Overload + operator to add two rational number
    b. Overload ≪ operator to enable input through cin
    c. Overload ≫operator to enable output through cout
    d. Write a main ( ) to test all the functions in the class.
7. Consider the following class definition:

    ```
    class father {
    protected age;
    public;
    father (int x) {age = x;}
    virtual void iam()
    {
    cout≪"I AM THE FATHER " ;
    cout ≪ "My age is : " ≪ age≪ endl;}
    };
    ```

    Derive the two classes son and daughter from the above class and for each, define iam () to write similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main() that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam () through the pointer to demonstrate polymorphism in action.
8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.
9. A hospital wants to create a database regarding its indoor patients. The information to store include
    a. Name of the patient
    b. Date of admission
    c. Disease
    d. Date of discharge

    Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the patients to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

10. Imagine a tollbooth with a class called toll Booth. The two data items are a type Unsigned INT to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called display() displays the two totals i.e. total cars and total cash Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC key should cause the program to print out the total cars and total cash and then exit.

Course Title:	**Basic Human Rights**	**Semester III**	
Course Code	**BH01**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To work for ensuring that basic human rights are respected everywhere.
2. To cooperate to avoid compromising on human rights for economic or political expediency.
3. To recognize democratic institutions as a fundamental human right.
4. To work towards the sovereignty and self-determination of entities with historical, cultural and ecological identity.
5. To actively engage with the Government of India and other countries to promote human rights education.
6. To bring diplomatic and commercial pressures on regimes that violates human rights, to ensure that they respect the basic rights of their citizens.
7. To keep the interests of disempowered communities foremost in all dealings with countries in which human rights violations occur.
8. To develop a more distinctive and effective role for the International Court of Justice in the field of human rights.
9. To promote a culture for educating the citizenry that cultivation and promotion of human rights culture is the sine qua non for the smooth functioning of the organs of a democratic State and for the kind of development that results into overall development of the society.
10. To train the young men and women for facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture.
11. To study the effect of draconian laws and unlawful use of State's machinery and force by the enforcement agencies

Course Outcomes:

After learning the course, the students should be able:

1. Appreciate the importance of the values of human rights.
2. Strengthen respect for human rights and fundamental freedoms and respect others caste, religion, region and culture.
3. Know about regional, national, state, and local law that reinforces international human rights law.
4. Understand being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.
5. Be aware of rights as Indian citizen.
6. Understand the importance of groups and communities in the society.
7. Realize the philosophical and cultural basis and historical perspectives of human rights.
8. Make students aware of their responsibilities towards the nation.

Course Content:

UNIT I

Introduction: Magna Carta, English bill of rights, American/French declaration, Universal declaration of human rights: background, Content and relevance. Theories/Justification/Perspectives on Human Rights Natural, Moral, Legal and human rights, Natural rights, Positivist, Liberal, Marxist, Feminist, Asian perspectives.

UNIT II

Debates: Universality of rights, Rights vs duties, Individual vs group rights, Civil and political rights vs social, The notion of rights in various religious traditions (Hindu, Muslim, Buddhist traditions), Western Influence (especially the impact of the British rule), National freedom movement, The roles of Gandhi, Ambedkar and Nehru.

UNIT III

Constitutional provisions (especially fundamental rights vs directive principles of state policy and emergency). Intergovernmental Organization The united nations (study of specific UN agencies related to human rights), Regional instruments.

UNIT IV

International NGO - Amnesty international: Its working and impact on India, Case studies of selected national NGOs, Case studies of selected regional NGOs, The government: Role and effort of some of its agencies including the army, police, and paramilitary forces.

UNIT V

National Human Rights Commission of India - Background, Structure and functioning, International humanitarian law, International refugee law, the judiciary including public interest litigation, The medical profession and human rights, The role of the media in human rights.

UNIT VI

Some Issues in Human Rights : Violence and terrorism, Women's rights, Child rights, Dalit rights, Minority rights, Tribal rights, Refugee rights, Capital punishment, Euthanasia, Rights of the elderly, Gay Rights.

Text Books

1. D. D. Basu, V. R. Manohar, B. P. Banerjee, S.A. Khan, ***"Introduction to the Constitution of India"***, 20th edition, Lexis Nexis Butterworths publication, 2008.
2. A. R. Desai, ***"Violation of Democratic Rights in India"***, Bombay Popular Prakashan.

Reference Books:

1. M. Mohanty, P. N. Mukherji, O. Tornquist, ***"People's Rights: Social Movements and the State in the Third World"***, New Delhi, Sage Publications, 1998
2. Nanda, P. Ved, J. R. Scarritt, G. W. Shepherd, ***"Global Human Rights: Public Policies Comparative Measures and NGO Strategies"***, Boulder Westview Press Inc., 1981
3. Nirmal, J. Chiranjivi, ***"Human Rights in India: Historical, Social and Political Perspectives"***, New Delhi, Oxford University Press, 2000.
4. Kothari, Smitu, Harsh Sethi, ***"Rethinking Human Rights: Challenges for Theory and Action"***, Delhi Lokayan, 1991
5. A. J. M. Milne, ***"Human Rights and Human Diversity: An Essay in the Philosophy of Human Rights"***, New York State University of New York Press, 1986.

Course Title:	**NSS-1**	**Semester III**	
Course Code	**IT305-01**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To understand the community
2. To understand the needs and problems of the community
3. To develop civic and social responsibility
4. To acquire leadership quality and democratic attitude.
5. To develop competence in group living

Course Outcomes:

After learning the course, the students should be able:

1. To create awareness in social issues
2. To participate in mass education program
3. To develop some proposals for local slum area development and waste disposal
4. To create environmental awareness
5. To participate in relief and rehabilitation work during natural calamities

Course Content:

UNIT I

Introduction and Basic Concepts of NSS: History, Philosophy, Aims & objectives of NSS Organizational structure, Concept of regular activities, Special camping, Day Camps. Basis of adoption of village/slums. Methodology of conducting survey.

UNIT II

Youth and community mobilization: Definition, Profile of youth, Categories of youth, Issues, Challenges and opportunities for youth, Youth as an agent of social change, Youth-adult partnership, Mapping of community stakeholders, Identifying methods of mobilization, Needs & importance of volunteerism.

UNIT III

Importance and Role of Youth Leadership: Meaning and types of leadership, Qualities of good leaders; Traits of leadership, Importance and role of youth leadership.

UNIT IV

Life Competencies and skill: Definition and importance of life competencies, Communication, Inter Personal, Problem solving and decision making, Positive thinking, Self-confidence and self-esteem, Life goals, Stress and time management.

UNIT V

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT VI

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the National Level, State Level and voluntary sector, Youth-focused and Youth-led organizations.

Text Books

1. Government of India, Ministry of Youth Affairs and Sports, ***"National Service Scheme Manual (Revised) 2006"***, New Delhi.
2. University of Mumbai, ***"National Service Scheme Manual"***, 2009.
3. Avhan Chancellor's Brigade – ***"NSS Wing, Training camp on Disaster Preparedness Guidelines"***, March 2012.
4. Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, ***"Rashtriya Seva Yojana Sankalpana"***, Diamond Publication, Pune.

Reference Books:

1. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya.
2. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
3. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
4. Case material as a Training Aid for Field Workers, Gurmeet Hans.
5. Social service opportunities in hospitals, Kapil K. Krishnan, TISS.
6. New Trends in NSS, Research papers published by University of Pune.
7. ANOOGUNJ Research Journal, published by NSS Unit C. K. Thakur college.
8. Training Manual for Field Work published by RGNIYD, Shreeperumbudur.
9. Prof. Ghatole R. N., Rural Social Science and Community Development.
10. Purushottam Shetha, Dr. Shailaja Mane, National Service Scheme, Joint programme of National Service Scheme, University of Mumbai & DISHA – DEEPSHIKHA Projects, Nair Hospital, 2011-12.
11. National Service Scheme in India: A Case study of Karnataka, M. B. Dishad, Trust Publications, 2001.
12. http://www.thebetterindia.com/140/national-service-scheme-nss/
13. http://en.wikipedia.org/wiki/national-service-scheme
14. http://nss.nic.in

Course Title:	**Developmental Engineering**	**Semester III**	
Course Code	**IT305-02**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To use multiple qualitative and quantitative methods to learn about user needs
2. To come up with new ideas, and to understand how new products and services achieve or fail to achieve their goals in a development setting
3. To consider solutions in context and devise business plans and plans for continuous improvement

Course Outcomes:

After learning the course, the students should be able:

1. To provide students with a set of skills that will allow them to flourish in a climate of complex problem solving and design challenges in development engineering
2. To participate in and lead innovation and creativity in collaborative settings
3. To learn from users using qualitative and quantitative tools including surveys, interviews, new monitoring technologies, statistical analyses and experimental designs
4. To apply these skills to current challenges in development engineering

Course Content:

UNIT I

Introduction to Development Engineering: Introduction to development engineering; need of development engineering; core disciplines and concept; major issues in development; urban development; rural development; socioeconomic development; scientific social research, formulation of research problem, field work and data collection, report drafting.

UNIT II

Design of Sustainable Communities: Concept and development of sustainable communities; Sustainable design principles, building regulations, codes and standards – ANSI, ASTM, ASHRAE, approval process; green buildings – green building techniques-energy solutions, site solutions, site solutions, exterior and interior solutions, Certification – BREEAM, GRIHA, NAHB, LEED, IGBC.

UNIT III

Town/City Planning: Town Planning, history of town planning in India, characteristics of city/town, town planning at national, regional and local levels, planning standards, master plan, site layout and development, zoning and density control, green belt, slum redevelopment; Smart city planning introduction to city planning, infrastructure elements of smart city planning, dimensions of smart cities global standards and performance benchmark; smart solutions e-governance, waste management, water management, energy management, urban mobility, citizen services, other services such as tele-medication and education, trade facilitation, skill development; GIS for Planning.

UNIT IV

Planning and Development of Rural Areas: District administration, District Planning, introduction to various sectors of rural areas such as drinking water, Waste water treatment, electricity, public transport, irrigation, sanitation and cooking energy; issues and challenges associated with these sectors; People's participation and role in development of rural areas; various schemes and policies floated by state and central government – phases in the schemes; life cycle costing of these schemes.

UNIT V

Geoinformatics for Planning and Development: Introduction to Geoinformatics; Advantages, benefits and limitations; Interdisciplinary applications; Data extraction; use of Geoinformatics for planning, mapping and preparation of layouts.

UNIT VI

Development aspects: Urban and Rural: Planning and designing of a model town / city and using Auto-CAD and/or GIS, Visit to a village or small town – The project will be carried out in groups. Problem faced by the villagers pertaining to various sectors or existing schemes; define the need, method, tools and techniques for development; deliver technology based solution.

Text Books

1. Chand M. and Purr U.K., ***"Regional Planning in India"***, Allied Publisher, New Delhi, 1983.
2. Kaiser E. J., et.at., ***"Urbun Landuse Planning"***, 4th Edition Urbana, University of Illinois Press.
3. Sundaram K. V., ***"Geography Planning"***, Concept Publishing Co., New Delhi.
4. Ayyar C.P.V., ***"Town Planning in Early South India"***, Mittal Publications, Delhi.
5. Reeder, Hoboken, ***"Guide to green building rating systems"***, John Wiley & Sons Inc.
6. Longley, et.al, ***"Geographic Information Systems and Science"***, John Wiley & Sons, New York.
7. Desai V., ***"Rural Development of India"***, Himalaya Publishing House, Mumbai.
8. Rau S. K., ***"Global Search for Rural Development"***, NIRD, Hyderabad.

Reference Books:

1. Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India, New Delhi, UDPFI Guidelines, 1996.
2. Miles R. Simon, 1970, 'Metropolitan Problems', Methuen Publications, Canada.
3. B.I.S., 1980, 'National Building Code of India', ISI, New Delhi.
4. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High – Performance Green Buildings Except Low-Rise Residential Buildings.
5. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

Course Title:	**Engineering Physics - II**	**Semester III**	
Course Code	**IT305-03**	**Course Type**	**Compulsory**
Pre-requisite	**Engineering Physics - I**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To enrich the understanding of various types of materials and their applications in engineering and technology

Course Outcomes:

After learning the course, the students should be able:

1. To explain the physics of materials and knowledge which can be used for different engineering and technology applications

Course Content:

UNIT I

Crystallography and X -rays: Crystalline and amorphous solids, crystal structure , Lattice point, space lattice, unit cells, lattice parameter and crystal systems, cubic system, number of atoms per unit cell, co-ordination number, atomic radius, packing density, Lattice constant. Lattice plane and Miller Indices, Interpalnner spacing for cubic system, Production and types of x-rays spectrum, x-ray diffraction, Bragg's law, Moseley's law

UNIT II

Conducting Materials: Electrical conduction, free electron theory, Fermi Dirac statistics, band theory of solids, Resistivity of metals, Superconductivity and types- Meissner effect, High temperature superconductor, applications

UNIT III

Semiconductor: Intrinsic and extrinsic semiconductor, conductivity of semiconductor and its temperature dependence, Fermi level, Hall Effect, semiconductor devices (P-N junction diode, Transistor)

UNIT IV

Dielectric Materials: Dielectric constant, polarization, types of polarization Internal field and Claussius-Mosotti equation, types of dielectric materials, temperature and frequency effect, application.

UNIT V

Magnetic Materials and Advanced Materials: Magnetic dipole moment, magnetic flux density, magnetic field strength magnetization, magnetic permeability , types of magnetic materials, domain theory, hysteresis loop, hard and soft materials, Nano materials, physical properties, a ferrites and garnets and application

UNIT VI

Electrodynamics: Coulomb's law for distribution of charges, polarization and Gauss's law, Maxwell's equation, electromagnetic wave equation, propagation of electromagnetic waves in free – space

Text Books

1. Dr. M. N. Avadhanulu, Dr. P. G. Kshrisagar, ***"A Textbook of Engineering Physics"***, S. Chand & Company Pvt. Ltd., 2014.
2. V. Raghavan, ***"Materials Science and Engineering"***, 5th edition, Prentice Hall of India, 2011

Reference Books:

1. E. M. Purcell, D.J. Morin, ***"Electricity and Magnetism"***, Cambridge University Press, 3rd edition, 2013.
2. J. R. Reitz, F. J. Milford and R. W. Christy, ***"Foundation of Electromagnetic Theory"***, Pearson Addison Wesley, 4th edition, 2008.

Course Title:	**Data Communications**	**Semester IV**	
Course Code	**IT401**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand network and transmission models, multiplexing and reception techniques.
2. To identify different types of mediums for transmission, resource sharing and access techniques.
3. To list issues with flow control, error detection and correction methods.
4. To explore different types of network.

Course Outcomes:

After learning the course, the students should be able:

1. To identify basic components of data communication system
2. To distinguish data transmission and modulation techniques
3. To analyze the impact of channel impairments on data transmission
4. To describe medium access methods used for communication

Course Content:

UNIT I

Introduction to Network Models: Components of communication, Data representation, Data flow, Communication model, Net-work, Network topologies, Network connection, LAN, WAN, MAN, Internet, Layered tasks, OSI Model - layered architecture, Layers in OSI model, TCP/IP model, Comparison.

Data and signals: Analog and digital data, Analog and digital signals, Periodic and non-periodic signals, Sine wave, Parameters of sine wave, Time and frequency domain, Composite signals, Bandwidth, Digital signal - bit rate, Baseband and broadband transmission, Trans-mission impairments, Nyquist bit rate, Shannon capacity, Performance: Throughput, latency, bandwidth, delay, jitter.

UNIT II

Analog Transmission and Multiplexing: Digital to analog conversion, Amplitude shift keying, Frequency shift keying, Phase shift keying, Quadrature amplitude modulation, Analog to analog Conversion, Amplitude modulation, Frequency modulation, Phase modulation, Need of multiplexing, Multiplexer and de-multiplexer, Frequency division multiplexing, Wavelength division multiplexing, Time division multiplexing - Statistical TDM, Synchronous TDM, Data rate management in TDM.

UNIT III

Digital Transmission: Digital to digital conversion, Signals element, Data element, Signal rate, Data rate, DC component, Self synchronization, Line coding schemes, NRZ, NRZI, Bipolar AMI, Pseudoternary, Manchester, Differential Manchester, Block coding schemes - 4B/5B, 8B/10B, Scrambling, HDB3, B8ZS, Analog to digital conversion, Pulse code modulation, Delta modulation, Trans-mission modes - Serial and parallel transmission.

UNIT IV

Transmission Media: Guided Media, Twisted pair cable, Co-axial cable, Fiber optic cable, Performance of guided media, Unguided media, Radio waves, Microwaves, Infrared, Introduction to fiber optics, Nature of light, Fiber characteristics, Sources and detectors, Connectors and splices.

UNIT V

Error Detection and Correction: Types of errors, Redundancy, Detection versus correction, Forward error correction and re-transmission, Modular arithmetic, Block Coding , Error detection, Error correction, Hamming

distance, Minimum hamming distance, Linear block codes, Cyclic codes, Cyclic redundancy check, Hardware implementation, Polynomials, Cyclic code analysis, Checksum concept, One's component.

UNIT VI

Introduction to Multiple Access: Random Access Protocol: ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled access: Reservation, Polling, Token passing, Channelization, FDMA, TDMA, and CDMA. Cellular Phones and Satellite Networks, Frequency reuse principle, Roaming, Satellite networks, Orbits, GEO, MEO, LEO satellite.

Text Books

1. W. L. Schweber, ***"Data Communications"***, Tata McGraw Hill Publication, 1st edition, 2009.
2. B. Forouzan, ***"Data Communications and Networking"***, McGraw Hill Publication, 5th edition, 2013.

Reference Books:

1. W. Stallings, ***"Data and Computer Communications"***, Prentice Hall of India Publication, 10th edition, 2013.
2. Trivedi, ***"Data Communication and Networks"***, Oxford University Press, 2016.

Course Title:	**Data Communications Lab**	**Semester IV**	
Course Code	**IT401L**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. Programming using C++ / Java

Lab Experiments List:

1. Implementation of sampling theorem.
2. Implementation of amplitude modulation, frequency modulation, phase modulation.
3. Implementation of frequency division multiplexing and de-multiplexing.
4. Implementation of time division multiplexing and de-multiplexing.
5. Implementation of Amplitude Shift Keying (ASK).
6. Implementation of Frequency Shift Keying (FSK).
7. Implementation of Phase Shift Keying (PSK).
8. Study of stop and wait protocol.
9. Study of ALOHA (Pure and Slotted) and CSMA.
10. Study of CSMA/CD.
11. Study of token passing access method.

Note: Practical 1 to 7 may be implemented with the help of kits

Course Title:	**Data Structures and Applications**	**Semester IV**	
Course Code	**IT402**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
2. To choose the appropriate data structure and algorithm design method for a specified application.
3. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps tournament trees, binary search trees, and graphs and writing programs for these solutions.
4. To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, branch and bound and writing programs for these solutions.

Course Outcomes:

After learning the course, the students should be able:

1. To write neat code by selecting appropriate data structure and demonstrate a working solution for a given problem.
2. To think of all possible inputs to an application and handle all possible errors properly.
3. To analyze clearly different possible solutions to a program and select the most efficient one.
4. To write an application requiring an effort of at least 1000 lines of code to demonstrate a good working solution.
5. To demonstrate the ability to write reusable code and abstract data types in C, using object-based way of thinking.

Course Content:

UNIT I

Introduction to Data Structures and Analysis of Algorithms: Need of data structures, Types of data structures, Recursion, ADT (Abstract Data Types), Basics of algorithm, Analysis of algorithm through time complexity and space complexity, Asymptotic notations, Pseudo code analysis, Recurrence relations and solving recurrences using substitution, Recursion tree and master method.

UNIT II

Stack and Queue: Stack: Representation, Stack operation, Application. Queue: Representation, Queue operation, Circular and priority queue, Applications.

UNIT III

Linked list: Operation on linked list, Linked stacks and Queues, Array implementation of linked list, Linked list using dynamic variable, doubly linked list, Circular linked list.

UNIT IV

Binary Tree: Basic tree concept, Binary tree operations, Binary tree representation, Binary tree traversals, Binary search tree and operations on it, Balanced tree: AVL trees and operations, Applications of binary trees, implementing priority queue using binary heap data structure.

UNIT V

Graphs: Basics concepts of graphs, Representation of graphs, Graph traversals BFS and DFS, Minimum spanning tree algorithms: Kruskal's algorithm and Prim's algorithm, Applications of graphs.

UNIT VI

Searching Techniques and Hashing: Linear search and binary search, Hashing: Direct-address tables, Hash tables, open addressing, Perfect Hashing. Sorting techniques: Various sorting methods and their time complexity analysis: Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort.

Text Books

1. E. Horowitz, D. Mehta, S. Sahni, ***"Fundamentals of Data Structures in C++"***, Silicon Press, 2nd edition, 2008.
2. R.S. Bichkar, ***"Programming with C and Data structures"***, Universities Press, 1st edition, 2014.

Reference Books:

1. Goodrich, Tamassia, ***"Data Structures and Algorithm in Java"***, Wiley publication, 6th edition, 2014.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, ***"Introduction to Algorithms"***, MIT Press, 3rd edition, 2009.
3. Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, ***"Data structures using Java"***, Pearson Education, 2003.
4. J. Murach, ***"Murach's Java Programming"***, Shroff Publishers, 4th edition, 2012.
5. V. Goyal, L. Goyal, P. Kumar, ***"A Simplified Approach to Data Structures"***, Shroff Publishers, 1st edition, 2014

Course Title:	**Programming in Java**	**Semester IV**	
Course Code	**IT403**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To use the Java SDK environment to create, debug and run simple Java programs.
2. To demonstrate knowledge of Java technology and the Java programming language structure of classes and methods.
3. To understand the fundamentals of Java programming such as variables, statements and values
4. To understand and code control structures such as conditional and iterative execution and methods
5. To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
6. To define interfaces and learn to manage exception
7. To learn input and output string manipulation
8. To understand the concept of inheritance and polymorphism
9. To learn the definition of data structures in Java programming language

Course Outcomes:

After learning the course, the students should be able:

1. To write java programs based OOP concepts.
2. To create animation & events based upon advanced java concepts.
3. To connect an application with database.
4. To develop programs using java collection API as well as java Standard Library.
5. To write, debug & document well structured java application

Course Content:

UNIT I

Introduction to Java: Fundamentals of Object-Oriented Programming, Evolution of Java, Overview of java language: Data types in Java, Operators and expressions, Decision making and branching: Control statements such as if-else, do statement, for statement, The else if ladder, jumps in loops, labeled loops, while repetition statement, Switch statement, Break and continue statement, Arrays, Strings ,Vectors, Wrapper classes, Enumerated types, Annotations.

UNIT II

Object Oriented Programming: Classes, Objects and methods: Defining class, Methods, Creating objects, Accessing class members, Static methods, Finalize methods, Visibility control, Method overloading, Method overriding, Recursion, Interfaces, Constructors.

UNIT III

Packages and Applet Programming: Java API packages, Using system packages, Naming conventions, Creating packages and jar files, Accessing and using a package, Hiding classes, Applet programming

UNIT IV

Multithreading: Creating threads, Extending thread class, stopping and blocking a thread, Life cycle of a thread, Using thread method, Thread exceptions, implementing the run able interface, Inter thread communication.

Managing errors and exceptions: Types of errors, Exceptions, Syntax of exception handling code, multiple catch statements, throwing your own exception, using exceptions for debugging.

UNIT V

Graphics Programming: The graphics class, Lines and rectangles, Circles, Arc and ellipses, Polygons, Drawing bar charts, AWT package and swings.

UNIT VI

Managing Files and I/O Handling: Files and streams, Stream classes, Byte stream classes, Character stream classes, Using streams, Reading / writing bytes and characters, Interactive input and output, Other stream classes.

Text Books

1. B. Eckel, ***"Thinking in Java"***, Prentice Hall of India Publication, 2nd edition, 2000.
2. Steven Holzner, ***"Java 8 Programming: Black Book"***, Dreamtech Press, 2015.
3. H.M. Deitel, P.J. Deitel, ***"Java: How to Program (Early Objects)"***, Pearson Publication, 10th edition, 2014.

Reference Books:

1. P. Naughton, ***"The Java Handbook"***, McGraw Hill Publication, 1996.
2. T. Lindholm, F. Yellin, ***"The Java Virtual Machine Specification"***, Addison Wesley Publication, 1996.
3. E. Balagurusamy, ***"Programming with Java: A Primer"***, Tata McGraw Hill Publication, 5th Edition, 2014.
4. J. Murach, M. Urban, ***"Murach's Beginning Java with Eclipse"***, Shroff Publishers, 1st edition, 2016.

Course Title:	**Data Structures and Applications Lab**	**Semester IV**	
Course Code	**IT402L**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To implement all linear and non-linear data structures in Java

Lab Experiments List:

1. To implement a character stack data type and use it to reverse a string.
2. To implement an integer stack data type that grows on demand.
3. To write a program using appropriate stacks for evaluating an infix expression with parenthesis.
4. To write a program, using a queue data type, to simulate a bank where customers are served on a first-come-first-serve basis.
5. To write one program for each of the following operations with singly linked lists:
    a. Concatenate two linked list and create third one.
    b. Free all nodes in a linked list
    c. Reverse a linked list
    d. Given two linked list, create a third list which is set-intersection of the elements in the two.
6. To delete every third element from the linked list.
7. To copy a given linked list into another (new) list
8. To implement a queue using a doubly linked list.
9. To write the following recursive functions for a singly-linked NULL-terminated list: insert(), traverse(), search().
10. To create simple application to access data base using JDBC
11. To read and write the files
12. To programs to implement polymorphism and method overriding in java.
13. To write programs implementing exception handling.
14. To programs to illustrate interfaces in java.
15. To write programs to create package in java
16. To design of multithreaded programs in java.
17. To write programs to manipulate strings.
18. To write programs to draw various shapes using java applets.

Course Title:	**Computer Organization and Architecture**	**Semester IV**	
Course Code	**IT404**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand the structure, functions and characteristics of computer systems
2. To learn basics of Parallel Computer Architecture.
3. To study hierarchical memory system including cache memories and virtual memory.
4. To identify input / output devices and their data transfer mechanism.

Course Outcomes:

After learning the course, the students should be able:

1. To identify components of a computer system, including CPU, memory, and input/output units.
2. To explain instruction types, its execution and interrupt mechanism.
3. To illustrate numerical and character representations in digital logic and floating point arithmetic.

Course Content:

UNIT I

Computer Evolution and Arithmetic: Computer structure and function, Designing for performance, Von Neumann architecture, Hardware architecture, Interconnection structures, Bus interconnection, Arithmetic and logic unit, Scalar data types, Fixed and floating point numbers, Booths algorithm, Hardware implementation, Division, Restoring and non restoring algorithms.

UNIT II

The Central Processing Unit: Machine instruction characteristics, Types of operands, Types of operations, Instruction for-mats, Instruction types, Processor organization, Register organization, Instruction cycle, Instruction pipelining.

UNIT III

The Control Unit: Single bus organization, Control unit operations: Instruction sequencing, Micro operations and register transfer, Hardwired implementation, Micro-programmed control, Control unit design, Microinstructions and micro- program sequencing, Microinstruction execution.

UNIT IV

Memory Organization: Characteristics of memory systems, Internal and external Memory, Types of memories, High-speed memories: Cache memory, Organization and mapping techniques, Replacement algorithms, Cache coherence, Virtual memory, Address translation: virtual to physical, Secondary storage devices.

UNIT V

I/O Organization: Input/output Systems, Programmed I/O, Interrupt driven I/O, Direct memory access (DMA), Input/Output Channels and processors.

UNIT VI

Parallel Organization: Parallelism in uni-processor systems, Instruction level pipelining, Pipeline computers, Array computers, multiple processor organizations, closely and loosely coupled multiprocessors systems, Symmetric multiprocessors.

Text Books

1. J. P. Hayes, ***"Computer Architecture and Organization"***, McGraw-Hill Publication, 3rd edition, 2012.
2. K. Hwang, Briggs, ***"Computer Architecture and Parallel Processing"***, Tata McGraw Hill Publication, 1st edition, 2012.

Reference Books:

1. W. Stallings, ***"Computer Organization and Architecture: Designing for Performance"***, Prentice Hall of India Publication, 9th edition, 2012.
2. A. S. Tanenbaum, ***"Structured Computer Organization"***, Prentice Hall of India Publication, 5th edition, 2005.
3. G. George, ***"Computer Organization: Hardware and Software"***, Prentice Hall of India Publication, 2nd edition, 1986.
4. D. A. Patterson, J. L. Hennessy, ***"Computer Organization and Design: The Hardware / Software Interface"***, Morgan Kauffmann Publication, 5th edition, 2014.
5. C. Hamacher, V. Zvonko, S. Zaky, ***"Computer Organization"***, McGraw Hill Publication, 6th edition, 2012.

Course Title:	**Numerical Methods**	**Semester IV**	
Course Code	**MA401**	**Course Type**	**Compulsory**
Pre-requisite	**Engineering Mathematics**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand working understanding of numerical methods
2. To learn various numerical algorithms
3. To study the concept of error in these methods, analyze and predict it.
4. To implement numerical methods through programming languages

Course Outcomes:

After learning the course, the students should be able:

1. To construct a curve by least squares method
2. To analyze the data based on large and small sample sizes
3. To determine an interpolating function for data
4. To solve initial value problems

Course Content:

UNIT I

Solution of Algebraic and Transcendental Equation: Bisection method, Method of false position, Newton's method and Newton-Raphson method, approximate solution of equation – Horner's method.

UNIT II

Solution of Linear Simultaneous Equation: Gauss elimination method, Gauss-Jordan method, Crout's triangular method, Iterative method of solution- Jacobi iteration method, Gauss-Seidal iteration method, Relaxation method.

UNIT III

Finite Differences: Forward difference operator, backward difference operator, Central difference operator, Newton's interpolation formulae, Newton's forward–backward-central interpolation formulae, Sterling formula, Bessel's formula, Interpolation with unequal intervals.

UNIT IV

Differentiation and Integration: Newton-Cortes formula, Trapezoidal rule, Simpson one–third rule, Simpson three-eighth rule, Weddle's rule.

UNIT V

Numerical Solution of ODE: Picard's methods, Taylor series method, Euler's method, Modified Euler's method, Runge - Kutta method, Predictor–corrector method, Milne's method.

UNIT VI

Adams-Bash fourth method, Second–order differential equation, Numerical solution for elliptical partial differential equation.

Text Books

1. B.S Grewal, ***"Higher Engineering Mathematics"***, 40th edition, Khanna Publication.
2. S. S. Shastri, ***"Introduction to Numerical Methods"***, PHI Publication.

Reference Books:

1. Conte and De boor, ***"Elementary Numerical Analysis"***, BPB Publication.
2. V. Rajaraman, ***"Computer Oriented Methods"***, 3rd edition, PHI Publication
3. E. Kreyszig, ***"Advanced Engineering Mathematics"***, BPB Publication.
4. Steven C. Chapra, ***"Numerical Methods for Engineers"***, 5th edition, McGraw Hill Publication.

Course Title:	**Programming Lab (Python)**	**Semester IV**	
Course Code	**IT406L**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn Python programming

Lab Experiments List:

1. Program to Find the Union of two Lists
2. Program to Find the Intersection of Two Lists
3. Program to Remove the “I” th Occurrence of the Given Word in a List where Words can Repeat
4. Program to Remove All Tuples in a List of Tuples with the USN Outside the Given Range
5. Program to Count the Occurrences of Each Word in a Given String Sentence
6. Program to Check if a Substring is Present in a Given String
7. Program to Map Two Lists into a Dictionary
8. Program to Count the Frequency of Words Appearing in a String Using a Dictionary
9. Program to Create a Dictionary with Key as First Character and Value as Words Starting with that Character
10. Program to Find the Length of a List Using Recursion
11. Program to Read a File and Capitalize the First Letter of Every Word in the File
12. Program to Read the Contents of a File in Reverse Order
13. Program to Create a Class in which One Method Accepts a String from the User and Another Prints it
14. Program to Create a Class and Get All Possible Subsets from a Set of Distinct Integers

Course Title:	**NSS-2**	**Semester III**	
Course Code	**IT405-01**	**Course Type**	**Compulsory**
Pre-requisite	**NSS-1**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To acquire leadership quality & democratic attitude
2. To develop competence in group living

Course Outcomes:

After learning the course, the students should be able:

1. To create environmental awareness
2. To participate in relief and rehabilitation work during natural calamities

Course Content:

UNIT I

Citizenship: Basic Features of Constitution of India, Fundamental Rights and Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

UNIT II

Health, Hygiene & Sanitation: Definition, Needs and scope of health education, Food and Nutrition, Safe drinking water, Water borne diseases and sanitation, National Health Programme, Reproductive health, Healthy Lifestyles, HIV AIDS, Drugs and Substance abuse, Home Nursing, First Aid.

UNIT III

Youth and Yoga: History, Philosophy and concept of Yoga, Myths and misconceptions about yoga, Different Yoga traditions and their Impacts Yoga as a preventive, pro-motive, and curative method, Yoga as a tool for healthy lifestyle.

UNIT IV

Environment Issues: Environment conservation, Enrichment and Sustainability, Climate change, Waste management, Natural resource management, Rain water harvesting, Energy conservation, Waste land development, Soil conversations and forestation.

UNIT V

Disaster a Management: Introduction to Disaster Management, Classification disaster, Role of youth in Disaster Management.

UNIT VI

Youth and crime: Sociological and psychological factors influencing youth crime, Peer mentoring in preventing crime, Awareness about anti-ragging, Cybercrime and its prevention, Juvenile justice.

Text Books

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual, 2009.
3. Avhan Chancellor's Brigade – NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.

4. Rashtriya Seva Yojana Sankalpana – Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya.

Reference Books:

1. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
2. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
3. Case material as a Training Aid for Field Workers, Gurmeet Hans.
4. Social service opportunities in hospitals, Kapil K. Krishnan, TISS.
5. New Trends in NSS, Research papers published by University of Pune.
6. ANOOGUNJ Research Journal, published by NSS Unit C. K. Thakur college.
7. Training Manual for Field Work published by RGNIYD, Shreeperumbudur.
8. Prof. Ghatole R. N., Rural Social Science and Community Development.
9. Purushottam Sheth, Dr. Shailaja Mane, National Service Scheme.
10. Joint programme of National Service Scheme, University of Mumbai & DISHA – DEEPSHIKHA Projects, Nair Hospital, 2011-12.
11. National Service Scheme in India: A Case study of Karnataka, M. B. Dishad, Trust - Publications, 2001.
12. http://www.thebetterindia.com/140/national-service-scheme-nss/
13. http://en.wikipedia.org/wiki/national-service-scheme
14. http://nss.nic.in

Course Title:	**Environmental Sciences**	**Semester III**	
Course Code	**IT405-02**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To demonstrate the ability to plan and execute experiments that demonstrate the use and understanding of modern instruments, accurate quantitative measurements, appropriate recording skills, safe lab practices, and appropriate use of computer applications
2. To demonstrate their ability to communicate effectively in written and oral form, demonstrating the ability to create an appropriate annotated bibliography and the ability to use effective presentation skills
3. To develop a sense of community responsibility by becoming aware of scientific issues in the larger social context
4. To demonstrate interpretative skills including the ability to analyze data statistically, assess reliability, interpret results and draw reasonable conclusions
5. To be well grounded in laws and theories of chemistry by demonstrating and applying the scientific method, developing a synthetic strategy toward a target molecule and effective use of chemical literature
6. To develop standards of professional behavior that include rules of ethics and etiquette

Course Outcomes:

After learning the course, the students should be able:

1. To understand the natural environment and its relationships with human activities.
2. To characterize and analyze human impacts on the environment.
3. To integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. To acquire practical skills for scientific problem-solving, including familiarity with laboratory and field instrumentation, computer applications, statistical and modeling techniques.
5. To understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data
6. To design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments

Course Content:

UNIT I

Environment, Ecosystems and Biodiversity: Definition, scope and importance of Risk and hazards; Chemical hazards, physical hazards, Biological hazards in the environment, concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle, energy flow in the ecosystem, ecological succession processes, Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Introduction to biodiversity definition: genetic, species and ecosystem diversity, bio geographical classification of India, value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values , Biodiversity at global, national and local levels, India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems, pond, river, hill slopes, etc.

UNIT II

Environmental Pollution: Definition, causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere, formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures, Control of particulate

and gaseous emission, Control of SO2, NOX, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters, physical, chemical and biological; absorption of heavy metals, Water treatment processes. (c) Soil pollution, soil waste management: causes, effects and control measures of municipal solid wastes, (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards, role of an individual in prevention of pollution, pollution case studies, Field study of local polluted site, Urban / Rural / Industrial / Agricultural.

UNIT III

Natural Resources: Forest resources: Use and over-exploitation, deforestation, case studies, timber extraction, mining, dams and their effects on forests and tribal people, Water resources: Use and overutilization of surface and ground water, dams-benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies,

UNIT IV

Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes, Biogas, production and uses, anaerobic digestion; case studies, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins, Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets, river / forest / grassland / hill / mountain

UNIT V

Social Issues and the Environment

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies, role of non-governmental organization environmental ethics: Issues and possible solutions, 12 Principles of green chemistry, nuclear accidents and holocaust, case studies, wasteland reclamation, consumerism and waste products, environment production act, Air act, Water act, Wildlife protection act, Forest conservation act, The Biomedical Waste (Management and Handling) Rules; 1998 and amendments scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation, central and state pollution control boards, disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT VI

Human Population and Environment

Population growth, variation among nations, population explosion, family welfare programmes, environment and human health, human rights, value education, HIV / AIDS – women and child welfare, Environmental impact analysis (EIA), GIS-remote sensing-role of information technology in environment and human health, Case studies.

Text Books / Reference Books:

1. Agarwal, K. C. ***"2001 Environmental Biology"***, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, ***"The Biodiversity of India"*** , Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
3. Brunner R. C., ***"Hazardous Waste Incineration"***, McGraw Hill Inc.
4. Clark R.S., ***"Marine Pollution"***, Clanderson Press Oxford (TB)
5. Cunningham, W. P. Cooper, T. H. Gorhani, E & Hepworth, M. T. 2001, ***"Environmental Encyclopedia"***, Jaico Publ. House, Mumbai,
6. De A. K., ***"Environmental Chemistry"***, Wiley Eastern Ltd.
7. Hawkins R.E., ***"Encyclopedia of Indian Natural History"*** , Bombay Natural History Society, Bombay (R)
8. Rao M N. & Datta, A. K. 1987. ***"Waste Water treatment"***. Oxford & IBH Publ. Co. Pvt. Ltd

Course Title:	**Engineering Chemistry - II**	**Semester III**	
Course Code	**IT405-03**	**Course Type**	**Compulsory**
Pre-requisite	**Engineering Chemistry - I**	**L – T – P**	**3 – 2 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To introduce this subject of Advanced Engineering Chemistry
2. To impart the basic and advanced knowledge to the students
3. To understand, remember and capable to explain and apply this knowledge in the field of Engineering/ Technology

Course Outcomes:

After learning the course, the students should be able:

1. To classify and explain various types of Corrosion and should apply methods to minimize the rate of Corrosion.
2. To apply concepts of Photochemical and Thermal reactions.
3. To explain basic concepts of Polymers, Polymerization and
4. To determine molecular weight of High-Polymer.
5. To apply the basic techniques in Chemistry and capable to explain concept of Solvent Extraction.
6. To determine and apply various types of Spectroscopic,
7. To explain concept of Thermo Gravimetric Analysis (TGA).

Course Content:

UNIT I

Corrosion and its Control: Introduction, Fundamental reason, Electrochemical Corrosion, Direct Chemical Corrosion, Factors affecting the rate of corrosion, types of corrosion-Galvanic, Pitting Corrosion, Microbiological corrosion, Stress corrosion, methods to minimize the corrosion- Proper design, Cathodic and Anodic protection.

UNIT II

Metals and Alloys: Metals: Introduction, Properties of metals and alloys. Occurrence, extraction, properties and uses of Ni, Cr and Ti. Alloys: Introduction, Need for alloying Steel, Application of Alloy Steel.

UNIT III

Polymers and its Characterization: Introduction, molecular weight determination by osmotic pressure and viscosity method, polymers in medicines and surgery, inorganic polymers: silicones. Classes of polymerization (Synthesis and Characterization). Plastic, Molding of plastic.

UNIT IV

Basic Techniques in Chemistry: Preparing substances for analysis, dissolving the samples, Precipitation, Filtration, Washing Precipitate, Drying and Igniting precipitate. Solvent Extraction: Aqueous and Organic phase liquid – liquid extraction.

UNIT V

Spectroscopy: Brief introduction to spectroscopy, UV – Visible Spectroscopy: Laws of absorption, instrumentation and application. IR spectroscopy: introduction, theory, instrumentation and application. Brief discussion on NMR Spectroscopy and its Applications. Brief introduction of AAS (Atomic Absorption Spectroscopy)

UNIT VI

Instrumental Methods of Analysis: Introduction to Chromatography, Types of Chromatography (Adsorption and partition chromatography), Paper and Thin Layer Chromatography, Gas Chromatography – introduction, theory, instrumentation. Brief discussion of Thermo gravimetric analysis (TGA).

Text Books

1. Bhal and Bhal, ***"Advance Organic Chemistry"***, S. Chand & Company, New Delhi, 1995.
2. Jain P.C & Jain Monica, ***"Engineering Chemistry"***, Dhanpat Rai & Sons, Delhi, 1992.
3. Bhal & Tuli, ***"Text book of Physical Chemistry",*** S. Chand & Company, New Delhi, 1995.
4. Chatwal Anand, ***"Instrumental Methods of Analysis"***, Himalaya Publication.

Reference Books:

1. Finar I.L., ***"Organic Chemistry (Vol. I & II)"***, Longman Gr. Ltd & English Language Book Society, London.
2. Barrow G.M., ***"Physical Chemistry"***, McGraw-Hill Publication, New Delhi.
3. Shikha Agarwal, ***"Engineering Chemistry- Fundamentals and Applications"***, Cambridge Publishers - 2015.
4. O. G. Palanna, ***"Engineering Chemistry"***, Tata McGraw-Hill Publication, New Delhi.
5. WILEY, ***"Engineering Chemistry"***, Wiley India, New Delhi 2014.
6. Willard, Dean, Merrit, ***"Instrumental Methods of Analysis"***, McGraw - Hill.
7. ***"Physical Chemistry"***, Glasstone.
8. Peter Atkins, ***"Physical Chemistry"***, W.H. Freeman & Co. 9th Edition, 2009.

Third Year B.Tech. In Information Technology

Bachelor of Technology (Information Technology) - Third Year - Semester V															
Sr. No.	Course Code	Title of the Course	Teaching Structure			Assessment Structure						Marks	Credits	Hours per week
			L	T	P	Mid Test	CA-1	CA-2	ESE	TW	PR			
1	IT501	Database Management Systems	3	0	0	20	10	10	60	-	-	100	3	3
2	IT501L	Data Base Management Systems Lab	0	0	2	-	-	-	-	25	25	50	1	2
3	IT502	Computer Algorithms	3	0	0	20	10	10	60	-	-	100	3	3
4	IT502L	Computer Algorithms Lab	0	0	2	-	-	-	-	25	25	50	1	2
5	IT503	Computer Networks	3	2	0	20	10	10	60	-	-	100	4	5
6	IT504DE	Departmental Elective - Group 1	3	0	0	20	10	10	60	-	-	100	3	3
7	IT504DEL	Departmental Elective - Group 1 Lab	0	0	2	-	-	-	-	25	25	50	1	2
8	IT505SE	Stream Elective - Group 1	3	2	0	20	10	10	60	-	-	100	4	5
9	IT506	Seminar	1	2	0	-	-	-	-	50	-	50	2	3
10	IT507	Programming Lab - Minor	0	2	2	-	-	-	-	25	25	50	2	4
Summary of Semester Assessment Marks, Credit & Hours			16	8	8	100	50	50	300	150	100	750	24	32

List of Departmental Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT504DE-01	Software Testing	Nil
2	IT504DE-02	Software Project Management	Nil
3	IT504DE-03	Compiler Construction	Data Structures

List of Stream Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT505SE-01	Software Engineering	Nil
2	IT505SE-02	IT Service Management	Nil
3	IT505SE-03	Information Storage Management	Computer Organization & Architecture
4	IT505SE-04	Network Management	Computer Networks
5	IT505SE-05	Data Visualization	Database Management Systems

Bachelor of Technology (Information Technology) - Third Year - Semester VI															
Sr. No.	**Course Code**	**Title of the Course**	**Teaching Structure**			**Assessment Structure**						**Marks**	**Credits**	**Hours per week**
			L	**T**	**P**	**Mid Test**	**CA-1**	**CA-2**	**ESE**	**TW**	**PR**			
1	IT601	Operating Systems	3	0	0	20	10	10	60	-	-	100	3	3
6	IT601L	Operating Systems Lab	0	0	2	-	-	-	-	25	25	50	1	2
2	IT602	Theory of Computing	3	2	0	20	10	10	60	-	-	100	4	5
3	IT603	Object Oriented System Design	3	0	0	20	10	10	60	-	-	100	3	3
7	IT603L	Object Oriented System Design Lab	0	0	2	-	-	-	-	25	25	50	1	2
4	IT604DE	Open Elective / Department Elective - Group 2	3	2	0	20	10	10	60	-	-	100	4	5
5	IT605SE	Stream Elective - Group 2	3	0	0	20	10	10	60	-	-	100	3	3
8	IT605SEL	Stream Elective - Group 2 Lab	0	0	2	-	-	-	-	25	25	50	1	2
10	IT606L	Programming Lab - Major	1	4	2	-	-	-	-	50	50	100	4	7
Summary of Semester Assessment Marks, Credit & Hours			16	8	8	100	50	50	300	75	75	750	24	32

List of Departmental Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT604DE-01	Enterprise Resource Planning	Database Management Systems
2	IT604DE-02	Decision Support System	Database Management Systems
3	IT604DE-03	Discrete Mathematics	Engineering Mathematics

List of Stream Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT605SE-01	Embedded Systems	Microprocessor & Microcontroller
2	IT605SE-02	Data Storage Technologies & Networks	Computer Networks, Operating Systems
3	IT605SE-03	Service Oriented Architecture	Nil
4	IT605SE-04	Network Programming	Computer Networks, Operating Systems
5	IT605SE-05	Advanced Database	Database Management Systems

Course Title:	**Database Management Systems**	**Semester V**	
Course Code	**IT501**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand architecture and functioning of database management systems.
2. To learn relational mode.
3. To use structured query language (SQL) and its syntax, transactions, database recovery and techniques for query optimization
4. To acquaint with various normalization forms and query processing.
5. To learn indexing methods

Course Outcomes:

After learning the course the students should be able:

1. To explain need of database management.
2. To design and implement a database schema for a given problem-domain
3. To normalize a database
4. To create and query a database using SQL DML/DDL commands, stored procedures and functions..
5. To declare and enforce integrity constraints on a database
6. To illustrate understanding of indexing methods.

Course Content:

UNIT I

Introduction: Basic concepts, Advantages of DBMS over file-processing systems, Data abstraction, Data models and data independence, Components of DBMS and overall structure of DBMS, Data modeling, Entity, Attributes, Relationships, Constraints, Keys E-R diagrams, Components of E-R Model.

UNIT II

Relational Model: Basic concepts, Attributes and domains, Concept of integrity and referential constraints, Schema diagram. Relational query languages, Relational Algebra and Relational Calculus: Tuple relational and domain relational calculus.

UNIT III

Structured Query Language-I: Introduction, Characteristics and advantages, Data types and literals, DDL, Tables: creating, modifying, deleting, Views: creating, dropping, Updation using views, DML, Operators, SQL DML queries, SELECT query and clauses.

UNIT IV

Structured Query Language- II: Set operations, Predicates and joins, Set membership, Tuple variables, Set comparison, Ordering of tuples, Aggregate functions, Nested queries, Database modification using SQL Insert, Update and Delete queries, Dynamic and embedded SQL and concept of stored procedures, Query-by-example.

UNIT V

Relational Database Design: Notion of normalized relations, Functional dependency, Decomposition and properties of decomposition, Normalization using functional dependency, Multi-valued dependency and join dependency. Storage and File Systems: Secondary storage, RAID, File organization, Indices, Static and dynamic hashing, B-Trees and B+ Trees.

UNIT VI

Query Processing and Transaction Management: Measures of query cost, Selection operation, Sorting and join operation, Transaction concept, Components of transaction management, Concurrency and recovery sys-tem, Different concurrency control protocols such as timestamps and locking, Validation, Multiple granularity, Deadlock handling, Different crash recovery methods such as log-based recovery, Shadow-paging, Buffer management and Remote backup system.

Text Books

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, ***"Database System Concepts"***, 6th edition, McGraw Hill Education, 2011.
2. Ramez Elmasri and Shamkant B. Navathe, ***"Fundamental Database Systems"***, 7th edition, Pearson Education, 2015.
3. Raghu Ramkrishnan, Johannes Gehrke, ***"Database Management Systems"***, 3rd edition, McGraw Hill Education, 2007.

Reference Books:

1. Carlos Coronel, Steven Morris ***"Database systems: Design Implementation and Management"***, 11th edition, Cengage Learning Press, 2014.
2. J. Murach, ***"Murach's MySQL"***, 2nd edition, Shroff Publication, 2016.
3. J. Murach, ***"Murach's Oracle SQL and PL/SQL: Works with All Versions Through 11g"***, Shroff Publication, 2008.

Course Title:	**Database Management Systems Lab**	**Semester V**	
Course Code	**IT501L**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design a database adopting the principles of relational database model
2. To practice and master DDL and DML through SQL
3. To learn building efficient queries to interact with a database

Lab Experiments List:

1. Creation of databases and use of SQL commands (DDL, DML and DCL).
2. Suitable exercises to practice SQL commands may be given for Insert, Update and Delete
3. Write SQL procedure for an application which uses exception handling.
4. Write SQL procedure for an application with cursors.
5. Write SQL for implementing Nested Queries.
6. Write SQL for implementing Join Queries.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write SQL block containing triggers.
9. Write SQL block containing stored procedures.
10. Develop a menu driven, GUI-based database application in any one of the domains such as Banking, Billing, Library management, Payroll, Insurance, Inventory, Healthcare etc. integrating all the features specified in the above exercises.

Course Title:	**Computer Algorithms**	**Semester V**	
Course Code	**IT502**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn fundamentals of algorithms design techniques
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To analyze the performance of algorithms, to compare algorithms with respect to time and space complexity.
4. To develop proficiency in problem solving and programming.

Course Outcomes:

After learning the course the students should be able:

1. Develop efficient algorithms for simple computational tasks
2. Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.
3. Design standard algorithms such as sorting, searching, and problems involving graphs.
4. Compute complexity measures of algorithms, including recursive algorithms using recurrence relations.

Course Content:

UNIT I

Introduction: Instruction counts, Growth functions, Necessity of time and space analysis of algorithms, Order notations (O, Θ, Ω notations), Problem instance size, frequently occurring recurrence relations in analysis of algorithms.

UNIT II

Design Techniques-I: Divide and Conquer: Binary search, finding maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication. Greedy Algorithms: Knapsack problem, Job sequencing with deadlines, optimal storage on tapes, Optimal merge pattern, Single source shortest paths.

UNIT III

Design Techniques-II: Dynamic Programming: Multistage graphs, All pairs shortest paths, 0/1 Knapsack, Travelling salesman problem.

UNIT IV

Design Techniques: Backtracking: 8-Queens Problems, Sum of subsets, Graph coloring. Branch-and-bound: Least cost (LC) search, Control abstractions for LC search, FIFO branch and bound, LC branch and bound.

UNIT V

Selected Algorithms from Various Areas: Graph Theory, Elementary Algorithms: DFS, BFS, Topological Sort, Minimum spanning trees (Kruskal and Prim's algorithms), Shortest Paths: Single source shortest paths, all pairs shortest paths, String Matching: The naive string-matching algorithm, The Robin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

UNIT VI

Complexity Theory: Lower-bound arguments, NP-completeness: Introduction to NP-Complete, Reducibility (SAT, Independent Set, 3VC, Subset Sum and Partition, Hamiltonian Circuit).

Text Books

1. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, ***"Introduction to Algorithms"***, 3rd edition, MIT Press, 2009.
2. E. Horowitz, S. Sahni and S. Rajsekaran, ***"Computer Algorithms"***, 2nd edition, Silicon Press, 2008.

Reference Books:

1. B. K. Joshi, ***"Data Structures and Algorithms in C++"***, Tata McGraw Hill Education, 2010.
2. G. T. Heineman, Gary Pollice, Stanley Selkow, ***"Algorithms in a Nutshell"***, 1st edition, Shroff Publication, 2008.
3. Kyle Loudon, ***"Mastering Algorithms with C"***, 1st edition, Shroff Publication, 2008.

Course Title:	**Computer Algorithms Lab**	**Semester V**	
Course Code	**IT502L**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design a develop various algorithms and analyze its efficiency to a specific problem

Lab Experiments List:

1. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and conquer method works along with its time complexity analysis: worst case, average case and best case.
2. Implement the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
3. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program.
4. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
5. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
6. Write programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm
7. (b) Implement Travelling Sales Person problem using Dynamic programming.
8. Design and implement a program to find a subset of a given set S = Sl, S2,.....,Sn of n positive integers whose SUM is equal to a given positive integer d. For example, if S = 1, 2, 5, 6, 8 and d = 9, there are two solutions 1, 2,6and 1, 8. Display a suitable message, if the given problem instance doesn't have a solution.
9. Design and implement a program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Title:	**Computer Networks**	**Semester V**	
Course Code	**IT503**	**Course Type**	**Mandatory**
Pre-requisite	**Computer Organization & Architecture**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand state-of-the-art in network protocols, architectures, and applications
2. To provide students with a theoretical and practical base in computer networks issues
3. To define the basic terminology of computer networks
4. To recognize the individual components of the big picture of computer networks
5. To outline the basic network configurations
6. To list the layers of the TCP/IP and OSI model and describe the duties of each layer
7. To understand the transmission methods underlying LAN and WAN technologies.

Course Outcomes:

After learning the course the students should be able:

1. To understand fundamental underlying principles of computer networking
2. To describe and analyze the hardware, software, components of a network and the interrelations.
3. To analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies;
4. To demonstrate basic knowledge of the use of cryptography and network security;
5. To demonstrate basic knowledge of installing and configuring networking applications.
6. To specify and identify deficiencies in existing protocols, and then go onto select new and better protocols.

Course Content:

UNIT I

The physical Layer and Data Link Layer: The theoretical basis for data communication, Guided transmission media, Wireless transmission, Communication satellites, Digital modulation and multiplexing, The public switched telephone network, The mobile telephone system, Data link layer: Design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols.

UNIT II

The Medium Access Control - I: The channel allocation problem, Multiple access protocols - ALOHA, Carrier Sense Multiple Access (CSMA) protocols, Collision free protocols, Limited contention protocols. Ethernet: Physical layer, MAC sub layer protocol, Performance, Switched, Fast, Gigabit Ethernet, Wireless LANs - 802.11 architecture and protocol stack, Physical layer, MAC sub-layer protocol, Frame structure .

UNIT III

The Medium Access Control – II: Broadband wireless: Comparison of 802.16 with 802.11 and 3G, Architecture and protocol stack, Physical layer, MAC sub layer protocol, Frame structure. Bluetooth: Architecture, Applications, Protocol stack, Radio layer, Link layer, Frame structure, RFID, Data link layer switching: Uses of bridges, Learning bridges, Spanning tree bridges, Repeaters, Hub, Switches, Routers, and Gateways.

UNIT IV

The Network Layer: Network layer design issues, Store and forward packet switching, Service to the transport layer, Implementation of connectionless service, Connection-oriented service. Routing Algorithms: The optimality principle, Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing. Congestion Control Algorithms: Approaches to congestion control, Traffic aware routing, Admission control, integrated services, differentiated services.

UNIT V

The Transport Layer: The transport services: Service provided to the upper layers, Transport service primitives, Berkeley sockets, Elements of transport protocols: Addressing, Connection establishment, Connection release, Error control and flow control, multiplexing. Congestion control: Desirable bandwidth allocation, sending rate regulation.

UNIT VI

The Application Layer: Domain Name System (DNS): Name space, Domain resource records, Name servers. Electronic mail: Architecture and services, the user agent, Message formats, Message transfer, Final delivery. World Wide Web: Architectural overview, Static web pages, Dynamic web pages and web applications, HTTP

Text Books

1. A.Tanenbaum, ***"Computer Networks"***, Pearson Education, 5th edition, 2010.
2. B. Forouzan, ***"Data Communications and Networking"***, Tata McGraw Hill Publication, 5th edition, 2013.

Reference Books:

1. S. Keshav, ***"An Engineering Approach to Computer Networking: ATM Networks, the Internet, and the Telephone Network"***, Addison-Wesley Publication, 1997.
2. D. E. Comer, ***"Computer Networks and Internet"***, Pearson Education, 5th edition, 2009.
3. M. Gallo, W. Hancock, ***"Computer Communications and Networking Technologies"***, Brooks/Cole, 2001.

Course Title:	**Software Testing**	**Semester V**	
Course Code	**IT504DE-01**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Department**	**Credits**	**3**

Course Objectives:

1. To study fundamental concepts in software testing, including software testing objectives, processes, criteria, strategies, and methods.
2. To learn planning of a test project, designing test cases and test data, conducting test operations, managing software problems and defects, and generating a test report.
3. To develop an understanding of the meaning and importance of quality in relation to software systems and the software development process.
4. To study issues and techniques for implementing and managing software quality assurance processes and procedures.

Course Outcomes:

After learning the course the students should be able:

1. To apply software testing knowledge and its processes to software applications.
2. To identify various software testing problems
3. To solve software testing problems by designing and selecting software test models, criteria, strategies and methods.
4. To apply the techniques learned to improve the quality of software development.
5. To prepare a software quality plan for a software project.

Course Content:

UNIT I

Principles of Testing Software development life cycle model: Phases of software project, Quality, Quality assurance and quality control, Testing, Verification and validation, Process models to represent various phases, Life cycle models, Software testing life cycle.

UNIT II

White Box Testing (WBT) and Black Box Testing: Static testing, Structural testing, Challenges in WBT. Black box testing: Black box testing process.

UNIT III

Integration Testing: Definition, As a type of testing: Top-down integration, Bottom-up integration, Bi-directional integration, System integration, Choosing integration method, As a phase of testing, Scenario testing: System scenarios, Use case scenarios, Defect bash.

UNIT IV

System and Acceptance Testing, Functional Vs non Functional, Functional system testing, Non- functional system testing, Acceptance testing.

UNIT V

Performance testing, Regression testing, Internationalization testing, Adhoc testing. Factors governing performance of testing, Methodology, tools and process for performance testing. Regression Testing: Introduction, Types of Regression testing, Regression testing process. Adhoc testing: Introduction, Buddy testing, Pair testing, exploratory testing, Iterative testing, Agile and Extreme testing, XP work flow, Defect seeding.

UNIT VI

Testing Object Oriented Software: Introduction, Comparison of object oriented and procedural software, Sys-tem testing example, Unit testing of classes, Tools for testing object oriented software, Testing web applications.

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh, ***"Software Testing: Principles and Practices"***, Pearson publication, 2nd edition, 2006.

Reference Books:

1. Loise Tamres, ***"Introducing Software Testing"***, Pearson publication, 2002.
2. Boris Beizer, ***"Software Testing Techniques"***, 2nd edition, Dreamtech press, 2014

Course Title:	**Software Testing Lab**	**Semester V**	
Course Code	**IT504DE-01L**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Department**	**Credits**	**1**

Lab Experiments Objective:

1. To implement different testing techniques to practical teat and understand their merits and demerits

Lab Experiments List:

1. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
2. Design, develop, code and run the program in any suitable language to solve the NextDate problem. Analyze it from the perspective of decision table-based testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
3. Design, develop, code and run the program in any suitable object-oriented language to solve the calendar problem. Analyze it from the perspective of OO testing, derive test cases to test the method that increment the date and the method that increments the month., execute these test cases and discuss the test results.
4. Design, develop, code and run the program in any suitable object-oriented language to solve the currency converter problem. Analyze it from the perspective of use case-based system testing, derive appropriate system test cases, execute these test cases and discuss the test results.
5. Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
6. Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

Course Title:	**Software Project Management**	**Semester V**	
Course Code	**IT504DE-02**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Department**	**Credits**	**3**

Course Objectives:

1. To understand basics of software project planning
2. To learn activities planning, Risks planning & Control
3. To acquire knowledge of cost monitoring, change controls
4. To know how to manage teams

Course Outcomes:

After learning the course the students should be able:

1. Demonstrate knowledge of project management concepts, methodologies and techniques
2. Exhibit knowledge on scheduling, cost, risks & mitigation
3. Showcase techniques on how to monitor progress and control activities
4. Assess team dynamics, motivating & decision making

Course Content:

UNIT I

Introduction to Software Project Management: Project definition, Contract management, Activities covered by software project management, Overview of project planning, Stepwise project planning.

UNIT II

Project Evaluation: Strategic assessment, Technical assessment, Cost benefit analysis, Cash flow forecasting, Cost benefit evaluation techniques and Risk evaluation.

UNIT III

Activity Planning: Objectives, Project schedule, Sequencing and scheduling activities, Network planning models, Forward pass, Backward pass, Activity float, Shortening project duration, Activity on arrow networks, Risk management, Nature of risk, Types of risk, Managing risk, Hazard identification, Hazard analysis, Risk planning and control.

UNIT IV

Monitoring and Control: Creating framework, Collecting the data, Visualizing progress, Cost monitoring, Earned value, Prioritizing monitoring, Getting project back to target, Change control, Managing contracts, Types of contract, Stages in contract placement, Typical terms of a contract, Contract management, Accep-tance.

UNIT V

Managing People: Introduction, Understanding behavior, Organizational behavior: A background, Select-ing the right person for the job, Instruction in the best methods, Motivation, The Oldman – Hackman job characteristics model.

UNIT VI

Organizing Teams: Working in groups, Becoming a team, Decision making, Leadership, Organizational structures, Stress, Health and safety, Case studies.

Text Books

1. Bob Hughes, Mike Cotterell, ***"Software Project Management"***, 4th edition, Tata McGraw Hill, 2006.

Reference Books:

1. Ramesh, Gopalaswamy, ***"Managing Global Software Projects"***, Tata McGraw Hill, 2005.
2. Royce, ***"Software Project Management"***, Pearson Education, 1999.
3. Jalote, ***"Software Project Management in Practice"***, Addison-Wesley Professional, 2002.

Course Title:	**Software Project Management Lab**	**Semester V**	
Course Code	**IT504DE-02L**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Department**	**Credits**	**1**

Lab Experiments Objective:

1. To create a project plan, assign resource and tasks for a project
2. To track changes to task progress
3. To track and report budget variations during the lifecycle of the project
4. To create GANTT chart and other views and print these reports

Lab Experiments List:

1. Create a project plan for a software development project
2. Assign tasks with start and end dates and set single and multiple dependencies
3. Assign resources to the tasks with working and non-working hours
4. Set milestones and priorities for tasks
5. Assign budget for the resources and report total project budget
6. Organize tasks into phases
7. Define relationships between tasks like, “finish-to-start”, “start-to-start”, “finish-to-finish” and “start-to-finish”
8. Create reports from various views of the project management software
9. Create effort and load balancing scenarios by changing timelines
10. Display metrics like variance, completion and budget remaining

Course Title:	**Compiler Construction**	**Semester V**	
Course Code	**IT504DE-03**	**Course Type**	**Elective**
Pre-requisite	**Data Structures**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To introduce the major concept areas of language translation and compiler design
2. To develop an awareness of the function and complexity of modern compilers.
3. To provide practical, hands on experience in compiler design.

Course Outcomes:

After learning the course the students should be able:

1. To understand the major concept areas of language translation and compiler design
2. To develop an awareness of the function and complexity of compilers.
3. To identify the similarities and differences among various parsing techniques and grammar transformation techniques

Course Content:

UNIT I

Introduction to Compiling and Lexical Analysis: Definition, analysis of the source program, the phases of a compiler, the grouping of phases, Compiler-Construction tools, The role of the Lexical analyzer, Input buffering, Specification of Tokens, A Language for Specifying Lexical Analyzers, Design of a Lexical Analyzer generator.

UNIT II

Syntax Analysis: The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Operator-precedence Parsing, LR-Parsers, Using Ambiguous Grammars, Parser Generators.

UNIT III

Syntax-Directed Translation: Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed definitions, Top-Down Translation, Bottom-Up Evaluation of Inherited attributes.

UNIT IV

Intermediate Code Generation: Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls.

UNIT V

Code Generation: Issues in the Design of a Code Generator, The target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, Simple Code Generator, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAGs, Dynamic Programming, Code-Generation Algorithm, Code-Generators.

UNIT VI

Code Optimization: Peephole optimization, principal sources of optimization, introduction to Global data flow analysis.

Text Books

1. Aho, Sethi, Ullman, ***"Compilers-Tools and Techniques"***, 2nd edition, Pearson, 2011.
2. Tremblay, Sorenson, ***"Theory and Practice of Compiler Writing"***, McGraw Hill Publication.

3. Hopcroft, ***"Introduction to Automata Theory, Languages and Computation"***, Pearson Publication.

Reference Books:

1. Paul G. Sorenson, ***"Compiler Writing"***, Tata McGraw Hill.
2. Robin Hunter, ***"The Essence of Compilers"***, Pearson Publication, 1998.

Course Title:	**Compiler Construction Lab**	**Semester V**	
Course Code	**IT504DE-03L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credits**	**1**

Lab Experiments Objective:

1. To be exposed to compiler writing tools.
2. To learn to implement the different Phases of compiler
3. To be familiar with control flow and data flow analysis
4. To learn simple optimization techniques

Lab Experiments List:

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool
4. Generate YACC specification for a few syntactic categories. a) Program to recognize a valid arithmetic expression that uses operator +, - , * and /. b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits. d)Implementation of Calculator using LEX and YACC
5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies(Heap, Stack, Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assemblies instructions can be simple move, add, sub, jump. Also simple addressing modes are used.
11. Implementation of Simple Code Optimization Techniques (Constant Folding., etc.)

Course Title:	**Software Engineering**	**Semester V**	
Course Code	**IT505SE-01**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application & Development**	**Credits**	**3**

Course Objectives:

1. To understand software lifecycle development models
2. To understand and apply software requirements engineering techniques ,software design principles , modeling and software testing techniques
3. To understand the use of metrics in software engineering
4. To understand software project management

Course Outcomes:

After learning the course the students should be able:

1. To use the techniques, skills, and modern engineering tools necessary for engineering practice.
2. To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. To identify, formulate, and solve engineering problems.

Course Content:

UNIT I

Software Development Process: Software crisis and myths, Software process and development: Generic view of process, Software life cycle and models, Analysis and comparison of varies models, an agile view of process.

UNIT II

Requirement Engineering: Requirements engineering tasks, Initiating requirement engineering process, Eliciting requirement, developing use-cases, Building the analysis model, Negotiating and validating requirement, Building the analysis model.

UNIT III

System Design Overview: Design process and design quality, Design concepts, Design model, Pattern based software design, Architectural design, User interface design. UML: Different methods: Rambaugh / Booch / Jakobsons, Need for standardization. Developing diagrams in UML (Use CASE, Class, Interaction, State diagrams) CASE TOOLS.

UNIT IV

Validation and Testing: Strategic approach to Software testing, Strategic issues, Test strategies for conventional software, Validation testing, System testing, Debugging. White box testing and Black box testing.

UNIT V

Web Engineering: WebApps engineering layers, Web engineering processes planning for web engineering projects, Project management issue for web engineering. Metrics, Requirement analysis, Analysis models for web engineering design for webApps, testing for webApps.

UNIT VI

Planning and Management of Project: Project management, Metrics for process and projects, Estimation, Project scheduling, Risk management, Importance of software quality and measurements software engineering techniques for quality assurance, and Change management. ISO 9000 and CMM/PCMM.

Text Books

1. Roger S. Pressman, "***Software Engineering"***, 6th edition, Tata McGraw-Hill, 2006.
2. G. Booch, J. Rambaugh, and I. Jacobson, ***"The Unified Modeling Language User Guide"***, 2nd edition, Addison Wesley, 2005.

Reference Books:

1. Shari Pfleeger, ***"Software Engineering"***, 3rd edition, Pearsons Education, 2008.
2. Ian Sommerville, ***"Software Engineering"***, 10th edition, Pearsons Higher Education, 2016.
3. Pankaj Jalote, ***"An Integrated Approach to Software Engineering"***, 2nd edition, Springer New York, 2013.

Course Title:	**IT Service Management**	**Semester V**	
Course Code	**IT505SE-02**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To introduce practical implementation of Information Technology Service Management (ITSM)
2. To understand how an integrated ITSM framework can be utilized to achieve IT business integration, cost reductions and increased productivity.
3. To learn the best practices of ITSM methodology

Course Outcomes:

After learning the course the students should be able:

1. To identify IT services as a means to provide functionality and value to customers
2. To describe the needs and targets of the different stakeholders (service providers, customers, suppliers/partners) in the services value chain.
3. To demonstrate the value of a service management framework
4. To explain the service management processes for given customers
5. To select the appropriate tools to support a given designed service management solution.

Course Content:

UNIT I

IT Infrastructure: Introduction, Challenges in IT Infrastructure Management, Design Issues of IT Organizations and IT Infrastructure, IT System Management Process, IT Service Management Process, Information System Design Process

UNIT II

Service Delivery Process: Service Level Management, Financial Management, IT Service Continuity Management, Capacity Management & Availability Management

UNIT III

Service Support Process: Configuration Management, Incident Management, Problem Management, Change Management & Release Management

UNIT IV

Storage Management: Storage, Backup, Archive and Retrieve, Disaster Recovery, Space Management, Database and Application Protection and Data Retention

UNIT V

Security Management: Computer Security, Internet Security, Physical Security, Identity Management, Access Control System and Intrusion Detection

UNIT VI

Case Studies on how IT Service Management and ITIL processes make IT efficient and save cost for organizations.

Text Books

1. Phalguni Gupta, Surya Prakash & Umarani Jayaraman, ***"IT Infrastructure & Its Management"***, Tata McGraw-Hill Education

Reference Books:

1. W. Ronald Hudson, Ralph C. G. Haas, Waheed Uddin, ***"Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation"***, McGraw-Hill, 1997
2. Anita Sengar, ***"IT Infrastructure Management"***, 2nd Edition, S.K. Kataria and Sons, 2009

Course Title:	**Information Storage Management**	**Semester V**	
Course Code	**IT505SE-03**	**Course Type**	**Elective**
Pre-requisite	**Computer Organization & Architecture**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To evaluate storage architecture; understand logical and physical components of storage Infrastructure including storage subsystems
2. To describe storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution – CAS
3. To identify different storage virtualization technologies and their benefits
4. To understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions
5. To define information security, and storage security domains and Identify parameters of managing and monitoring storage infrastructure and describe common storage management activities and solutions.

Course Outcomes:

After learning the course the students should be able:

1. To describe and apply storage technologies
2. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers
3. To describe important storage technologies' features such as availability, replication, scalability and performance
4. To design, analyze and manage clusters of resources

Course Content:

UNIT I

INTRODUCTION TO STORAGE MANAGEMENT: Introduction to Information Storage Management - Intelligent Storage System (ISS) and its components Implementation of ISS as high-end and midrange storage-arrays. Direct Attached -Storage - Introduction to SCSI

UNIT II

Introduction to parallel SCSI, SCSI Command Model – Storage Area Networks - Fiber Channel Connectivity, Login types, Topologies.

UNIT III

STORAGE NETWORKING TECHNOLOGIES: Network-Attached Storage- General purpose servers vs NAS Devices - Benefits of NAS, NAS File I/O – NAS Components, Implementation, File Sharing protocols, I/O operations – IPSAN-ISCSI, Components of ISCSI- Content-Addressed Storage.

UNIT IV

STORAGE VIRTUALIZATION: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, object storage and Retrieval, examples - Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations, challenges, Types of storage virtualization - Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT V

BUSINESS CONTINUITY AND RECOVERY: Information Availability, BC Terminology, Life cycle, Failure analysis - Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup

methods, process, backup and restore operations , Overview of emerging technologies - duplication, offsite backup.

UNIT VI

STORAGE SECURITY AND MANAGEMENT: Storage security framework, Securing the Storage infrastructure Risk triad - Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure List key management activities and examples Define storage management standards and initiative-Industry trend.

Text Books

1. EMC Corporation, ***"Information Storage and Management"***, 1st edition, 2009. Wiley India.

Reference Books:

1. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th edition, November 2012.
2. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
3. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st edition, 2001.
4. Tom Clark, ***"Designing Storage Area Networks -A Practical Reference for Implementing Fiber Channel and IP SANs",*** 2nd edition, Tata McGraw Hill 2003.

Course Title:	**Network Management**	**Semester V**	
Course Code	**IT505SE-04**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks**	**L – T – P**	**3 – 0 – 0**
Stream	**Network**	**Credits**	**3**

Course Objectives:

1. To understand the principles of network management, different standards and protocols used in managing complex networks.
2. To understand the automation of network management operations and making use of readily available network management systems.

Course Outcomes:

After learning the course the students should be able:

1. To acquire the knowledge about network management standards (OSI and TCP/IP)
2. To acquire the knowledge about various network management tools and the skill to use them in monitoring a network
3. To analyze the challenges faced by Network managers
4. To evaluate various commercial network management systems and open network management systems.
5. To analyze and interpret the data provided by an NMS and take suitable actions.

Course Content:

UNIT I

DATA COMMUNICATION AND NETWORK MANAGEMENT OVERVIEW: Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

UNIT II

SNMPV1 NETWORK MANAGEMENT MANAGED NETWORK: Organization and Information Models MANAGED NETWORK: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

UNIT III

SNMPV1 NETWORK MANAGEMENT: Communication and Functional Models, The SNMP Communication Model, Functional model. SNMP MANAGEMENT: SNMPv2 Major Changes in SNMPv2, SNMPv2 System architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

SNMP MANAGEMENT: RMON : What is Remote Monitoring? ,RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

UNIT IV

TELECOMMUNICATIONS MANAGEMENT NETWORK: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation Issues.

UNIT V

NETWORK MANAGEMENT TOOLS AND SYSTEMS: Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management and Enterprise Management Solutions.

UNIT VI

WEB-BASED MANAGEMENT: NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network , Future Directions. Case Studies:

Text Books

1. Mani Subrahmanian, ***"Network Management Principles and Practice"***, 2nd Edition, Pearson Education, 2010.

Reference Books:

1. Morris, ***"Network management"***, 1st Edition, Pearson Education, 2008.
2. Mark Burges, ***"Principles of Network System Administration"***, 1st edition, Wiley DreamTech, 2008.

Course Title:	**Data Visualization**	**Semester V**	
Course Code	**IT505SE-05**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To learn the principles involved in information visualization
2. To learn about the variety of existing techniques and systems in information visualization
3. To develop skills in critiquing different visualization techniques as applied to particular tasks
4. To learn how to evaluate visualization systems
5. To gain a background that will aid the design of new, innovative visualizations

Course Outcomes:

After learning the course the students should be able:

1. To understand and apply principles of data visualization
2. To acquire, parse, and analyze abstract data sets
3. To design and implement standard visualization techniques
4. To evaluate existing visualizations quantitatively and qualitatively
5. To prototype visualizations rapidly

Course Content:

UNIT I

FOUNDATIONS FOR DATA VISUALIZATION: Introduction to Visualization – Visualization stages – Experimental Semiotics based on Perception – Gibson‘s Affordance theory – A Model of Perceptual Processing – Costs and Benefits of Visualization – Types of Data.

UNIT II

COMPUTER VISUALIZATION: Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces –Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Non Linear Magnification – Comparing Visualization of Information Spaces – Abstraction in computer Graphics – Abstraction in user interfaces.

UNIT III

MULTIDIMENSIONAL VISUALIZATION: 1D, 2D, 3D – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.

UNIT IV

TEXTUAL METHODS OF ABSTRACTION: From Graphics to Pure Text – Figure Captions in Visual Interfaces – Interactive 3D illustrations with images and text – Related work – Consistency of rendered – images and their textual labels – Architecture – Zoom techniques for illustration purpose – Interactive handling of images and text.

UNIT V

ABSTRACTION IN TIME AND INTERACTIVE SYSTEMS: Animating non Photo realistic Computer Graphics – Interaction Facilities and High Level Support for Animation Design – Zoom Navigation in User Interfaces – Interactive Medical Illustrations – Rendering Gestural Expressions – Animating design for Simulation – Tactile Maps for Blind People – Synthetic holography – Abstraction Versus Realism– Integrating Spatial and Non Spatial Data.

UNIT VI

Case Studies: Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

Text Books

1. Colin Ware, ***"Information Visualization Perception for Design"***, 3rd edition, Morgan Kaufman 2012.
2. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, ***"Readings in Information Visualization Using Vision to think"***, Morgan Kaufmann Publishers, 1999.
3. Thomas Strothotte, ***"Computer Visualization–Graphics Abstraction and Interactivity"***, Springer Verlag Berlin Heiderberg 1998.

Reference Books:

1. Chaomei Chan, ***"Information Visualization", Beyond the Horizon"***, 2nd edition, Springer Verlag, 2004.
2. Pauline Wills, ***"Visualisation: A Beginner's Guide"***, Hodder and Stoughlon, 1999.
3. Robert Spence ***"Information visualization – Design for interaction"***, Pearson Education, 2nd edition, 2007
4. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, ***"Readings in Information Visualization Using Vision to think"***, Morgan Kaufmann Publishers.

Course Title:	**Seminar**	**Semester V**	
Course Code	**IT506**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**1 – 2 – 0**
Stream	**Core**	**Credits**	**2**

Seminar topic is included to enable the students to apply their knowledge to understand advanced technologies, designs etc. Literature survey may help to select such topics which are invaluable to an engineer in an Information Technology industry. It will encourage students to develop their presentation skills, good communication skills and skills of collecting the correct information regarding the technical topic.

The students will be able to deliver seminar with useful information. He/she should under-stand the technologies, designs and skills of writing technical report, to do literature survey and to attempt the queries from examiner.

Course Title:	**Programming Lab - Minor**	**Semester V**	
Course Code	**IT507**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 2 – 2**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To learn R programming

Lab Experiments List:

1. Download R programming language SDK and setup to run programs
2. Develop and write a programs to declare R variables, constants, operators and reserved words and understand the operator precedence
3. Write a program to declare and understand the functioning of all the decision and loop constructs like If-Else, While, Break-Next and Repeat
4. Execute all R functions
5. Execute program to demonstrate Vectors, Matrix, data frame and factor
6. Execute programs to test R Objects and Class
7. Write a program to use and display various graphs and charts in R
8. Execute programs to use plot in R

Course Title:	**Operating Systems**	**Semester VI**	
Course Code	**IT601**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To study the basic concepts and functions of operating systems.
2. To understand the structure and functions of OS.
3. To learn about Processes, Threads and Scheduling algorithms.
4. To understand the principles of concurrency and Deadlocks.
5. To learn various memory management schemes.
6. To study I/O management and File systems.

Course Outcomes:

After learning the course the students should be able:

1. To design various Scheduling algorithms.
2. To apply the principles of concurrency.
3. To design deadlock, prevention and avoidance algorithms.
4. To compare and contrast various memory management schemes.
5. To design and Implement a prototype file systems.

Course Content:

UNIT I

Operating System Structures: Definition, Types of operating system, Real time operating system, System components, Sys-tem services, Systems calls, System programs, System structure, Virtual machines, System design and implementation.

UNIT II

Processes and CPU scheduling: Process concept, Process scheduling, Operation on a process, Co-operating processes, Threads, Interprocess communication, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling, Scheduling algorithms and performance evaluation.

UNIT III

Process Synchronization: The critical-section problem, Critical regions, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

UNIT IV

Deadlocks: Systems model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, Combined approach to deadlock handling.

UNIT V

Memory Management and Virtual Memory: Logical versus physical address space, Swapping, Contiguous allocation, Paging, Segmentation with paging, Demand paging, Page replacement algorithms, Thrashing.

UNIT VI

File Management: File system and secondary storage devices, Real-time operating systems.

Text Books

1. A. Silberschatz, P. Galvin, ***"Operating System Concepts"***, Wiley Publication, 9th edition, 2013.

2. A. S. Tanenbaum, H. Bos, ***"Modern Operating Systems"***, Pearson Education, 4th Edition, 2015.

Reference Books:

1. D.M. Dhamdhere, ***"Systems Programming and Operating Systems"***, Tata McGraw Hill Publication, 2nd edition, 2001.
2. G. Nutt, ***"Operating Systems Concepts"***, Addison Wesley Publication, 3rd Edition.
3. H. M. Deitel, ***"An Introduction to Operating Systems"***, Addison Wesley Publication, 1990.

Course Title:	**Operating Systems Lab**	**Semester VI**	
Course Code	**IT601L**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn shell programming and the use of filters in the UNIX environment.
2. To learn to programming in C using system calls.
3. To learn to use the file system related system calls.
4. To process creation and inter process communication.
5. To familiarize with implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance

Lab Experiments List:

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms
    a. Round Robin
    b. SJF
    c. FCFS
    d. Priority
4. Implement all file allocation strategies
    a. Sequential
    b. Indexed
    c. Linked
5. Implement Semaphores
6. Implement all File Organization Techniques
    a. Single level directory
    b. Two level
    c. Hierarchical
    d. DAG
7. Implement Bankers Algorithm for Dead Lock Avoidance
8. Implement an Algorithm for Dead Lock Detection
9. Implement e all page replacement algorithms
    a. FIFO
    b. LRU
    c. LFU
10. Implement Shared memory and IPC
11. Implement Paging Technique of memory management.
12. Implement Threading & Synchronization Applications

Course Title:	**Theory of Computing**	**Semester VI**	
Course Code	**IT602**	**Course Type**	**Mandatory**
Pre-requisite	**Computer Organization and Architecture**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.
2. To be aware of Decidability and Un-decidability of various problems.
3. To learn types of grammars

Course Outcomes:

After learning the course the students should be able:

1. Design Finite State Machine, Pushdown Automata, and Turing Machine.
2. Explain the Decidability or Undecidability of various problems

Course Content:

UNIT I

Fundamentals: Strings, Alphabet, Language, Operations, Finite state machine, Definitions, Finite automaton model, Acceptance of strings and languages, Deterministic finite automaton and Non deterministic finite automaton, Transition diagrams, Language recognizers.

UNIT II

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with €- moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without €-moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

UNIT III

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions - Null productions – Greiback Normal form – Chomsky normal form – Problems related to CNF and GNF

UNIT IV

Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL – problems based on pumping Lemma.

UNIT V

Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems about Turing machine- Chomskian hierarchy of languages.

UNIT VI

Unsolvable Problems and Computable Functions – Primitive recursive functions – Recursive and recursively enumerable languages – Universal Turing machine. MEASURING AND CLASSIFYING COMPLEXITY: Tractable and Intractable problems- Tractable and possibly intractable problems – P and NP completeness - Polynomial time reductions.

Text Books

1. Hopcroft J. E., Motwani R. and Ullman J. D., ***"Introduction to Automata Theory, Languages and Computations"***, Second Edition, Pearson Education, 2008.
2. John C Martin, ***"Introduction to Languages and the Theory of Computation"***, Tata McGraw Hill Publishing Company, New Delhi, Third Edition, 2007.

Reference Books:

1. Mishra K L. P. and Chandrasekaran N, ***"Theory of Computer Science - Automata, Languages and Computation"***, Third Edition, Prentice Hall of India, 2004.
2. Harry R. Lewis and Christos H. Papadimitriou, ***"Elements of the Theory of Computation"***, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
3. Peter Linz, ***"An Introduction to Formal Language and Automata"***, 3rd edition, Narosa Publishers, New Delhi, 2002.
4. Kamala Krithivasan and Rama R., ***"Introduction to Formal Languages, Automata Theory and Computation"***, Pearson Education, 2009.

Course Title:	**Object Oriented System Design**	**Semester VI**	
Course Code	**IT603**	**Course Type**	**Mandatory**
Pre-requisite	**Object Oriented Paradigm**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn the concept of Object Oriented Software Development Process
2. To get acquainted with UML Diagrams
3. To understand Object Oriented Analysis Processes

Course Outcomes:

After learning the course the students should be able:

1. To understand Object Oriented Software Development Process
2. To gain exposure to Object Oriented Methodologies & UML Diagrams
3. To apply Object Oriented Analysis Processes for projects

Course Content:

UNIT I

Object Basics, Object oriented philosophy, objects, classes, attributes, object behavior and methods, encapsulation and information hiding, class hierarchy, polymorphism, object relationships and associations, aggregations and object containment, case study, object identity, persistence.. Object oriented systems development life cycle: Software development process, building high quality software, use- case driven approach, reusability.

UNIT II

Object Oriented Methodologies: Rumbaugh et al.'s object modeling technique, Booch methodology, Jacobson et al methodologies, patterns, frameworks, and the unified approach. Unified modeling language: Static and dynamic models, UML diagrams, UML class diagrams, use-case diagrams, UML dynamic modeling, packages, UML extensibility and UML Meta model.

UNIT III

Object Oriented Analysis Process: Business object analysis, use-case driven object oriented analysis, business process modeling, use-case model, developing effective documentation, case study. Classification: Classification theory, noun phrase approach, common class patterns approach, use-case driven approach, classes, responsibilities, and collaborators, naming classes.

UNIT IV

Identifying Object Relationships, Attributes And Methods: Association, super-subclass relationships, a-part of relationships, case study, class responsibility, defining attributes for vianet bank objects, object responsibility, defining methods for vianet bank objects Design process and design axioms: Corollaries, design patterns.

UNIT V

Designing Classes: UML object constraint languages, designing classes, class visibility, refining attributes for the vianet bank objects, designing methods and protocols, designing methods for the vianet bank objects, packages and managing classes. Designing access layer. Designing view layer, macro level process.

UNIT VI

Case study – the Next Gen POS system, Inception -Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes –

Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition

Text Books

1. Ali Bahrami, ***"Object Oriented Systems Development using the Unified Modeling Language"***, McGraw Hill, Reprint, 2009.
2. Craig Larman, ***"Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development"***, 3rd Edition, Pearson Education, 2005.

Reference Books:

1. Bernd Oestereich, ***"Developing Software with UML, Object-Oriented Analysis and Design in Practice"***, Addison-Wesley, 2000.
2. James Rumbaugh, Ivar Jacobson, Grady Booch, ***"The Unified Modeling Language Reference Manual"***, 2nd edition, Addision Wesley,2005
3. Simon Bennett, Steve Mc Robb and Ray Farmer, ***"Object Oriented Systems Analysis and Design Using UML"***, Fourth Edition, McGraw Hill Education, 2010.
4. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ***"Design Patterns: Elements of Reusable Object-Oriented Software"***, Addison-Wesley, 1995.

Course Title:	**Object Oriented System Design Lab**	**Semester VI**	
Course Code	**IT603L**	**Course Type**	**Mandatory**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn the concept of Object Oriented Software Development Process
2. To get acquainted with UML Diagrams
3. To understand Object Oriented Analysis Processes

Lab Experiments List:

1. Program to implement classes and objects.
2. Program to implement constructors and destructors with array of objects.
3. Program to demonstrate function overloading.
4. Program to implement different types of inheritances like multiple, Multilevel and hybrid.
5. I/O Program to demonstrate the use of abstract classes.
6. Program to demonstrate I/O streams and functions.
7. Program to perform all possible type conversions.
8. Program to demonstrate exception handling technique.
9. Program to implement networking concepts.
10. Program to implement RMI concepts.
11. Program to implement AWT concepts.
12. Program to implement swing concepts.
13. Program to design and implement applet.
14. Program to design and implement JDBC
15. Program to design an event handling event for simulating a simple calculator.

Course Title:	**Enterprise Resource Planning**	**Semester VI**	
Course Code	**IT604DE-01**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To introduce to enterprise systems and show how organizations use enterprise systems to run their operations more efficiently and effectively.
2. To learn about the critical success factors and implementation strategies that lead to enterprise system success
3. To learn about the informational, knowledge, and decision-making opportunities afforded by enterprise systems.
4. To examine typical Enterprise Systems modules: materials management (MM), supply chain management (SCM), customer relationship management (CRM), financials, projects, human resource management (HRM).

Course Outcomes:

After learning the course the students should be able:

1. To demonstrate a good understanding of basic issues in Enterprise Systems,
2. To explain the scope of common Enterprise Systems (e.g., MM, SCM, CRM, HRM, procurement),
3. To explain the challenges associated with implementing enterprise systems and their impacts on organizations
4. To describe the selection, acquisition and implementation of enterprise systems
5. To use one of the popular ERP packages to support business operations and decision-making,
6. To communicate and assess an organization's readiness for enterprise system implementation with a professional approach in written form,
7. To demonstrate an ability to work independently and in a group.

Course Content:

UNIT I

Enterprise Resource Planning: Introduction, Disadvantages of non-ERP systems, What Is ERP? Need of ERP, Advantage of ERP, Risks of ERP, Growth of ERP

UNIT II

ERP Modules: Finance, Production Planning, Control and Management, Sales and Distribution, Human Resource Management, Inventory Control System, Quality Management, Plant Maintenance

UNIT III

ERP Implementation: ERP Implementation (Transition) strategies, ERP Implementation Life Cycle, Implementation Methodologies, Evaluation and selection of ERP package, ERP Project Team: Vendors, Employees, Consultants, Training & Education, Project management & Monitoring, Post Implementation Activities, Operation & maintenance of ERP system, Measuring the Performance of ERP System, Success & failure factors of an ERP, Implementation

UNIT IV

ERP Market and Vendors: ERP Marketplace and Marketplace Dynamics, Comparison of Current ERP Packages and Vendors, like; SAP, Oracle, PeopleSoft, BAAN etc.

UNIT V

ERP and related technologies: Business Process Re-Engineering (BPR), Information Systems -Management Information, System (MIS), Decision Support System (DSS), Executive Support System (ESS) Data Warehousing, Data Mining, On-Line Analytical Processing (OLAP), Supply Chain Management, Customer Relationship Management

UNIT VI

ERP Case Studies: ERP systems implemented in – for example :TISCO, SKF Automotive Bearings Co. Ltd, Qualcomm CDMA, California, Post Implementation review of ERP packages – in, Manufacturing, Services and Others Organizations, Customization of ERP for different types of Industries.

Text Books

1. Alexis Leon, ***"ERP Demystified"***, TMH New Delhi, 2nd Ed.
2. V. K. Garg & N. K. Venkita Krishnan, ***"ERP Ware: ERP Implementation Framework"***, PHI.

Reference Books:

1. V. K. Garg & N. K. Venkita Krishna, ***"ERP Concepts & Planning"***, PHI, 2nd Ed.

Course Title:	**Decision Support Systems**	**Semester VI**	
Course Code	**IT604DE-02**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To select appropriate modeling techniques for supporting semi-structured business decision making
2. To identify and select appropriate decision support systems for generating innovative business solutions
3. To design and implement decision support systems for generating innovative business solutions

Course Outcomes:

After learning the course the students should be able:

1. To recognize the relationship between business information needs and decision making
2. To appraise the general nature and range of decision support systems
3. To appraise issues related to the development of DSS
4. To select appropriate modeling techniques
5. To analyze, design and implement a DSS

Course Content:

UNIT I

Basic Concepts: Decision making systems, Modeling and support, Basics and definition Systems models, Modeling process, Decision making, Intelligence phase, Design phase Choice phase, Evaluation, Implementation phase, Alternative decision making models, Decision support systems, Decision makers, Case applications.

UNIT II

Decision Support System Development: Decision support system development, Basics, Life cycle, Methodologies, Prototype, Technology levels and tools, Development platforms, Tool selection, Developing DSS, Enterprise systems, Concepts and definition, Evolution of information systems, Information needs, Characteristics and capabilities, Comparing and integrating EIS and DSS, EIS data access, Data warehouse, OLAP, Multidimensional analysis, Presentation and the Web, Including soft information enterprise on systems, Organizational DSS, Supply and value chains, Decision support, Supply chain problems and solutions, Computerized systems. MRP, ERP, SCM, Frontline decision support systems.

UNIT III

Knowledge Management: Organizational learning and memory, Knowledge management, Development Methods, Technologies and tools, Success , Knowledge management and artificial intelligence, Electronic Document Management, Knowledge Acquisition and Validation, Knowledge Engineering – Scope, Acquisition Methods, Interviews, Tracking Methods, Observation and other Methods, Grid Analysis, Machine Learning, Rule Induction, Case-Based Reasoning, Neural Computing, Intelligent Agents, Selection of an appropriate Knowledge Acquisition Methods, Multiple Experts, Validation and Verification of the Knowledge Base-Analysis, Coding, Documenting, and Diagramming, Numeric and Documented.

UNIT IV

Knowledge Acquisition, Knowledge Acquisition and the Internet/Intranets, Knowledge Representation Basics, Representation in Logic and other Schemas, Semantic Networks, Production Rules, Frames, Multiple Knowledge Representation, Experimental Knowledge Representations, Representing Uncertainty. Intelligent System Development: Inference Techniques, Reasoning in Artificial Intelligence, Inference with Rules, Inference Tree, Inference with Frames, Model Based and Case Based Reasoning, Explanation and Meta Knowledge, Inference with Uncertainty, Representing Uncertainty, Probabilities and Related Approaches, Theory of Certainty, Approximate Reasoning using Fuzzy Logic

UNIT V

Intelligent Systems Development, Prototyping, Project Initialization, System Analysis and Design, Software Classification, Building Expert Systems with Tools, Shells and Environments, Software Selection, Hardware, Rapid Prototyping and a Demonstration Prototype, System Development, Implementation, Post Implementation.

UNIT VI

Management Support Systems: Implementing and Integrating Management Support Systems, Implementation, Major Issues, Strategies, System Integration, Generic Models MSS, DSS–ES, Integrating EIS, DSS and ES, Global Integration, Intelligent DSS, Intelligent Modeling and Model Management, Examples of Integrated Systems, Problems and Issues in Integration.

Text Books

1. Efrain Turban and Jay E. Aronson, "***Decision Support Systems and Intelligent Systems"***, 6th Edition, Pearson Education, 2001.

Reference Books:

1. Ganesh Natarajan and Sandhya Shekhar, ***"Knowledge Management Enabling Business Growth"***, Tata McGraw Hill, 2002.
2. George M. Marakas, ***"Decision Support System"***, Prentice Hall, India, 2003.
3. Efrem A. Mallach, ***"Decision Support and Data Warehouse Systems"***, Tata McGraw, Hill, 2002.
4. Kimiz Dalkir, ***"Knowledge Management: Theory and Practice"***, Elsevier Science, 2005.
5. Becerra Fernandez and Laidener, ***"Knowledge Management: An Evolutionary View"***, PHI, 2009.

Course Title:	**Discrete Mathematics**	**Semester VI**	
Course Code	**IT604DE-03**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To develop a foundation of set theory concepts, notation and applications
2. To inculcate the habit of logical and mathematical thinking and its application to computer science and IT
3. To understand logic, basic counting principles, relations, induction, sequences and summations.
4. To be able to present a coherent and mathematically accurate argument
5. To understand the theory of graphs and algebraic structures and their applications

Course Outcomes:

After learning the course the students should be able:

1. To perform operations on various discrete structures such as sets functions, relations, and sequences.
2. To solve problems using counting techniques, permutation and combination, recursion and generating functions
3. To construct and verify correctness of a boolean expression using K-Maps and truth tables
4. To use graphs as tools to visualize and simplify Problems.
5. To solve problems using algebraic structures (Rings, Monoids and Groups)

Course Content:

UNIT I

The Foundations: Sets theory and its applications sets, Set operations, Laws of set theory, Power sets, Partitions, Multi-sets, Cardinality, Principle of inclusion and exclusion, Algebra of sets and duality, Applications of sets: Problems on set operations and principle of inclusion-exclusion, Logics and proofs, Propositional logic, Propositional equivalences, Propositional algebra, Basic logical operations, De Morgan's laws, Predicates and quantifiers, Nested quantifiers, Rules of inference, Proof methods and strategy, Applications of logic: Translating English statements into propositions, Boolean searches in web pages, Bit operations.

UNIT II

Induction, Sequences and Summations: Induction and recursion: Mathematical induction, Strong induction, Recursive definitions, Re-cursive algorithms, Applications: Proofs using mathematical induction, Program correctness, Well formed formulae, Functions, Sequences and summations, Definition and types of functions: Injective, surjective and bijective , Composition, Identity and inverse of function, Re-cursively defined functions, Sequences and summations, Applications of functions, Sequences and summations: Job scheduling problem, Countability of rational numbers.

UNIT III

Basic Counting Principles: Permutations, Combinations, Binomial coefficients, Generalized permutations and combinations, Combinations and permutations with repetition, Generating permutations and combinations, Recurrence relation, Solving linear recurrence relations with constant coefficients, Applications of counting principles, Pigeonhole principle and its applications.

UNIT IV

Relations: Properties of binary relations, Closure of relations, Warshall's algorithm, Equivalence relations and partitions, Partial ordering relations and lattice application of relations: n-ary relations and their applications, Databases and relations.

UNIT V

Graph Theory: Basic terminology, Multi graphs and weighted graphs, Paths and circuits, Shortest path in weighted graph, Hamiltonian and Euler paths and circuits, Factors of a graph, Shortest path algorithm, Travelling salesman problem, Transport networks, Special types of graphs and applications: Job assignment, LANs, Interconnection networks for parallel computation, Mesh networks, Graph coloring and applications.

UNIT VI

Algebraic Structures: Algebraic systems, Groups, Semi groups, Monoid, Subgroups, Permutation groups, Codes and group codes, Isomorphism and automorphisms, Homomorphism, Fermat's little theorem, Polynomial rings, Applications of groups.

Text Books

1. K. H. Rosen, ***"Discrete Mathematics and Its Applications"***, Tata McGraw Hill Publication, 7th edition, 2012.
2. J. P. Tremblay, R. Manohar, ***"Discrete Mathematical Structures with Applications to Computer Science"***, 1st edition, McGraw Hill Publication, 2001.

Reference Books:

1. B. Kolman, R. Busby, S. Ross, ***"Discrete Mathematical Structures"***, Pearson Education, 6th edition, 2009.
2. R. K. Bisht, H. S. Dhami, ***"Discrete Mathematics"***, Oxford University Press, 2015.

Course Title:	**Embedded Systems**	**Semester VI**	
Course Code	**IT605SE-01**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Microcontroller**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To understand the fundamental concepts in Embedded Systems,
2. To learn Real Time Operating Systems
3. To get acquainted with hardware & interfaces
4. To know Embedded System Design Techniques

Course Outcomes:

After learning the course the students should be able:

1. To demonstrate & explain embedded systems hardware & software components
2. To define embedded systems using real time operating system – VxWorks/ µCOS II RTOS
3. To design & develop embedded applications using C language
4. To apply design techniques in real-life application

Course Content:

UNIT I

Introduction: Introduction to embedded systems-hardware and software components, Types, Examples, Characteristics, Challenges in embedded computing system design, Embedded sys-tem design processes, Introduction to IC technology.

UNIT II

Analysis and Design of Embedded System: Software engineering practices in the embedded systems, Software develop process, Interprocess communication and synchronization of process, Task and threads, Programme language, Program concept and embedded programming in C, Software components-Interpreter, Compiler, Assembler, Cross assembler.

UNIT III

OS for Embedded Systems: Introduction to real time theory, Operating system services, Real time operating system concepts, Basic design using a RTOS, Introduction to RTOS programming tools Micro C/OSII and VxWorks.

UNIT IV

Hardware for Embedded Systems: Hardware components, SOC, Processors, CPU, Types of memory, Memory management, I/O devices and interfacing, Parallel I/O interface, Blind counting synchronization and busy waiting, Parallel port interfacing with switches, Keypads and display unit, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above using C language.

UNIT V

Performance Issues of an Embedded System: CPU performance, CPU power consumption, Analysis and optimization of CPU power consumption program execution time, Analysis and optimization of energy and power, Analysis of program size, Hardware accelerators.

UNIT VI

Design Examples and Case Studies: Personal Digital Assistants, Set Top Boxes, Ink Jet Printers, Digital thermometer, Case Studies of digital camera, Smart card, Case study of coding for sending application layer byte stream on TCP/IP network using RTOS VxWorks.

Text Books

1. Raj Kamal, ***"Embedded Systems Architecture, and Programming"***, 3rd edition, TMH Publication, 2015.
2. Iyer, Gupta, ***"Embedded Real Time Systems Programming"***, TMH Publication, 2003.

Reference Books:

1. Wayne Wolf, ***"Computer as Components – Principles of Embedded Computing System Design"***, 2nd edition, Gulf Professional Publishing, 2008.
2. David E Simon, ***"An Embedded Software Primer"***, Addison Wesley Publication, 2004.

Course Title:	**Embedded Systems Lab**	**Semester VI**	
Course Code	**IT605SE-01L**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Microcontroller Programming**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application and Development**	**Credits**	**1**

Lab Experiments Objective:

1. To understand the Embedded system design issues.
2. To learn real time operating system concepts.
3. To understand the Embedded Linux environment
4. To learn embedded software development and testing process.

Lab Experiments List:

1. Multitasking in µCOS II RTOS using minimum 3 tasks on ARM7/ ARM Cortex- M3.
2. Semaphore as signaling & Synchronizing on ARM7/ ARM Cortex- M3.
3. Mailbox implementation for message passing on ARM7/ ARM Cortex- M3.
4. Queue implementation for message passing on ARM7/ ARM Cortex- M3.
5. Implementation of MUTEX using minimum 3 tasks on ARM7/ ARM Cortex- M3.
6. Download pre-configured Kernel Image, File System, bootloader to target device- ARM9.
7. Writing simple application using embedded Linux on ARM9.
8. Writing “Hello World” device Driver. Loading into & removing from Kernel on ARM9 board.
9. Write a program for I2C based RTC using embedded Linux on ARM9.
10. Using Device driver for GPIO, write a program to blink LED onARM9.
11. Write a program for External Interruption ARM9.

Course Title:	**Data Storage Technologies & Networks**	**Semester VI**	
Course Code	**IT605SE-02**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To gain knowledge and understand the design of a Data Centre,
2. To understand the best practice of design in the Data Centre
3. To learn the options in the running of an efficient Data Centre.
4. To understand the value of data to a business, Information Lifecycle
5. To understand the challenges in data storage and data management
6. To learn solutions available for data storage.

Course Outcomes:

After learning the course the students should be able:

1. To explain the design of a data center and storage requirements
2. To discuss the various types of storage and their properties
3. To explain physical and virtualization of storage
4. To explain the backup, archiving with regard to recovery and business continuity

Course Content:

UNIT I

DATA CENTRE: Introduction, Site Selection and Environmental Considerations, Hierarchical or Layered Architecture, Architect Roles, Goals and Skills, Architecture Precursors

UNIT II

DATA CENTRE DESIGN: Architecture Design and Standards Recommendations, Raised Access Floor and Design Best Practices, connecting the infrastructure with copper and fiber. IT Hardware, Cooling System Options and Environmental Control, Electrical Power Systems, Room Layout, Fire Protection and Security Systems, Building Automation and Energy Management Systems, Commissioning and Handover

UNIT III

STORAGE MANAGEMENT: Introduction to Storage Technology, Storage Systems Architecture, Physical and logical components of a connectivity environment, Major physical components of a disk drive and their functions, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Integrated and Modular storage systems, high-level architecture and working of an intelligent storage systems

UNIT IV

NETWORKED STORAGE: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Need for long-term archiving solutions and describe how CAS fulfill the need, Appropriateness of the different networked storage options for different application environments

UNIT V

MANAGING DATA CENTER: Reasons for planned/unplanned outages, Impact of downtime, Difference between business continuity (BC) and disaster recovery (DR), RTO and RPO, Identification of single points of failure in a storage infrastructure and solutions to mitigate these failures, Architecture of backup/recovery and the different backup/recovery topologies, replication technologies and their role in ensuring information availability and business continuity Remote replication technologies and their role in providing disaster recovery and business

continuity capabilities, Key areas to monitor in a data center, Industry standards for data center monitoring and Management Key metrics to monitor storage infrastructure.

UNIT VI

SECURING STORAGE AND STORAGE VIRTUALIZATION: Information Security, Critical security attributes for information systems, Storage security domains, Analyze the common threats in, each domain, Storage Virtualization: Forms, Configurations and Challenges, Types of Storage Virtualization: Block-level and File-Level.

Text Books

1. Mauricio Arregoces, ***"Data Center Fundamentals"***, Cisco Press; 1st edition, 2003.
2. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne. 2001.
4. Meeta Gupta, ***"Storage Area Network Fundamentals"***, Pearson Education Limited, 2002

Reference Books:

1. G. Somasundaram, Alok Shrivastava, ***"Information Storage and Management"***, EMC Education Series, Wiley, Publishing Inc., 2011.
2. Gustavo Santana, ***"Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyond"***, Cisco Press; 1 edition, 2013

Course Title:	**Data Storage Technologies & Networks Lab**	**Semester VI**	
Course Code	**IT605SE-02L**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Operating Systems**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credits**	**1**

Lab Experiments Objective:

1. Understand the functionalities of storage network administration.
2. Set up a NAS server to support file level data access via the NSF and the CIFS protocols.
3. Set up a SAN server to support the iSCSI protocol for block level data access.
4. Demonstrate ability to design and build a small-scale data center and a small-scale cloud computing environment.
5. Be hand-on with data and network management software

Lab Experiments List:

1. Install a hard disk on a Linux machine covering all the below activities
    a. Connecting the disk to an HBA (Host Bus Adapter) and BIOS setup for the disk;
    b. Partitioning the disk;
    c. Creating file systems within disk partitions;
    d. Mounting the files systems;
    e. Setting up automatic mounting;
    f. Labeling disk partitions;
    g. Setting up swapping on swap partitions.
2. Use “smartmontools” to monitor the disk performance monitoring and testing
    a. Use “smartctl” to enable S.M.A.R.T. support and offline data collection on the disk
    b. Check the overall health of the disk
    c. Run a self-test on the disk
    d. Set up “smartd” to do tests automatically.
3. Use “hdparm”, “iostat”, and “iometer” tools to measure the performance of different storage devices, such as SATA drive, SCSI drive, and USB drives.
    a. Plot graphs to compare read/write and sequential/random access rates among different storage devices.
4. Use Navisphere Manager Simulator to perform management on SAN disk array systems
    a. Configure storage pools and LUNs (Logical Unit Number) for storage groups;
    b. Configure snapshots and clones;
    c. Create SANCopy full and incremental sessions;
    d. Create MirrorView synchronous and asynchronous images;
    e. Expand a LUN to create metaLUNs;
    f. Migrate a LUN to another LUN.
5. Use Openfiler for network storage configuration management
    a. Configure the Openfiler to support locally attached USB drives;
    b. Set up a NAS server to support NSF and CIFS protocols;
    c. Set up a SAN server to support an iSCSI protocol.
6. Configure Openfiler as a NAS Server
    a. Configure access control rules and NFS/CIFS shares for the NAS server.
    b. Configure the Linux client machine to access the NFS shares on the NAS server.
    c. Configure a Windows VM on the Linux client machine to access the CIFS shares on the NAS server
    d. Use Openfiler to set up a SAN server, to supports iSCSI protocol for the block level data access.
    e. Configure access control rules for the SAN server and configure iSCSI targets on the server.
7. Use VMware to create virtual disks, Virtual Machine File Systems and provisioning
    a. Use thin and thick provisioning concepts

Course Title:	**Service Oriented Architecture**	**Semester VI**	
Course Code	**IT605SE-03**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To gain understanding of the basic principles of service orientation
2. To learn service oriented analysis techniques
3. To learn technology underlying the service design
4. To learn advanced concepts such as service composition, orchestration and Choreography
5. To know about various WS specification standards

Course Outcomes:

After learning the course the students should be able:

1. Build applications based on XML.
2. Develop web services using technology elements.
3. Build SOA-based applications for intra-enterprise and inter-enterprise applications.

Course Content:

UNIT I

Introducing SOA: Fundamental SOA: Common Misperceptions about SOA, Common tangible benefits of SOA, Common pitfalls of adopting SOA, The Evolution of SOA:-from XML to Web services to SOA, The continuing evolution of SOA, The roots of SOA. Web Services and Primitive SOA: The Web services framework-Services, Service descriptions, messaging with SOAP.

UNIT II

Web Services and Contemporary SOA: Message exchange patterns- Service activity-coordination-Atomic transactions-Business activities-Orchestration-Choreography- Web Services and Contemporary SOA: Addressing- Reliable messaging-Correlation- Policies- Metadata exchange- Security- Notification and eventing.SOA and Service-Orientation: Principles of Service - Anatomy of a service-oriented architecture-Common principle of service orientation-Service Layers –Service orientation.

UNIT III

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis-Benefits of a business-centric SOA- Deriving business services-Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.

UNIT IV

Service-Oriented Design: Introduction to service-oriented design- WSDL-related XML Schema language basics-WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SO Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT V

SOA Service Design: - Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics-WS Coordination.

UNIT VI

SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)- Web Services Interoperability Technologies (WSIT)

Text Books

1. Thomas Erl, ***"Service-Oriented Architecture: Concepts, Technology, and Design"***, Pearson Education, 2006.
2. Frank. P. Coyle, ***"XML, Web Services And The Data Revolution"***, Pearson Education, 2002.
3. Sandeep Chatterjee, James Webber, ***"Developing Enterprise Web Services. An Architect's Guide"***, Pearson Education, 2005.
4. Eric Newcomer, Greg Lomow, ***"Understanding SOA with Web Services"***, Pearson Education, 2005.
5. Ron Schmelzer et al. ***"XML and Web Services"***, Pearson Education, 2002

Reference Books:

1. Dan woods and Thomas Mattern, ***"Enterprise SOA designing IT for Business Innovation"***, O'REILLY, 1st Edition, 2006.
2. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew, ***"Java Web. Services Architecture"***, Morgan Kaufmann Publishers, 2003.
3. Atul Kahate, ***"XML and Related technologies"***, Pearson Education, 2008.
4. Kennard Scibner and Mark C. Stiver, ***"Understanding SOAP"***, SAMS publishing.
5. B. V. Kumar, S. V. Subrahmanya, ***"Web Services: An Introduction"***, 2nd Edition, TMH India 2012

Course Title:	**Service Oriented Architecture Lab**	**Semester VI**	
Course Code	**IT605SE-03L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credits**	**1**

Lab Experiments Objective:

1. To learn to create web services and web service clients
2. To learn SOAP, UDDI and WSDL platforms

Lab Experiments List:

1. Write a simple web application program in Java to create web services incorporating:
    a. Development of web service
    b. Testing the web service
    c. Developing the client
    d. Deploying the application
2. Write a factorial application program in Java to create web services
3. Implement a Calculator program and calculate Simple and Compound Interest using .Net
4. Develop an invoice order processing system
5. Invoke EJB components as Web Service

Course Title:	**Network Programming**	**Semester VI**	
Course Code	**IT605SE-04**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Network**	**Credits**	**3**

Course Objectives:

1. To learn the basics of socket programming using TCP Sockets.
2. To learn about Socket Options.
3. To learn to develop Macros for including Objects In MIB Structure.
4. To understand SNMPv1, v2 and v3 protocols & practical issues.

Course Outcomes:

After learning the course the students should be able:

1. To analyze the requirements of a networked programming environment and identify the issues to be solved;
2. To create conceptual solutions to those issues and implement a programming solution;
3. To understand the key protocols that support the Internet;
4. To apply several common programming interfaces to network communication;
5. To understand the use of TCP/UDP Sockets
6. To apply advanced programming techniques such as Broadcasting, Multicasting

Course Content:

UNIT I

SOCKETS AND APPLICATION DEVELOPMENT: Introduction to Socket Programming - System Calls - Address conversion functions - POSIX Signal Handling - Server with multiple clients - Boundary conditions - Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown - I/O Multiplexing - I/O Models -TCP echo client/server with I/O Multiplexing

UNIT II

SOCKET OPTIONS: Socket options - getsockopt and setsockopt functions - Generic socket options - IP socket options -ICMP socket options - TCP socket options - Multiplexing TCP and UDP sockets - SCTP Sockets -SCTP Client/server - Streaming Example - Domain name system - gethostbyname, gethostbyaddr, getservbyname and getservbyport functions - Protocol Independent functions in TCP Client/Server Scenario

UNIT III

UNIT III ADVANCED SOCKETS: IPv4 and IPv6 interoperability - Threaded servers - Thread creation and termination - TCP echo server using threads - Mutex - Condition variables - Raw sockets - Raw socket creation - Raw socket output - Raw socket input - ping program - traceroute program

UNIT IV

UNIT IV SIMPLE NETWORK MANAGEMENT: SNMP network management concepts - SNMPv1 - Management information - MIB Structure – Object syntax - Standard MIB's - MIB-II Groups - SNMPv1 protocol and Practical issues.

UNIT V

SNMP V2, V3 AND RMO: Introduction to SNMPv2 - SMI for SNMPV2 - Protocol - SNMPv3 - Architecture and applications -Security and access control model - Overview of RMON.

UNIT VI

Protocols, Sessions, State, and Implementing Custom Protocols State vs. Stateless, Methods for Maintaining State, What Is a Protocol? Designing a Custom Protocol, Our Chat Protocol, Protocol Registration

Elementary Name, Address Conversions and design decisions Domain Name System, gethostbyname Function, RES_USE_INET6 Resolver Option, gethostbyname2 Function and IPv6 Support, gethostbyaddr Function, uname Function, gethostname Function, getservbyname and getservbyport Functions

Text Books

1. W. Richard Stevens, ***"UNIX Network Programming Vol-I"***, 3rd Edition, PHI Pearson Education, 2003.
2. William Stallings, ***"SNMP, SNMPv2, SNMPv3 and RMON 1 and 2"***, 3rd Edition, Pearson Edition, 2009.

Reference Books:

1. D.E. Comer, ***"Internetworking with TCP/IP Vol- III: Client-Server Programming and Application BSD Sockets Version"***, 2nd Edition, Pearson Edition, 2003.

Course Title:	**Network Programming Lab**	**Semester VI**	
Course Code	**IT605SE-04L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C**	**L – T – P**	**0 – 0 – 2**
Stream	**Network**	**Credits**	**1**

Lab Experiments Objective:

1. To develop TCP Socket Programming, UDP applications and to implement File Transfer Protocols
2. To utilize RMI and Routing Algorithms

Lab Experiments List:

1. Write a socket Program for Echo/Ping/Talk commands.
2. Create a socket (TCP) between two computers and enable file transfer between them.
3. Create a socket (UDP) between two computers and enable file transfer between them.
4. Write a program to implement Remote Command Execution. (Two M/Cs may be used)
5. Write a code simulating ARP /RARP protocols.
6. Create a socket for HTTP for web page upload and download.
7. Write a program for TCP module implementation.(TCP services)
8. Write a program for File Transfer in client-server architecture using following methods.
    a. (a) RS232C (b) TCP/IP
9. Write a program to implement RMI (Remote Method Invocation)
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    a. Shortest path routing
    b. Flooding
    c. Distance vector
11. Implement client in C and server in Java and initiate communication between them.
12. Using OPNET
    a. Create a scenario with the following specifications.
        i. • No of subnets – 2
        ii. • No. of nodes – 40
        iii. • Traffic
            1. FTP - 11 to 21
            2. FTP - 30 to 40
            3. UDP - 5 to 7
        iv. • Routing Protocol – AODV
        v. • 802.16
    - · Show the throughput using different bandwidths i.e., 10 Mbps and 100 Mbps respectively.

    b. Create a scenario as described below.

        No of students – 2
        SN -1 Nodes – 15
        SN -2 Nodes - 10
        Generate FTP Traffic & HTTP traffic between
        Nodes 1 to 11 (FTP)
        14 to 7 (HTTP / Gen FTP)

    - · Trace the packet within the Simulation time and display the Trace file.

Course Title:	**Advanced Database**	**Semester VI**	
Course Code	**IT605SE-05**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To learn the various types of databases and their advanced applications
2. To understand how and where databases are used in industry
3. To examine the requirements on special databases
4. To learn complex queries and interface them with applications

Course Outcomes:

After learning the course the students should be able:

1. To explain how databases are used in various fields of industry
2. To apply query evaluation techniques and query optimization techniques.
3. To develop transaction processing systems with concurrency control.
4. To design and develop a database application system as part of a team.
5. To explore open issues in advanced databases

Course Content:

UNIT I

PARALLEL AND DISTRIBUTED DATABASES: Database System Architectures: Centralized and Client-Server Architectures – Server System, Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.

UNIT II

OBJECT AND OBJECT RELATIONAL DATABASES: Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL /Oracle – Case Studies.

UNIT III

XML DATABASES: XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC– Information Retrieval – Data Warehousing – Data Mining.

UNIT IV

MOBILE DATABASES: Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes.

UNIT V

INTELLIGENT DATABASES: Active databases – Deductive Databases – Knowledge bases – Multimedia Databases-Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.

UNIT VI

COMPLEX QUERIES AND REASONING: Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Datalog – Fix-point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues.

Text Books

1. Carlo Zaniolo, Stefano Ceri, ***"Advanced Database Systems"***, Morgan Kauffmann Publishers.
2. Subramaniam, ***"Multimedia Databases"***, Morgan Kauffman Publishers, 2008.
3. Rajesh Narang, ***"Object Oriented Interfaces and Databases"***, Prentice-Hall of India, Pvt. Ltd., 2004.
4. Thomas Cannolly and Carolyn Begg, ***"Database Systems, A Practical Approach to Design, Implementation and Management"***, 3rd Edition, Pearson Education, 2007.
5. Jeffrey A. Hoffer, Mary B. Prescottand Fred R. McFadden, ***"Modern Database Management"***, Prentice Hall, 2007.

Reference Books:

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, ***"Database System Concepts"***, 6th Edition, McGraw Hill, 2011.
2. C. J. Date, A. Kannan and S. Swamynathan, ***"An Introduction to Database Systems"***, 8th Edition, Pearson Education, 2006.
3. R. Elmasri, S. B. Navathe, ***"Fundamentals of Database Systems"***, 5th Edition, Pearson Education/Addison Wesley, 2007.
4. Ramakrishnan, Gehrke, ***"Database Management System"***, Tata McGraw Hill Publications, 4th Edition.
5. Ramez Elmasri, Sham Navathe, ***"Fundamentals of Database Systems"***, Addison-Wesley, 2000.

Course Title:	**Advanced Database Lab**	**Semester VI**	
Course Code	**IT605SE-05L**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credits**	**1**

Lab Experiments Objective:

1. To learn the various types of databases and their advanced applications
2. To understand how and where databases are used in industry
3. To examine the requirements on special databases
4. To learn complex queries and interface them with applications

Lab Experiments List:

1. A University wants to track persons associated with them. A person can be an Employee or Student. Employees are Faculty, Technicians and Project associates. Students are Full time students, Part time students and Teaching Assistants.
    a. Design an Enhanced Entity Relationship (EER) Model for university database. Write OQL for the following
        i. Insert details in each object.
        ii. Display the Employee details.
        iii. Display Student Details.
        iv. Modify person details.
        v. Delete person details.
    b. Extend the design by incorporating the following information.
    Students are registering for courses which are handled by instructor researchers (graduate students). Faculty are advisors to graduate students. Instructor researchers' class is a category with super class of faculty and graduate students. Faculty is having sponsored research projects with a grant supporting instruction researchers. Grants are sanctioned by different agencies. Faculty belongs to different departments. Department is chaired by a faculty. Implement for the Insertion and Display of details in each class.
2. Consider the application for University Counseling for Engineering Colleges. The college, department and vacancy details are maintained in 3 sites. Students are allocated colleges in these 3 sites simultaneously. Implement this application using parallel database [State any assumptions you have made].
3. There are 5 processors working in a parallel environment and producing output. The output record contains college details and students mark information. Implement parallel join and parallel sort algorithms to get the marks from different colleges of the university and publish 10 ranks for each discipline.
4. Create triggers and assertions for Bank database handling deposits and loan and admission database handling seat allocation and vacancy position. Design the above relational database schema and implement the following triggers and assertions.
    a. When a deposit is made by a customer, create a trigger for updating customers account and bank account
    b. When a loan is issued to the customer, create a trigger for updating customer's loan account and bank account.
    c. Create assertion for bank database so that the total loan amount does not exceed the total balance in the bank.
    d. When an admission is made, create a trigger for updating the seat allocation details and vacancy position.
5. Construct a knowledge database for kinship domain (family relations) with facts. Extract the following relations using rules.
    Parent, Sibling, Brother, Sister, Child, Daughter, Son, Spouse, Wife, husband, Grandparent, Grandchild, Cousin, Aunt and Uncle.

6. Work with Weka tool classification and clustering algorithms using the given training data and test with the unknown sample. Also experiment with different scenarios and large data set
7. Design XML Schema for the given company database, Department (deptName, deptNo, deptManagerSSN, deptManagerStartDate, deptLocation), Employee (empName, empSSN, empSex, empSalary, empBirthDate, empDeptNo, empSupervisorSSN, empAddress, empWorksOn), Project (projName, projNo, projLocation, projDeptNo, projWorker)
    a. Implement the following queries using XQuery and XPath
        i. Retrieve the department name, manager name, and manager salary for every department'
        ii. Retrieve the employee name, supervisor name and employee salary for each employee who works in the Research Department.
        iii. Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project.
        iv. Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project with more than one employee working on it
            1. Implement a storage structure for storing XML database and test with the above schema.

Fourth Year B.Tech. In Information Technology

Bachelor of Technology (Information Technology) - Fourth Year - Semester VII														
Sr. No.	Course Code	Title of the Course	Teaching Structure			Assessment Structure						Marks	Credits	Hours per week
			L	T	P	Mid Test	CA-1	CA-2	ESE	TW	PR			
1	IT701	Ethical and Social Issues in Computing	3	2	0	20	10	10	60	-	-	100	4	5
2	IT702DE	Departmental Elective - Group 3	3	0	0	20	10	10	60	-	-	100	3	3
3	IT702DEL	Departmental Elective - Group 3 Lab	0	0	2	-	-	-	-	25	25	50	1	2
4	IT703DE	Open / Departmental Elective - Group 4	3	2	0	20	10	10	60	-	-	100	4	5
5	IT704SE	Stream Elective - Group 3	3	0	0	20	10	10	60	-	-	100	3	3
6	IT704SEL	Stream Elective - Group 3 Lab	0	0	2	-	-	-	-	25	25	50	1	2
7	IT705	Project Phase I	1	2	2	-	25	25	-	25	25	100	3	5
8	IT706	Industrial Training Assessment*	0	2	0	-	-	-	-	50	-	50	1	2
9	IT707	Advanced Programming - Lab (Web Technologies)	1	4	2	-	-	-	-	50	50	100	4	7
Summary of Semester Assessment Marks, Credit & Hours			**14**	**12**	**8**	**80**	**65**	**65**	**240**	**175**	**125**	**750**	**24**	**34**

List of Departmental Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT702DE-01	Artificial Intelligence	Computer Algorithms
2	IT702DE-02	Soft Computing	Computer Algorithms

List of Departmental Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT703DE-01	Natural Language Processing	Artificial Intelligence, Computer Algorithms
2	IT703DE-02	Cloud Computing	Computer Networks

List of Stream Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT704SE-01	Real Time Systems	Operating Systems, Computer Algorithms
2	IT704SE-02	Information Security	Computer Algorithms, Computer Networks
3	IT704SE-03	Management Information Systems	Decision Support Systems
4	IT704SE-04	Distributed Computing	Computer Algorithms
5	IT704SE-05	Data Warehousing And Data Mining	Database Management Systems

Bachelor of Technology (Information Technology) - Fourth Year - Semester VIII															
Sr. No.	**Course Code**	**Title of the Course**	**Teaching Structure**			**Assessment Structure**						**Marks**	**Credits**	**Hours per week**
			L	**T**	**P**	**Mid Test**	**CA-1**	**CA-2**	**ESE**	**TW**	**PR**			
1	IT801DE	Departmental Elective - Group 5	3	0	0	20	10	10	60	-	-	100	3	3
5	IT801DEL	Departmental Elective - Group 5 Lab	0	0	2	-	-	-	-	25	25	50	1	2
2	IT802SE	Stream Elective - Group 4	3	0	0	20	10	10	60	-	-	100	3	3
6	IT802SEL	Stream Elective - Group 4 Lab	0	0	2	-	-	-	-	25	25	50	1	2
3	IT803SE	Stream Elective - Group 5	3	2	0	20	10	10	60	-	-	100	4	5
4	IT804SE	Stream Elective - Group 6	3	0	0	20	10	10	60	-	-	100	3	3
7	IT804SEL	Stream Elective - Group 6 Lab	0	0	2	-	-	-	-	25	25	50	1	2
8	IT805	Project Phase II	2	4	8	-	25	25	-	50	100	200	8	14
Summary of Semester Assessment Marks, Credit & Hours			**14**	**6**	**14**	**80**	**65**	**65**	**240**	**125**	**175**	**750**	**24**	**34**

List of Departmental Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT801DE-01	Internet of Things	Microprocessor & Microcontrollers
2	IT801DE-02	Ecommerce Systems	Nil

List of Stream Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT802SE-01	Mobile Computing	Computer Networks, Operating Systems
2	IT802SE-02	Cryptography	Computer Organization & Architecture
3	IT802SE-03	Information Retrieval	Computer Algorithms
4	IT802SE-04	Network Security	Computer Networks, Network Programming
5	IT802SE-05	Big Data Analytics	Database Management Systems

List of Stream Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT803SE-01	User Experience Design	Software Engineering
2	IT803SE-02	Infrastructure Auditing & Implementation	IT Service Management
3	IT803SE-03	Cyber Law and IPR	Nil
4	IT803SE-04	Internetworking Protocols	Computer Networks
5	IT803SE-05	Web & Text Mining	Data Mining

List of Stream Electives – Group 6

Sr. No.	Course Code	Title of the Course	Prerequisite
1	IT804SE-01	Multimedia Application	Nil
2	IT804SE-02	Ethical Hacking	Operating Systems
3	IT804SE-03	CRM & SCM	Enterprise Resource Planning
4	IT804SE-04	Wireless Networking	Computer Networks
5	IT804SE-05	Machine Learning	Engineering Mathematics

Course Title:	**Ethical and Social Issues in Computing**	**Semester VII**	
Course Code	**IT701**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To familiarize with the existence of computer abuse, laws pertaining to such abuse and legal gray areas.
2. To introduce the Association of Computing Machinery (ACM) and Institute of Electrical and Electronic Engineers (IEEE) codes of ethics.
3. To provide with the context to appreciate the value of technology
4. To understand that technology is not neutral, that it creates ethical and moral muddles that must be dealt with.
5. To create and nurture an ideal atmosphere for academic dialogue, debate, and question-answer sessions intended to deepen your understanding of technology and its effects on society.
6. To affect behavior by challenging to examine ethical and moral situations, think through them and identify relevant support systems.

Course Outcomes:

After learning the course the students should be able:

1. To be familiar with the legal requirements, ethical issues, and professional issues in the computing profession.
2. To be familiar with types of ethical issues arising in the computing profession.
3. To be familiar with the social impact of decisions and actions in the computing profession

Course Content:

UNIT I

Introduction to Social and Ethical Computing, History of Computing, The beginning of irresponsible computing, Moral and Ethical theories,

UNIT II

Professionalism and professional codes of conduct Ethics, Technology and Value, Anonymity, Security, Privacy and Civil Liberties.

UNIT III

Intellectual Property Rights (Copyrights, Patents, Trademarks, trade secrets, and Rights of Publicity)

UNIT IV

Social Computing, Software Issues: Risks and Liabilities (virus, worms, piracy, hacking). Workplace Issues (whistle blowing, home office, privacy, electronic monitoring, outsourcing, downsizing)

UNIT V

Reliability and Risk, Prevention, Detection, and Digital Forensics, Artificial Intelligence, Virtual reality and Expert Systems

UNIT VI

Cyberspace Issues – The Internet, CDA, Free speech, electronic commerce, pornography, gambling, language and cultural imperialism and the politics of regulation

Text Books:

5. Joseph M. Kizza, ***"Ethical and Social Issues in the Information Age"***, Third Edition. Springer 2007.
6. Paul A. Alcorn, ***"Practical Ethics for a Technological World"***, Prentice-Hall, 2001.
7. Chuck Huff and Thomas Finholt, ***"Social Issues in Computing: Putting Computing in its Place"***, McGraw-Hill, 1994.

Reference Books:

1. Joseph M. Kizza, ***"Civilizing the Internet: Concerns and Efforts towards Regulations"***, McFarland Publishers, 2006.
2. Joseph M. Kizza, ***"Social and Ethical effects of the Computer Revolution"***, Second Edition, McFarland Publishers 1997.
3. Kevin Bowyer, ***"Ethics and Computing: Living Responsibly in a Computerized World"***, IEEE Computer Society Press, 1996.
4. Jacques Berluer and Diane Whitehouse, ***"An Ethical Global Information Society: Culture and Democracy Revisited"***, Chapman & Hill, 1998.
5. Jacques Berleur and Klaus Brunnstein, ***"Ethics in Computing: Codes spaces for Discussion and the Law"***, Chapman & Hill, 1997.
6. Robert C. Solomon, ***"Morality and the Good Life: An Introduction to Ethics through Classical Cases"***, Second Edition, McGraw-Hill, 1992.

Course Title:	**Artificial Intelligence**	**Semester VII**	
Course Code	**IT702DE-01**	**Course Type**	**Elective**
Pre-requisite	**Computer Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To acquaint the students with the theoretical and computational techniques in Artificial Intelligence.
2. To use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
3. To use different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
4. To understand the conceptual and computational trade-offs between the expressiveness of different formal representations.

Course Outcomes:

After learning the course the students should be able:

1. To find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
2. To analyze, formalize and write algorithmic methods for search problem
3. To explain important search concepts, the definitions of admissible and consistent heuristics and completeness and optimality.
4. To implement and execute by hand alpha-beta search.
5. To design good evaluation functions and strategies for game playing.
6. To carry out proofs in first order and propositional logic using techniques such as resolution, unification, backward and forward chaining.
7. To choose and implement learning algorithms such as decision trees, support vector machines, and boosting.

Course Content:

UNIT I

Introduction: Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

UNIT II

Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics and issues in the design of search programs.

Search techniques: Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

UNIT III

Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT IV

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules: Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

UNIT V

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning: Overview, components of a planning system, Goal stack planning, Hierarchical planning and other planning techniques.

UNIT VI

Natural Language processing: Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning: Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Text Books:

1. Rich, E. and Knight, K., ***"Artificial Intelligence"*** , Tata McGraw- Hill.
2. Russell, S. and Norvig, P., ***"Artificial Intelligence: A Modern Approach"*** , Pearson Education.
3. Patterson, Dan W. , ***"Introduction to Artificial Intelligence & Expert Systems"***, Patterson, PHI, 2005

Reference Books:

1. Nilsson, N. J., ***"Artificial Intelligence: A New Synthesis"*** , Morgan Kaufmann.

Course Title:	**Artificial Intelligence Lab**	**Semester VII**	
Course Code	**IT702DE-01L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credits**	**1**

Lab Experiments Objective:

1. To implement various AI search procedures.
2. To implement various knowledge representation techniques.
3. To develop an Expert system for medical diagnosis.

Lab Experiments List:

1. Implement Breadth First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
2. Implement Depth First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
3. Implement Best First Search (for 8 puzzle problem or Water Jug problem or any AI search problem)
4. Implement Single Player Game (Using Heuristic Function)
5. Implement Two Player Game (Using Heuristic Function)
6. Implement A* Algorithm
7. Implement Propositional calculus related problem
8. Implement First order propositional calculus related problem
9. Implement Certainty Factor problem
10. Implement Syntax Checking of English sentences-English Grammar
11. Develop an Expert system for Medical diagnosis.
12. Develop any Rule based system for an application of your choice.

Course Title:	**Soft Computing**	**Semester VII**	
Course Code	**IT702DE-02**	**Course Type**	**Elective**
Pre-requisite	**Computer Algorithms**	**L – T – P**	**3 – 0 - 4**
Stream	**Departmental**	**Credits**	**5**

Course Objectives:

1. To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
2. To gain insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems
3. To create awareness of the application areas of soft computing technique
4. To learn alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system

Course Outcomes:

After learning the course the student will be able:

1. To use a new tool /tools to solve a wide variety of real world problems
2. To find an alternate solution, more adaptable, resilient and optimum
3. To apply knowledge of soft computing domain to real world problems

Course Content:

UNIT I

Artificial Neural Network – I: Biological neuron, artificial neuron model, concept of bias and threshold, McCulloch Pits Neuron Model, implementation of logical AND, OR, XOR functions. Soft Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, linear neuron model: Concept of error energy, gradient descent algorithm and application of linear neuron for linear Regression, activation functions: binary, bipolar (linear, signup, log sigmoid, tan sigmoid) Learning mechanisms: Hebbian, Delta Rule of Perceptron and its limitations

UNIT II

Artificial Neural Network – II: Multilayer perceptron (MLP) and back propagation algorithm of Application of MLP for classification and regression of Self organizing Feature Maps, clustering of Learning vector quantization.

Radial Basis Function networks: Cover's theorem, mapping functions (Gaussian, Multi-quadrics, Inverse multiquadrics, Application of RBFN for classification and regression of Hopfield network, associative memories.

UNIT III

Fuzzy Logic – I: Concept of Fuzzy number, fuzzy set theory (continuous, discrete) of Operations on fuzzy sets. Fuzzy membership functions (core, boundary, support), primary and composite linguistic terms. Concept of fuzzy relation, composition operation (T-norm, T-conorm) of Fuzzy if-then rules.

UNIT IV

Fuzzy Logic – II: Fuzzification , Membership Value Assignment techniques, De-fuzzification (Maxmembership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules- Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems – Mamdani fuzzy model , Sugeno fuzzy model , Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.

UNIT V

Fuzzy Control Systems: CONTROL SYSTEM DESIGN PROBLEM 1.5, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design V, Fuzzy Logic Controllers Soft o Comparison with traditional PID control, advantages of FLC, Architecture of a FLC: Mamdani Type , Example Aircraft landing control problem.

UNIT VI

Adaptive Neuro-Fuzzy Inference Systems (ANFIS): ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression

Text Books:

1. Laurene Fausett, ***"Fundamentals of Neural Networks: Architectures, Algorithms And Applications"***, Pearson Education, Inc, 2008.
2. Timothy Ross, "***Fuzzy Logic With Engineering Applications"***, Third Edition Thomas, John Wiley & Sons, 2010
3. J.S. Jang, C.T. Sun, E. Mizutani, ***"Neuro- Fuzzy and Soft Computing"***, PHI Learning Private Limited.
4. S. N. Sivanandam, S. N. Deepa, ***"Principles of Soft Computing"***, John Wiley & Sons, 2007

Reference Books:

1. John Hertz, Anders Krogh, Richard Palmer, ***"Introduction to the theory of neural computation"***, Addison –Wesley Publishing Company, 1991
2. Simon Haykin, ***"Neural Networks A comprehensive foundation"***, Prentice Hall International Inc-1999
3. José C. Principe Neil R. Euliano , W. Curt Lefebvre, ***"Neural and Adaptive Systems: Fundamentals through Simulations"***, John-Wiley & Sons, 2000
4. Peter E. Hart, David G. Stork Richard O. Duda, ***"Pattern Classification"***, Second Edition,2000
5. Sergios Theodoridis , Konstantinos Koutroumbas, ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008
6. Hung T. Nguyen, Elbert A. Walker, ***"A First Course in Fuzzy Logic"***, 3rd Edition, Taylor & Francis Group, LLC, 2008
7. S. N. Sivanandam , S. Sumathi, S. N. Deepa, ***"Introduction to Fuzzy Logic using MATLAB"***, Springer Verlag, 2007

Course Title:	**Soft Computing - Lab**	**Semester VII**	
Course Code	**IT702DE-02L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 4**
Stream	**Departmental**	**Credits**	**2**

Lab Experiments Objective:

1. To utilize Soft computing algorithms to solve engineering problems
2. To compare results and provide a analysis of algorithms efficiency
3. To apply soft computing thought process for solving issues

Lab Experiments List:

1. Implement simple logic network using MP neuron model
2. Implement a simple linear regressor with a single neuron model
3. Implement and test MLP trained with back-propagation algorithm
4. Implement and test RBF network
5. Implement SOFM for character recognition
6. Implement fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)
7. Implement defuzzyfication (Max-membership principle, Centroid method, Weighted average method)
8. Implement FIS with Mamdani Inferencing mechanism
9. A small project: may include classification or regression problem, using any soft computing technique studied earlier

Course Title:	**Natural Language Processing**	**Semester VII**	
Course Code	**IT703DE-01**	**Course Type**	**Elective**
Pre-requisite	**Artificial Intelligence, Computer Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the leading trends and systems in natural language processing
2. To understand the concepts of morphology, syntax, semantics and pragmatics of the language
3. To recognize the significance of pragmatics for natural language understanding
4. To describe simple system based on logic and demonstrate the difference between the semantic presentation and interpretation of that presentation
5. To describe application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing

Course Outcomes:

After learning the course the student will be able:

1. To understand the models, methods, and algorithms of statistical Natural Language Processing
2. To implement probabilistic models in code, estimate parameters for such models, and run meaningful experiments to validate such models.
3. To apply core computer science concepts and algorithms, such as dynamic programming.
4. To understand linguistic phenomena and explore the linguistic features relevant to each NLP task.
5. To identify opportunities and conduct research in NLP
6. To analyze experimental results and write reports

Course Content:

UNIT I

Introduction to NLP: Definition, issues and strategies, application domain, tools for NLP, Linguistic organization of NLP, NLP vs PLP.

UNIT II

Word Classes: Review of Regular Expressions, CFG and different parsing techniques. Morphology: Inflectional, derivational, parsing and parsing with FST, Combinational Rules.

UNIT III

Phonology: Speech sounds, phonetic transcription, phoneme and phonological rules, optimality theory, machine learning of phonological rules, phonological aspects of prosody and speech synthesis. Pronunciation, Spelling and N-grams: Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora, simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

UNIT IV

Syntax: POS Tagging: Tagsets, concept of HMM tagger, rule based and stochastic POST, algorithm for HMM tagging, transformation based tagging. Sentence level construction & unification: Noun phrase, co-ordination, sub-categorization, concept of feature structure and unification.

UNIT V

Semantics: Representing Meaning: Unambiguous representation, canonical form, expressiveness, meaning structure of language, basics of FOPC. Semantic Analysis: Syntax driven, attachment & integration, robustness. Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, internal structure of words,

metaphor and metonymy and their computational approaches. Word Sense Disambiguation: Selectional restriction based, machine learning based and dictionary based approaches

UNIT VI

Pragmatics: Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Dialogues: Turns and utterances, grounding, dialogue acts and structures. Natural Language Generation: Introduction to language generation, architecture, discourse planning (text schemata, rhetorical relations).

Text Books:

1. D. Jurafsky & J. H. Martin – ***"Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition"***, Pearson Education
2. Allen, James. 1995. – ***"Natural Language Understanding"***. Benjamin/Cummings, 2ed.

Reference Books:

1. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. ***"Natural Language Processing-A Pananian Perspective"***. Prentice Hall India, Eastern Economy Edition.
2. Eugene Cherniak, ***"Statistical Language Learning"***, MIT Press, 1993.
3. Manning, Christopher and Heinrich Schütze, ***"Foundations of Statistical Natural Language Processing"***. MIT Press, 1999.

Course Title:	**Cloud Computing**	**Semester VII**	
Course Code	**IT703DE-02**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the concept of cloud computing
2. To understand the trade-off between deploying applications in the cloud over local infrastructure
3. To learn advantages and disadvantages of various cloud computing platforms
4. To learn performance, scalability and availability issues of cloud platforms
5. To understand the cloud security issues

Course Outcomes:

After learning the course the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing
2. To assess the economics, financial, and technological implications for selecting cloud computing for organization
3. To assess the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.
4. To assess needs for capacity building and training in cloud computing-related IT areas

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, deployment models, and service models.

UNIT II

Virtualization: Issues with virtualization, virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, virtualization of data centers, and Issues with Multi-tenancy.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine, and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from Inside and Outside a Cloud Architecture. MapReduce and its extensions to Cloud Computing, HDFS, and GFS.

UNIT IV

Interoperability and Service Monitoring: Issues with interoperability, Vendor lock-in, Interoperability approaches. SLA Management, Metering Issues, and Report generation.

UNIT V

Resource Management and Load Balancing: Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration, Scheduling Techniques for Advance Reservation, Capacity Management to meet SLA Requirements, and Load Balancing, various load balancing techniques.

UNIT VI

Migration and Fault Tolerance: Broad Aspects of Migration into Cloud, Migration of virtual Machines and techniques. Fault Tolerance Mechanisms.

Security: Vulnerability Issues and Security Threats, Application level Security, Data level Security, and Virtual Machine level Security, Infrastructure Security, and Multi-tenancy Issues. IDS: host-based and network-based, Security-as-a-Service. Trust Management, Identity Management, and Access Controls Techniques

Advances: Grid of Clouds, Green Cloud, Mobile Cloud Computing

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, ***"Cloud Computing Principles and Paradigms"*** , Wiley Publishers, 2011
2. Barrie Sosinsky, ***"Cloud Computing Bible"***, Wiley Publishers 2010
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, ***"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"***, O'Reilly 2010

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, ***"Mastering Cloud Computing"***, McGraw Hill 2013
2. Michael Miller, ***"Cloud Computing : Web-based Applications that change the way you work and collaborate online"***, Pearson Education, 2008
3. Toby Velte, Antohy T Velte, Robert Elsenpeter, ***"Cloud Computing : A Practical Approach"***, McGraw Hill
4. David S. Linthicum, ***"Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide"***, 2010

Course Title:	**Real Time Systems**	**Semester VII**	
Course Code	**IT704SE-01**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems, Computer Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of real-time systems.
2. To study issues related to the design and analysis of systems with real-time constraints.
3. To learn real-time scheduling and schedulability analysis
4. To understand formal specification and verification of timing constraints and properties
5. To design methods for real-time systems
6. To learn new techniques of state-of-the-art real-time systems research

Course Outcomes:

After learning the course the student will be able:

1. To characterize real-time systems and describe their functions.
2. To analyze, design and implement a real-time system.
3. To apply formal methods to the analysis and design of real-time systems.
4. To apply formal methods for scheduling real-time systems.
5. To characterize and debug a real-time system.

Course Content:

UNIT I

Introduction: Hard vs. Soft real time systems, A reference model of real time system. Real-time scheduling: Clock driven approach, Weighted Round-robin approach, Priority driven approach, Dynamic vs. static system, Effective Release Times and Deadlines, EDF and LST algorithm, Optimality and Non-Optimality of the EDF and LST algorithms, Off line vs. online Scheduling.

UNIT II

Clock-Driven Scheduling: Static, Time-Driven scheduler, General structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time Of a-periodic Jobs, Scheduling Sporadic Jobs.

UNIT III

Priority Driven Scheduling Of Periodic Tasks: Fixe-priority vs. Dynamic priority algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM algorithms, A Schedulability test for fixed-priority tasks with short response times, Sufficient Schedulability conditions for the RM and DM algorithms.

UNIT IV

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and Weighted Fair-Queueing Servers.

UNIT V

Resources and Resource Access control: Resource contention, resource access control, Nonpreemptive critical section, Basic Priority-Inheritance protocol, Basic Priority Ceiling Protocol, Stack based, Priority-ceiling protocol, preemption ceiling protocol.

UNIT VI

Multiprocessor scheduling, Resource Access Control, and Synchronization: Model of multiprocessor & distributed systems, task assignment, multiprocessor Priority-ceiling protocol, Elements of Scheduling Algorithms For End-to-End Periodic Tasks- IPS protocols, PM protocols, MPM protocol.

Text Books:

1. Jane W. S. Liu, ***"Real-Time System"***, Pearson Education
2. C. M. Krishna and K. G. Shin, ***"Real-Time Systems"***, McGraw Hill

Reference Books:

1. Laplante, ***"Real Time System Design and Analysis: An Engineer Handbook"***, PHI
2. Dr. K. V. K.K. Prasad, ***"Embedded Real Time System Concept Design and Programming"***, Wiley India

Course Title:	**Real Time Systems Lab**	**Semester VII**	
Course Code	**IT704SE-01L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 4**
Stream	**Software Application and Development**	**Credits**	**2**

Lab Experiments Objective:

1. To design and write programs to demonstrate various real time system concepts of scheduling processes
2. To demonstrate how real time principles can be applied to business problems by simulating business processes

Lab Experiments List:

1. Execute a program to demonstrate real time scheduling EDF v LST to show a comparative result
2. Demonstrate clock driven scheduler system
3. Develop a random generator to set priority and demonstrate a priority driven scheduler system
4. Simulate a manufacturing process to demonstrate resource and resource control scheduling system in real time
5. Simulate a logistics service provider scheduling of product delivery system using the principles of real-time system learnt in the course

Course Title:	**Information Security**	**Semester VII**	
Course Code	**IT704SE-02**	**Course Type**	**Elective**
Pre-requisite	**Computer Algorithms, Computer Networks**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure and Security Management**	**Credits**	**3**

Course Objectives:

1. To understand information security's importance in the increasingly computer-driven world.
2. To master the key concepts of information security and its working
3. To develop a security mindset
4. To learn to critically analyze situations of computer and network security usage
5. To identify the salient issues, viewpoints, and trade-offs of information security.

Course Outcomes:

After learning the course the student will be able:

1. To explain the challenges and scope of information security;
2. To explain security concepts as confidentiality, integrity, and availability
3. To explain the importance of cryptographic algorithms used in information security
4. To identify and explain symmetric algorithms for encryption-based security of information;
5. To describe the access control mechanism used for user authentication and authorization;
6. To describe Secure Sockets Layer (SSL), Internet Protocol (IP) communications by using Internet Protocol Security (IPSec);
7. To explain the use of security tools as firewalls and intrusion prevention systems;
8. To explain malicious software issues introduced by software-based viruses and worms;
9. To describe the process of risk assessment in the context of IT security management.

Course Content:

UNIT I

Introduction to Information Systems: Security concepts, Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, Computer Security Trends, Computer Security Strategy

UNIT II

Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Practical Application: Encryption of Stored Data

UNIT III

Models, Frameworks, Standards & Legal Framework: A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000, BS7799,

Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity, Indian IT Act, Laws of IPR, Indian Copyright Act

UNIT IV

Controls: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Role-Based Access Control, Case Study

UNIT V

Virus and Malware: Introduction & types of Malicious Software (Malware), Propagation–Infected Content–Viruses, Propagation–Vulnerability Exploit–Worms, Propagation–Social Engineering–SPAM E-mail, Trojans, Payload–

System Corruption, Payload–Attack Agent–Zombie, Bots, Payload–Information Theft–Keyloggers, Phishing, Spyware, Payload–Stealthing–Backdoors, Rootkits, Countermeasures

UNIT VI

Security issues: Database security challenge in the modern world, Federated Databases, securing Mobile databases, Network Security, trusted & un trusted networks, network attacks, network security dimensions, network attack – the stages; using firewalls effectively; Privacy – Privacy invasion due to direct marketing, outsourcing, using data masking ; privacy issues in smart card applications, Ethical Hacking ;Role of Cryptography in information security, digital signatures

Text Books:

1. Nina Gobole, ***"Information Systems Security: Security Management, Metrics, Frameworks And Best Practices"***, Wiley, 2008
2. Mark Rhodes –Ousley, ***"Information Security: The Complete Reference"***, McGraw-Hill Education, 2nd edition, 2013
3. Dhiren R Patel, ***"Information Security Theory and Practices"***, PHI Learning Pvt. Ltd., 2008.
4. Mark Stamp, ***"Information Security: Principles and Practice"***, Wiley, 2nd edition, 2011

Reference Books:

1. Gary R. McGraw, ***"Software Security: Building Security In"*** Addison Wesley, 2006
2. Ankit Fadia, ***"Network Security: A Hacker's Perspective"***, Thompson Course Technology, 2006

Course Title:	**Information Security - Lab**	**Semester VII**	
Course Code	**IT704SE-02L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 4**
Stream	**Infrastructure and Security Management**	**Credits**	**2**

Lab Experiments Objective:

1. To be familiar with the algorithms of data mining,
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining

Lab Experiments List:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
    a. Caesar Cipher
    b. Playfair Cipher
    c. Hill Cipher
    d. Vigenere Cipher
    e. Rail fence – row & Column Transformation
2. Implement the following algorithms
    a. DES
    b. RSA Algorithm
    c. Diffiee-Hellman
    d. MD5
    e. SHA-1
3. Implement the SIGNATURE SCHEME - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler)
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

Course Title:	**Management Information Systems**	**Semester VII**	
Course Code	**IT704SE-03**	**Course Type**	**Elective**
Pre-requisite	**Decision Support Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To create interest and awareness about the proliferation of the Information Systems in today's organizations.
2. To understand categories of MIS: Operations Support System, Management Support System and Office automation system, Functional management system.
3. To learn Information Systems for strategic management and strategic role of information systems.
4. To plan for information systems: Identification of Applications, Business Application Planning, Systems and Critical Success Factors, Method of Identifying Applications,
5. To understand System Development Process and Approaches, System Implementation, System maintenance, Introduction to MIS Risks, System Evaluation, IT Procurement Options. Change management in IT Projects.

Course Outcomes:

After learning the course the student will be able:

1. To understand the usage and constituents of MIS in organizations
2. To understand the classifications, understanding and the different functionalities of these MIS.
3. To explain the functions and issues at each stage of system development.
4. To identify emerging trends in MIS technologies
5. To identify and assess MIS in real-life organization

Course Content:

UNIT I

MANAGEMENT & ORGANIZATIONAL SUPPORT SYSTEMS FOR DIGITAL FIRM: Definition of MIS; Systems approach to MIS: Report writing s/w, MIS and Human factor considerations, concept of organizational information sub-system, MIS & problem solving.

UNIT II

INFORMATION SYSTEMS & BUSINESS STRATEGY: Information Management. Who are the users? Manager & Systems, Evolution of Computer based information system (CBIS), Model of CBIS. Information services organization: Trend to End-User computing, justifying the CBIS, Achieving the CBIS, Managing the CBIS, Benefits & Challenges of CBIS implementation. Strategic Information System, Business level & Firm level Strategy

UNIT III

INFORMATION SYSTEMS IN THE ENTERPRISE: Systems from Management & Functional perspective & their relationship: Executive Information System, Decision Support System Sales & Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance & Account Information System

UNIT IV

INFORMATION TECHNOLOGY FOR COMPETITIVE ADVANTAGE: Firm in its environment, What are the information resources? Who manages the information resources? Strategic planning for information resources. End-User Computing as a strategic issue, Information resource management concept

UNIT V

E-COMMERCE & INTERNATIONAL INFORMATION SYSTEM: Introduction to E-Commerce, Business Intelligence. E-Commerce strategy, Electronic Data Interchange, E-commerce methodology, E-commerce technology, Business application of the Internet. Electronic Business success strategies.

UNIT VI

Managing International Information Systems: IIS architecture, Global business Drivers, challenges, strategy: divide, conquer, and appease, cooptation, business organization, problems in implementing global information systems, Computer crime, ethics & social issues.

Text Books:

1. Kelkar, S.A., ***"Management Information Systems"***, Prentice Hall of India, Jan 2003.

Reference Books:

1. Mark G. Simkin, ***"Introduction to computer Information System for Business"***, S. Chand & Co., 1996.
2. James A. Senn, ***"Analysis & Design of Information Systems"***, McGraw-Hill International.

Course Title:	**Management Information Systems - Lab**	**Semester VII**	
Course Code	**IT704SE-03L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/Python**	**L – T – P**	**0 – 0 – 4**
Stream	**Information Management & Quality Control**	**Credits**	**2**

Lab Experiments Objective:

1. To prepare organizational data for MIS reports and dashboards
2. To learn what data should be used to prepare MIS reports
3. To write programs to produce MIS reports
4. To depict data in a MIS report to support decision making

Lab Experiments List:

1. Prepare a MIS report for HR system to depict the various grades of employee in an organization by years of service
2. Prepare a EIS report of Sales of an organization
3. Prepare a graphical EIS dashboard of the Sales over a period of 1 year
4. Prepare a manufacturing MIS report of all orders fulfilled, in progress and pending for management
5. Prepare a monthly MIS profit and loss dashboard from financial data
6. Prepare an EIS for reporting population demographic

Course Title:	**Distributed Computing**	**Semester VII**	
Course Code	**IT704SE-04**	**Course Type**	**Elective**
Pre-requisite	**Computer Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To understand the major tools and techniques that allow programmers to effectively program the parts of the code that require substantial communication and synchronization;
2. To study the core ideas behind modern coordination and communication paradigms and distributed data structures
3. To Introduce a variety of methodologies and approaches for reasoning about concurrent and distributed programs
4. To realize basic principles and best practice engineering techniques of concurrent and distributed computing;
5. To study the safety and progress properties of concurrent and distributed algorithms;
6. To understand the performance of current multi-core and future many-core systems.

Course Outcomes:

After learning the course the student will be able:

1. To identify the core concepts of distributed systems
2. To learn orchestration of multiple machines to correctly solve problems in an efficient, reliable and scalable way.
3. To examine concepts of distributed systems in designing large systems
4. To apply distributed computing concepts to develop sample systems.

Course Content:

UNIT I

Introduction: Historical background, key characteristics, design goals and challenges; Review of networking and internetworking, Internet protocols.

UNIT II

Processes and Inter process Communication: processes and threads, virtualization, code migration; The API for the Internet protocols, External data representation, Client-server communication, Multicast communication, message oriented communication, Network virtualization: Overlay networks, RPC and MPI

UNIT III

Naming: Name services and Domain Name System, Directory services, Case study: X.500 directory service

UNIT IV

Time, Global States and Synchronization: Physical and logical clocks, global states, mutual exclusion, election algorithms. Consistency and Replication: Consistency models, Replica management, Consistency protocols, Case studies of highly available services: the gossip architecture and Coda

UNIT V

Fault Tolerance and Security: Distributed Commit, Recovery, Security Issues, Cryptography. Distributed File Systems: File service architecture, Case study: Sun Network File System, The Andrew File System

UNIT VI

Peer to peer Systems: Introduction, Napster, Peer-to-peer middleware, Routing overlays, Case studies: Pastry, Tapestry. Distributed Object Based Systems: Distributed objects, Java beans, CORBA

Text Books:

1. Tanenbaum, A.S, ***"Distributed Systems: Principles and Paradigms"*** , 2nd Ed., Pearson Education., 2006
2. Coulouris G., Dollimore J., Kindberg T. and Blair G., ***"Distributed Systems: Concepts and Design"*** , 5th Edition, Addison Wesley., 2011
3. Mahajan S., Shah S., ***"Distributed Computing"***, 1st Ed., Oxford University Press, 2010

Reference Books:

1. Hwang K., Dongarra J., Geoffrey C. Fox, ***"Distributed and Cloud Computing: From Parallel Processing to the Internet of Things"*** , Morgan Kaufmann, 2011
2. Comer, D.E. and Droms, R.E., ***"Computer Networks and Internets"***, 4th Ed., Prentice-Hall, 2004

Course Title:	**Distributed Computing-Lab**	**Semester VII**	
Course Code	**IT704SE-04L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 4**
Stream	**Networking**	**Credits**	**2**

Lab Experiments Objective:

1. To implement distributed systems paradigms practically to understand impact on resources and processes

Lab Experiments List:

1. Load Balancing Algorithm.
2. Scalability in Distributed Environment
3. Client/server using RPC/RMI.
4. Inter-process communication
5. Election Algorithm.
6. Distributed Deadlock.
7. Name Resolution protocol.
8. Clock Synchronization algorithms.
9. Mutual Exclusion Algorithm.
10. Group Communication.
11. CORBA architecture.
12. Parallel Algorithms.
13. Message Passing Interface.

Course Title:	**Data Warehousing And Data Mining**	**Semester VII**	
Course Code	**IT704SE-05**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Interpret the contribution of data warehousing and data mining to the decision support level of organizations;
2. Evaluate different models used for OLAP and data pre-processing;
3. Categorize and carefully differentiate between situations for applying different data mining techniques: mining frequent pattern, association, correlation, classification, prediction, and cluster analysis;
4. Design and implement systems for data mining;
5. Evaluate the performance of different data mining algorithms;
6. Propose data mining solutions for different applications.

Course Outcomes:

After learning the course the student will be able:

1. Process raw data to make it suitable for various data mining algorithms.
2. Discover and measure interesting patterns from different kinds of databases.
3. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

Course Content:

UNIT I

Introduction: Introduction to Data Mining, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining.

Getting to know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity.

Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT II

DataWarehousing and Online Analytical Processing: DataWarehouse: Basic Concepts, DataWarehouse Modeling: Data Cube and OLAP, DataWarehouse Design and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing, DataWarehouse Implementation.

Mining Frequent Patterns, Associations and correlations: Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods, Pattern Mining in Multilevel and multidimensional space.

UNIT III

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting and AdaBoost.

Classification: Advanced Methods: Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

UNIT IV

Cluster Analysis: Basic Concepts and Methods, Overview of Basic Clustering Methods, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, BIRCH: Multiphase Hierarchical Clustering Using Clustering Feature Trees.

Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density, OPTICS: Ordering Points to Identify the Clustering Structure, Grid-Based Methods.

UNIT V

Evaluation of Clustering: Assessing Clustering Tendency, Determining the Number of Clusters, Measuring Clustering Quality.

Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches

UNIT VI

Data Mining Trends and Research Frontiers: Mining Complex Data Types: Mining Sequence Data: Time-Series, Symbolic Sequences and Biological Sequences, Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Text Books:

1. Han J & Kamber M, ***"Data Mining: Concepts and Techniques"***, Third Edition, Elsevier, 2011.

Reference Books:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education, 2008.
2. M.Humphires, M.Hawkins, ***"Data Warehousing: Architecture and Implementation"***, Pearson Education, 2009.
3. Anahory, Murray, ***"Data Warehousing in the Real World"***, Pearson Education, 2008.
4. Kargupta, Joshi, etc., ***"Data Mining: Next Generation Challenges and Future Directions"***, Prentice Hall of India Pvt Ltd, 2007.

Course Title:	**Data Warehousing and Data Mining-Lab**	**Semester VII**	
Course Code	**IT704SE-05L**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 4**
Stream	**Data Science**	**Credits**	**2**

Lab Experiments Objective:

1. To be familiar with the algorithms of data mining,
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining

Lab Experiments List:

1. Creation of a Data Warehouse.
2. Apriori Algorithm.
3. FP-Growth Algorithm.
4. K-means clustering.
5. One Hierarchical clustering algorithm.
6. Bayesian Classification.
7. Decision Tree.
8. Support Vector Machines.
9. Applications of classification for web mining.
10. Case Study on Text Mining or any commercial application.

Course Title:	**Project Phase - I**	**Semester VII**	
Course Code	**IT705**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**1 – 2 – 2**
Stream	**Core**	**Credits**	**3**

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

Course Title:	**Industrial Training Assessment**	**Semester VII**	
Course Code	**IT706**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 2 – 0**
Stream	**Core**	**Credits**	**1**

The students receive theoretical knowledge of the basic engineering and applied engineering in first six semesters. They have to do in plant training of four weeks at least during vacation after sixth semester. The training enables the students to expose to industry during their training, provides orientation and improves their prospects for employment.

The students should prefer industrial training in the domain of Information Technology.

Training report and Assessment

During the industrial training he/she will observe layout, working environment, various equipments, tools, instruments etc. under the supervision of supervisor and engineer of the company.

Students are required to submit a printed report of industrial training in the seventh semester. The report should contain information about the major field of company, particularly about the section/department where he/she have undergone the training giving the details of equipments, product, tools their detailed specification, use etc. The training report and field work done by students will be assessed by internal examiner(s) and appropriate grade will be awarded.

Course Title:	**Advanced Programming - Lab**	**Semester VII**	
Course Code	**IT707**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**1 – 4 – 2**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To be familiar with Web page design using HTML / DHTML and style sheets
2. To be exposed to creation of user interfaces using Java frames and applets.
3. To learn to create dynamic web pages using server side scripting.
4. To learn to write PHP database functions.
5. To learn and implement RMI

List of Experiments

1. Write a html program for Creation of web site with forms, frames, links, tables etc
2. Design a web site using HTML and DHTML. Use Basic text Formatting, Images,
3. Create a script that asks the user for a name, then greets the user with "Hello" and the user name on the page
4. Create a script that collects numbers from a page and then adds them up and prints them to a blank field on the page.
5. Create a script that prompts the user for a number and then counts from 1 to that number displaying only the odd numbers.
6. Create a script that will check the field in Assignment 1 for data and alert the user if it is blank. This script should run from a button.
7. Using CSS for creating web sites
8. Creating simple application to access data base using JDBC Formatting HTML with CSS.
9. Program for manipulating Databases and SQL.
10. Program using PHP database functions.
11. Write a web application that functions as a simple hand calculator, but also keeps a "paper trail" of all your previous work
12. Install Tomcat and use JSP and link it with any of the assignments above
13. Reading and Writing the files using .Net
14. Write a program to implement web service for calculator application
15. Implement RMI concept for building any remote method of your choice.

Course Title:	**Internet of Things**	**Semester VII**	
Course Code	**IT801DE-01**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Microcontrollers**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To understand the vision of IoT.
2. To understand IoT market perspective.
3. To study the data and knowledge management and use of devices in IoT technology.
4. To understand state of the art – IoT Architecture.
5. To study the real world IoT design constraints, industrial automation and commercial building automation in IoT.

Course Outcomes:

After learning the course the students should be able:

1. To interpret the vision of IoT from a global context.
2. To determine the market perspective of IoT.
3. To compare and contrast the use of devices, gateways and data management in IoT.
4. To implement state of the art architecture in IoT.
5. To illustrate the application of IoT in industrial automation and identify real world design constraints.

Course Content:

UNIT I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.

UNIT II

M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT III

M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management

UNIT IV

IoT Architecture-State of the Art – Introduction, State of the art, Architecture Reference Model - Introduction, Reference Model and architecture, IoT reference Model

UNIT V

IoT Reference Architecture - Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints - Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT VI

Industrial Automation - Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation - Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ***"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence"***, 1st Edition, Academic Press, 2014.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, ***"Internet of Things (A Hands-on-Approach)"***, 1st Edition, VPT, 2014.
2. Francis da Costa, ***"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything"***, 1st Edition, Apress Publications, 2013

Course Title:	**Internet of Things - Lab**	**Semester VII**	
Course Code	**IT801DE-01L**	**Course Type**	**Elective**
Pre-requisite	**Microprocessors & Microcontrollers Programming**	**L – T – P**	**0 – 0 – 4**
Stream	**Departmental**	**Credits**	**2**

Lab Experiments Objective:

1. To implement M2M programs using ARM/Raspberry Pi boards
2. To interface real-world devices with Internet and display data and information collected

Lab Experiments List:

1. Write program for creating different LED patterns and use ARM/Raspberry Pi boards, on-board LEDs for checking output.
2. Write program for interfacing LEDs and push to on switch with ARM/Raspberry Pi board at different GPIO pins.
3. Write program for interfacing 16x2 LCD with ARM/Raspberry Pi board at different GPIO pins.
4. Write program to read the onboard temperature and display on cloud.

Course Title:	**Ecommerce Systems**	**Semester VII**	
Course Code	**IT801DE-02**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the importance of E-commerce and its impact on business
2. To understand the various e-commerce business models and its uses
3. To learn the various E-commerce technologies and IT requirements for a successful e-commerce business
4. To discover factors required for good e-commerce systems

Course Outcomes:

After learning the course the students should be able:

1. To explain e-commerce systems construct limitations and benefits
2. To design e-commerce applications
3. To discuss security and IT requirements to deploy e-commerce systems
4. To explain the critical success factors of good e-commerce applications

Course Content:

UNIT I

Introduction to e-commerce: Meaning, nature and scope; channels of e-commerce, Business applications of e-commerce, Traditional commerce vs. E-commerce and Business model of ecommerce: B2B, B2C, C2C, B2G and other models of ecommerce.

UNIT II

Mobile commerce: Introduction to M-Commerce, History & Key Benefits & limitations, Critical Success factors, Wireless Application protocol (WAP), Mobile banking.

Electronic payment system: Type of payment systems- e-cash and currency servers, e- cheques, credit card, smart card, electronic purses and debit cards, operational, credit and legal risks of e-payments, risk management options for e-payment system, order fulfillment for e-commerce.

UNIT III

E-commerce strategy: Overview, Strategic Methods for developing E – commerce.

UNIT IV

The Four C's of E-commerce: (Convergence, Collaborative Computing, Content Management & Call Center). Convergence: Technological Advances in Convergence – Types, Convergence and its implications. Convergence & Electronic Commerce. Collaborative Computing: Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management: Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management; Content Marketing. Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

UNIT V

E-commerce Technologies: Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking For E – Commerce, Internet, Intranet & Extranet, EDI Systems

UNIT VI

Security issues in e-commerce: Security risk of e-commerce, type and sources of threats; protecting the electronic commerce assets and intellectual property; firewalls; client server network security; data and message security; digital identification and electronic signature; encryption approach to e-commerce security.

Text Books:

1. C.S.V. Murthy, ***"E-Commerce Concept-model-strategies"***, Himayalaya Publication House
2. Nidhi Dhawan, ***"E-Commerce Concepts and Applications"***, International book house Pvt Ltd.
3. Kalkota and Whinston, ***"Frontiers of Electronic Commerce"***, Pearson

Reference Books

1. Elias M. Awad., ***"Electronic Commerce"***, PHI
2. Joseph, ***"E-commerce"***, PHI, 2nd edition
3. Bhaskar Bharat, ***"Electronic Commerce - Technologies & Applications"***, TMH
4. Chris Bates, ***"Web Programming"***, 3rd edition, Wiley publication, 2009.
5. B.V. Kumar, S.V. Subrahmanya, ***"Web Services: An Introduction"***, Tata McGraw Hill Publication, 2008.

Course Title:	**Ecommerce Systems Lab**	**Semester VII**	
Course Code	**IT801DE-02L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Web Technologies**	**L – T – P**	**0 – 0 – 4**
Stream	**Departmental**	**Credits**	**2**

Lab Experiments Objective:

1. To design a ecommerce website
2. To develop the various modules for a B2C ecommerce business
3. To program and implement various web pages and workflows to deploy a B2C ecommerce business
4. To develop the various web forms and page panels for a ecommerce

List of Lab Experiments:

Students can choose any online retail business on the B2C model of e-commerce business.

1. Creating the Website Layout for E-Commerce
2. Inserting & Displaying the Products & Categories
3. Creating the Shopping Cart
4. Creating the User Registration & Login Systems
5. Creating the Checkout System
6. Creating the Payment Integration System
7. Creating the Admin Panel for E-Commerce
8. Uploading the E-Commerce to Online Server

Course Title:	**Mobile Computing**	**Semester VII**	
Course Code	**IT802SE-01**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objective

1. To describe the basic concepts and principles in mobile computing
2. To understand the concept of Wireless LANs, PAN, Mobile Networks, and Sensor Networks
3. To explain the structure and components for Mobile IP and Mobilty Management
4. To understand positioning techniques and location-based services and applications
5. To describe the important issues and concerns on security and privacy
6. To design and implement mobile applications to realize location-aware computing
7. To design algorithms for location estimations based on different positioning techniques and platforms
8. To acquire the knowledge to administrate and to maintain a Wireless LAN

Course Outcome:

After learning the course the students should be able:

1. To describe wireless and mobile communications systems
2. To choose an appropriate mobile system from a set of requirements.
3. To work around the weaknesses of mobile computing
4. To interface a mobile computing system to hardware and networks.
5. To program applications on a mobile computing system and interact with servers and database systems.

Course Content:

UNIT I

Fundamental of Wireless and basics of wireless network: Digital communication, wireless communication system and limitations, wireless media, frequency spectrum, technologies in digital wireless communication, wireless communication channel specification, wireless network, wireless switching technology, wireless communication

UNIT II

Mobile Communications and Computing: An Overview Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Mobile Devices and Systems, Mobile Phones, Digital Music Players, Hand-held Pocket Computers, Hand-held Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.

UNIT III

GSM and other architectures: GSM-Services & System Architectures ,Radio Interfaces, Protocols Localization, Calling, Handover, Security, New Data Services, modulation, multiplexing, controlling the medium access, spread spectrum, coding methods, CDMA, IMT 2000, WCDMA and CDMA 2000, 4G Networks.

UNIT IV

Mobile Network and Transport Layer: IP & Mobile IP Network Layers, Packet Delivery & Handover Management, Location Management, Registration, Tunneling & Encapsulation, Route Optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Mobile Ad-hoc Networks (MANET), Routing and Routing Algorithms in MANET, security in ad-hoc networks.

UNIT V

Data Dissemination and Data Synchronization in Mobile Computing: Communication Asymetry, classification of data delivery mechanism, data dissemination broadcast models, selective tuning and indexing techniques, synchronization, synchronization software for mobile devices, synchronization protocols.

UNIT VI

Mobile Devices and Mobile Operating System: Mobile agent, applications framework, application server, gateways, service discovery, device management, mobile file system, Mobile Operating Systems, Characteristics, Basic functionality of Operating Systems: Window 8, iOS, Android OS.

Text Book:

1. Raj Kamal, "Mobile Computing", 2nd edition , Oxford University Press-New Delhi
2. Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, ***"Wireless and Mobile Networks, Concepts and Protocols"***, Wiley, India.

Reference Book:

1. Mark Ciampa, ***"Guide to Designing and Implementing wireless LANs"***, Thomson learning, Vikas Publishing House, 2001.
2. Ray Rischpater, ***"Wireless Web Development"***, Springer Publishing,
3. Sandeep Singhal, ***"The Wireless Application Protocol"*** , Pearson.
4. P.Stavronlakis, ***"Third Generation Mobile Telecommunication Systems"*** , Springer Publishers,

Course Title:	**Mobile Computing - Lab**	**Semester VII**	
Course Code	**IT802SE-01L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 4**
Stream	**Software and Application Development**	**Credits**	**2**

Lab Experiments Objective:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

List of Lab Experiments:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock

Course Title:	**Cryptography**	**Semester VII**	
Course Code	**IT802SE-02**	**Course Type**	**Elective**
Pre-requisite	**Computer Organization & Architecture**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objective

1. To learn cryptography in information security implementation
2. To know the methods of conventional encryption.
3. To understand the concepts of public key encryption and number theory.
4. To understand authentication and Hash functions.
5. To know the network security tools and applications.
6. To understand the system level security used.

Course Outcome:

After learning the course the students should be able:

1. To compare and contrast a range of different cryptosystems.
2. To list and elaborate the differences between secret key and public key cryptosystems.
3. To identify the different approaches to quantifying secrecy.
4. To recognize the different modes of operation for block ciphers and their applications.
5. To explain the role of hash functions in Information Security.
6. To discuss the place of ethics in the Information Security Area.

Course Content:

UNIT I

Introduction: What is cryptology: (cryptography + cryptanalysis), Overview of cryptology: How cryptography works?, how to break a cryptographic system ? Classical conventional encryption, modern conventional encryption, public key encryption, hashing algorithm. OSI Security Architecture, Cryptanalysis of Classical Cryptosystems, Shannon's Theory

UNIT II

Symmetric Cipher: Classical Encryption Techniques, Symmetric Cipher Model, Block Cipher Principles, DES, Triple DES, Cryptanalysis of Symmetric Key Ciphers: Differential and Linear Cryptanalysis, Block Cipher Design Principle, The Euclidean Algorithm, Finite field of Form GP(p), Advance Encryption Standard (AES), AES Cipher, Multiple Encryption and Triple DES, Stream Cipher and RC4, Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random number generation

System Security: Intrusion detection, Password Management, Virus countermeasure, Denial of Service Attack, Firewall design principles, Trusted System

UNIT III

Public Key Cryptography: Key Management - The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, Cryptanalysis of DLP, Elliptic Curve Architecture and Cryptography - Confidentiality using Symmetric Encryption - Public Key Cryptography, RSA, Primality Testing, Factoring Algorithms, Other attacks on RSA and Semantic Security of RSA ElGamal Cryptosystems,

UNIT IV

Authentication and Hash Function: Authentication requirements - Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions, Hash functions: The Merkle Damgard Construction and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - RIPEMD – HMAC, CMAC, Whirlpool and Comparative analysis. Digital Signatures - Authentication Protocols - Digital Signature Standard.

UNIT V

Network Security: Authentication Applications: Kerberos - X.509 Authentication Service - Electronic Mail Security - PGP - S/MIME - IP Security - Web Security

UNIT VI

System Level Security: Intrusion detection - password management - Viruses and related Threats - Virus Counter measures - Firewall Design Principles - Trusted Systems.

Cryptanalysis: Differential Cryptanalysis, Linear Cryptanalysis, Truncated differential cryptanalysis, etc

Assignments (not limited to this): including Cryptographic standards, application of cryptosystems, network security (IPSEC, VPN, Web Security), privilege management infrastructure (PMI) and Access Control, e-Commerce and Smart IC cards)

Text Books

1. William Stallings, ***"Cryptography and Network Security - Principles and Practices"***, Prentice Hall of India, Third Edition, 2003.

Reference Books

1. Atul Kahate, ***"Cryptography and Network Security"***, Tata McGraw-Hill, 2003. Detailed Syllabus B. Tech. Program, NIT Patna Session 2015-16 Page 161
2. Bruce Schneier, ***"Applied Cryptography"***, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, ***"Security in Computing"***, Third Edition, Pearson Education, 2003.

Course Title:	**Cryptography - Lab**	**Semester VII**	
Course Code	**IT802SE-02L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 4**
Stream	**Infrastructure & Security Management**	**Credits**	**2**

Lab Experiments Objective:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

List of Lab Experiments:

1. Lab on encryption using binary/byte addition
2. Encryption using binary Exclusive-OR (XOR)
3. Triple DES with CBC mode and Weak DES keys
4. Lab on RSA Encryption and Factorization Attacks
5. Attack on RSA encryption with short RSA modulus
6. Lab on hash generation and sensitivity of hash functions to plaintext modifications
7. Lab on Digital Signature Visualization
8. Lab on RSA Signature
9. Lab on Attack on Digital Signature/Hash Collision

Course Title:	**Information Retrieval**	**Semester VII**	
Course Code	**IT802SE-03**	**Course Type**	**Elective**
Pre-requisite	**Computer Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Description

1. To learn the techniques used to retrieve useful information from repositories such as the Web.
2. To understand the concepts in information retrieval such as documents, queries, collections, and relevance.
3. To learn approaches for efficient indexing, for quick identification of candidate answer documents
4. To learn modern techniques for crawling data from the web.

Course Learning Outcomes

After learning the course the students should be able:

1. To apply information retrieval principles to locate relevant information in large collections of data
2. To understand and deploy efficient techniques for the indexing of document objects that are to be retrieved
3. To implement features of retrieval systems for web-based and other search tasks
4. To analyze the performance of retrieval systems using test collections
5. To make practical recommendations about deploying information retrieval systems in different search domains, including considerations for document management and querying

Course Content

UNIT I

Introduction to the Course: Information retrieval problem, first take at building an inverted index, processing of Boolean queries, extended Boolean model vs. ranked retrieval.

Term vocabulary and postings lists: document delineation and character sequence decoding, determining vocabulary of terms, Faster postings list intersection via skip pointers, positional postings and phrase queries.

UNIT II

Dictionaries, Tolerant Retrieval and Indexing: search structures for dictionaries, wildcard queries, spelling correction, Phonetic correction; Index construction, Blocked sort-based indexing, single-pass in-memory indexing, distributed indexing, dynamic indexing and other types; Index compression: Heaps' and Zipf's law, dictionary compression and postings file compression.

UNIT III

Scoring and IR System Evaluation: parametric and zone indexes, term frequency and weighing, vector space model for scoring, variant tf-idf functions, efficient scoring and ranking, components of an IR system, vector space scoring and query operator interaction; IR system evaluation, Standard test collections, evaluation of unranked and ranked retrieval results, Assessing relevance, System quality and user utility; Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

UNIT IV

XML and Probabilistic Information Retrieval: Basic concepts of XML retrieval and challenges, vector space model for XML retrieval, Text-centric vs. data centric XML retrieval; probability ranking principal, binary independence model, appraisal and some extensions; Language models for information retrieval, query likelihood model, language modeling vs. other approaches in IR.

UNIT V

Document Classification: Text classification problem, Naïve Bayes text classification, Bernoulli model, Feature selection, evaluation of text classification; Vector space classification: Document representations and measure of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear vs. Non-linear classifiers, bias-variance tradeoff; Support vector machines, extensions to SVM models, Issues in the classification of text documents, Machine learning methods in ad hoc information retrieval.

UNIT VI

Document Clustering and Matrix Decomposition: Flat clustering, cardinality, evaluation of clustering, K-means, Model based clustering; Hierarchical Agglomerative clustering, singlelink and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Optimality of HAC, Divisive clustering, Cluster labeling; Matrix decompositions, Term document matrices and singular value decomposition, Low-rank approximations, Latent semantic indexing.

Web Search: basics concepts, web graph, spam, search user experience, Index size and estimation, Near-duplicates and shingling; Web crawling and indexes: overview, crawler architecture, DNS resolution, URL frontier, Distributing indexes and connectivity servers; Link analysis: Anchor text and web graph, Page Rank, Hubs and Authorities.

Text Book

1. Manning, C. D., Raghavan, P., & Schütze, H. ***"Introduction to Information Retrieval"***. Cambridge University Press. 2008
2. Witten, I. H., Moffat, A., & Bell, T. C. ***"Managing Gigabytes: Compressing and Indexing Documents and Images.",*** Morgan Kaufmann. 1999
3. Grossman, D. A., ***"Information Retrieval: Algorithms and Heuristics"***, Springer. 2004

Reference Books

1. Baeza-Yates, R., & Ribeiro-Neto, B. ***"Modern information Retrieval"***, New York: ACM press. 1999
2. Belew, R. K. ***"Finding Out About: A Cognitive Perspective on Search Engine Technology and the WWW"***, Cambridge University Press. 2000
3. Chakrabarti, S. ***"Mining the Web: Discovering Knowledge from Hypertext Data"***, Morgan Kaufmann. 2003
4. Manning, C. D. ***"Foundations of Statistical Natural Language Processing"***, H. Schütze (Ed.). MIT press. 1999

Course Title:	**Information Retrieval - Lab**	**Semester VII**	
Course Code	**IT802SE-03L**	**Course Type**	**Elective**
Pre-requisite	**Computer Algorithms, Programming**	**L – T – P**	**0 – 0 – 4**
Stream	**Information Management & Quality Control**	**Credits**	**2**

Lab Experiments Objective:

1. To implement various information retrieval (IR) algorithms across data and web successfully
2. To compare results and discuss the merits and demerits of various algorithms

Lab Experiments List:

1. Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.
2. Pre-processing of a Text Document: stop word removal and stemming.
3. Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.
4. Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.
5. Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.
6. Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.
7. To parse XML text, generate Web graph and compute topic specific page rank.
8. Matrix Decomposition and LSI for a standard dataset.
9. Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.
10. Implementation of PageRank on Scholarly Citation Network

Course Title:	**Network Security**	**Semester VII**	
Course Code	**IT802SE-04**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Network Programming**	**L – T – P**	**3 – 0 – 0**
Stream	**Networks**	**Credits**	**3**

Course Description

1. To understand the number theory used for network security
2. To understand the design concept of cryptography and authentication
3. To understand the design concepts of internet security
4. To develop experiments on algorithm used for security

Course Learning Outcomes

After learning the course the students should be able:

1. To describe network security awareness and a clear understanding of its importance
2. To explain how threats to an organization are discovered, analyzed, and dealt with
3. To explain protocols for security services
4. To describe network security threats and countermeasures
5. To explain network security designs using available secure solutions (such as PGP, SSL, IPSec, etc)
6. To demonstrate advanced security issues and technologies (such as DDoS attack detection and containment, and anonymous communications)

Course Content

UNIT I

Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher Principles-DES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.

UNIT II

Number Theory – Prime number – Modular arithmetic – Euclid's algorithm - Fermet's and Euler's theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography.

UNIT III

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.

UNIT IV

Security Services for E-mail-establishing keys-privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME.

UNIT V

SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL-Attacks fixed in v3-Exportability-Encoding-Secure Electronic Transaction (SET)

UNIT VI

Firewall Design Principles- Packet Filters- Application level Gateways-Tunnels-DoS attacks-Intrusion Detection-Password Management-Malicious Software.

Text Book

1. William Stallings, ***"Cryptography & Network Security"***, Pearson Education, Fourth Edition 2010.

Reference Books

1. Charlie Kaufman, Radia Perlman, Mike Speciner, ***"Network Security, Private Communication in Public World"***, PHI Second Edition, 2002.
2. Bruce Schneier, Neils Ferguson, ***"Practical Cryptography"***, Wiley Dreamtech India Pvt Ltd, First Edition, 2003.
3. Douglas R Simson ***"Cryptography – Theory and Practice"***, CRC Press, First Edition, 1995.

Course Title:	**Network Security - Lab**	**Semester VII**	
Course Code	**IT802SE-04L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++**	**L – T – P**	**0 – 0 – 4**
Stream	**Networks**	**Credits**	**2**

Lab Experiments Objective:

1. To highlight the issues with computer and network security by giving the hands on knowledge of various things like monitoring and analyzing network traffic
2. To install and configure different tools like Wireshark, SNORT, NMAP and Port Scanners etc.

Lab Experiments List:

1. Perform An Experiment To Grab A Banner With Telnet And Perform The Task Using Netcat Utility.
2. Perform An Experiment For Port Scanning With Nmap, Superscan Or Any Other Software.
3. Using Nmap
4. Find Open Ports On A System
5. Find The Machines Which Are Active
6. Find The Version Of Remote Os On Other Systems
7. Find The Version Of S/W Installed On Other System
8. Perform An Experiment On Active And Passive Finger
9. Printing Using Xprobe2 and Nmap.
10. Perform an experiment to demonstrate how to sniff for Router Traffic by Using the Tool Wireshark.
11. Perform an experiment How To Use Dumpsec.
12. Perform a Wireless Audit Of An Access Point / Router And Decrypt WEP And WPA.
13. Perform an Experiment To Sniff Traffic Using Arp Poisoning
14. Install Jcrypt Tool (Or Any Other Equivalent) And Demonstrate Asymmetric, Symmetric Crypto Algorithm, Hash And Digital/Pki Signatures
15. Demonstrate Intrusion Detection System (Ids) Using Any Tool e.g. Snort Or Any Other S/W
16. Install Rootkits And Study Variety Of Options
17. Generating Password Hashes With Openssl
18. Setup A Honey Pot And Monitor The Honeypot On Network

Course Title:	**Big Data Analytics**	**Semester VII**	
Course Code	**IT802SE-05**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Description

1. To understand the concept of Big Data
2. To learn Big Data file systems and their storage methods
3. To understand the algorithms and
4. To learn to process Big Data information for analytics
5. To discuss and understand Big Data implementations within large corporations like Google and Facebook

Course Learning Outcomes

After learning the course the students should be able:

1. To model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.
2. To analyze methods and algorithms, to compare and evaluate them with respect to time and space requirements, and make appropriate design choices when solving real-world problems.
3. To explain trade-offs in big data processing technique design and analysis in written and oral form.
4. To explain the Big Data Fundamentals, including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.
5. To apply non-relational databases, the techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.
6. To apply the novel architectures and platforms introduced for Big data, in particular Hadoop and MapReduce.

Course Content

UNIT I

Introduction to Big Data: Introduction to Big Data The four dimensions of Big Data: volume, velocity, variety, veracity, Drivers for Big Data, Introducing the Storage, Query Stack, Revisit useful technologies and concepts, Real-time Big Data Analytics

UNIT II

Distributed File Systems: Hadoop Distributed File System, Google File System, Data Consistency

UNIT III

Big Data Storage Models: Distributed Hash-table, Key-Value Storage Model (Amazon's Dynamo), Document Storage Model (Facebook's Cassandra), Graph storage models

UNIT IV

Scalable Algorithms: Mining large graphs, with focus on social networks and web graphs. Centrality, similarity, all-distances sketches, community detection, link analysis, spectral techniques. Map-reduce, Pig Latin, and NoSQL, Algorithms for detecting similar items, Recommendation systems, Data stream analysis algorithms, Clustering algorithms, Detecting frequent items

UNIT V

Big Data Applications: Advertising on the Web, Web Page Quality Ranking, Mining Social-Networking Group, Human Interaction with Big-Data. Recommendation systems with case studies of Amazon's Item-to-Item recommendation and Netfix Prize, Link Analysis with case studies of the PageRank algorithm and the Spam farm analysis, Crowd Sourcing

UNIT VI

Big Data Issues: Privacy, Visualization, Compliance and Security, Structured vs Unstructured Data

Text Book

1. Anand Rajaraman and Jeffrey Ullman, ***"Mining of Massive Datasets"***, Cambridge University Press, 2012

Reference Books

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, ***"An Introduction to Information Retrieval"***, Cambridge University Press, 2008.
2. Jimmy Lin and Chris Dyer, ***"Data-Intensive Text Processing with MapReduce"***, Morgan and ClayPool Publishers, 2010

Course Title:	**Big Data Analytics - Lab**	**Semester VII**	
Course Code	**IT802SE-05L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++ / Python**	**L – T – P**	**0 – 0 – 4**
Stream	**Data Science**	**Credits**	**2**

Lab Experiments Objective:

1. To learn the concepts of Big data processing techniques by writing programs in Hadoop and MapReduce algorithms

Lab Experiments List:

1. Study of Hadoop ecosystem
2. Two programming exercises on Hadoop
3. Two programming exercises in No SQL
4. Implementing simple algorithms in MapReduce: Matrix multiplication, Aggregates, joins, sorting, searching
5. Implementing any one frequent item set algorithm using MapReduce
6. Implementing any one clustering algorithm using MapReduce
7. Implementing any one data streaming algorithm using MapReduce
8. Mini Project: one real life large data application to be implemented (use standard datasets available on the web)

Course Title:	**User Experience Design**	**Semester VII**	
Course Code	**IT803SE-01**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To understand user experience design principles
2. To understand the various elements and how the elements of user experience work together
3. To understand strategy, structure, skeleton and scope as an element of user experience
4. To identify business goals, user needs, content requirements
5. To create a functional specification and an effective information design
6. To learn to prioritize specs and requirements
7. To architect information effectively and navigation
8. To learn resources available to assist with User Experience Design Process

Course Outcomes:

After learning the course the students should be able:

1. To design applications and web pages with effective and easy to use user experience
2. To utilize tools and techniques for research and build user screens based on best practices
3. To collect and document business, user and information specification
4. To implement user screens and package information with ease of navigations

Course Content:

UNIT I

UX Introduction: User Interaction with the products, applications and services – Cognitive Model/Mental Model; Why User Experience Design; What is User Experience (UX) Design?

UNIT II

Elements of UX Design: Core elements of User Experience. How these elements work together. UX Design Process: Defining the UX Design Process and Methodology

UNIT III

UX Design Process: RESEARCH & DEFINE: Why Research is critical?; Research methods and tools. Understanding the User Needs and Goals; Understanding the Business Goals; Deliverables of the Research & Define phase-Insight on User Goals and Business Goals; Hands-on assignments and Quiz

UNIT IV

UX Design Process: IDEATE/DESIGN - Visual Design Principles, Information Design and Data, Visualization: Interaction Design, Information Architecture, Wire-framing & Story-boarding, UI Elements and Widgets, Screen Design and Layouts, Hands-on Assignments and Quiz

UNIT V

UX Design Process: PROTOTYPE & TEST: Why Test your Design? What is Usability Testing? Types of Usability Testing, Usability Testing Process, How to prepare and plan for the Usability, Tests? Prototype your Design to Test? Introduction of prototyping tools, How to conduct Usability Test? How to communicate Usability Test Results?

UNIT VI

UX Design Process: ITERATE/IMPROVE: Understanding the Usability Test findings Applying the Usability Test feedback in improving the design. UX Design Process: DELIVER: Communication with implementation team UX Deliverables to be given to implementation team

Text Book

1. Jesse James Garrett, ***"The Elements of User Experience: User-Centered Design for the Web and Beyond"***, New Riders Publishing, 2nd edition, 2002
2. Steve Krug, ***"Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability"***, 3rd Edition, 2014
3. Thomas Tullis, Willaim Albert, ***"Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics"***, Morgan Kaufman, 1st Edition, 2008

Reference Books

1. Jeff Gothelf, Josh Seiden, ***"Lean UX: Applying Lean Principles to Improve User Experience"***, O'Reilly, 1st Edition, 2013
2. Kevin Mullet, Darrell Sano, ***"Designing Visual Interfaces: Communication Oriented Techniques"***, Soft Press, 1995
3. Wilbert O. Galitz, ***"The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques"***, Wiley, 2002

Course Title:	**Infrastructure Auditing & Implementation**	**Semester VII**	
Course Code	**IT803SE-02**	**Course Type**	**Elective**
Pre-requisite	**IT Service Management**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To know the goals and objectives of IT audit and its role in internal control system
2. To learn the techniques of audit planning and audit performance, gathering of audit related information and audit evidence
3. To understand how to audit and evaluate effectiveness of the IT internal controls system
4. To learn the fundamentals of information risk management and audit of information security.

Course Outcomes

After learning the course the students should be able:

1. To describe the need for information security audit
2. To define the requirements of IT risks, security and policies required for organizations
3. To explain the mandatory items that need to be checked

UNIT I

FUNDAMENTALS OF INFRASTRUCTURE AUDIT meaning and definition, Overview, Choice of correct methods, Need, Scope and Objectives

UNIT II

INTRODUCTION TO RISK ASSESSMENT- Entity area, strategies and policies, in operation, support, External Drivers, User Interaction, Consequences-Importance of demonstrating control over network and security staffs, Risk of operator access controls over device and server settings.

UNIT III

CHECKLIST FOR IT AUDIT- Alignment with Business Strategy, Long Term IT Strategy, Short range IT Plans, Information System Security Policy, Implementation of Security Policy, Information System Audit Guidelines, Acquisition and implementation of packaged software

UNIT IV

REQUIREMENT IDENTIFICATION AND ANALYSIS Configuration audits, Need for an audit trail, A real-time, live-network change review, Automatically verify compliance with both external best practices and internal standards.

UNIT V

VENDOR SELECTION CRITERIA & PROCESS-Tracking the vendor selection criteria. CONTRACTING- The issues of site licenses, usage of open sources software, Annual maintenance Contracts

UNIT VI

IMPLEMENTATION- Importance of regulations and standards such as Sarbanes-Oxley, ISO 17799 and Visa's Cardholder Information Security Program (CISP), On-demand historical reports, Governance & Cobit as a model for IT compliance. BENEFITS OF INFRASTRUCTURE AUDIT, Strong change management process

Text Books

1. Richard E. Cascarino, ***"Auditor's Guide to Information Systems Auditing"***, Wiley, 2007
2. Chris Jackson, ***"Network Security Auditing"***, Cisco Press, 2010

Reference Books

1. www.netwrix.com
2. www.rbi.org

Course Title:	**Cyber Law and IPR**	**Semester VII**	
Course Code	**IT803SE-03**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To understand cyber laws and its applicability in India.
2. To learn the basic concepts of technology and law, digital contracts, rights of netizens and E-governance. To study cyber space and the cyber laws and regulating them through relevant Acts.
3. To learn the comparative study of national and international laws keeping in view international scenario in a no-barrier world.
4. To be aware about IPR in scientific and technical community for protecting their inventions.
5. To understand IPR from a non-lawyers perspective like senior managers, administrators etc.
6. To experience practices and procedures in various government offices administering IPR Laws.

Course Outcomes

After learning the course the students should be able:

1. To describe the cyber world and cyber law in general
2. To explain about the various facets of cyber crimes
3. To explain the problems arising out of online transactions and provoke them to find solutions
4. To clarify the Intellectual Property issues in the cyber space and the growth and development of the law in this regard
5. To educate about the regulation of cyber space at national and international level

Course Content

UNIT I

Introduction to Cyber crimes: Definition, cybercrime and information security, Classes of cybercrime and categories, Cyber offences, Cybercrimes with mobile and wireless devices.

UNIT II

Jurisdiction in the cyber world across the world: Cybercrime law in Asia, Cybercrime & federal laws, legal principles on jurisdiction and jurisdictional disputes w.r.t. the internet in United States of America, cybercrime legislation in African region, Foreign judgments in India

UNIT III

Indian IT act: Information Technology Act, 2000(Complete including digital signature, certifying authorities and E-governance), Positive aspects, weak areas, Amendments to the Information Technology Act, 2008. Challenges to Indian law and cybercrime scenario in India. Protection of cyber consumers in India

UNIT IV

Emerging Electronic System: E – commerce; E – governance; Concept of Electronic Signature; Credit Cards; Secure Electronic Transactions

UNIT V

Intellectual property Rights: Intellectual Property law basics, Types of Intellectual Property, Agencies responsible for Intellectual Property registration. International organizations, Agencies and Treaties. Increasing importance of Intellectual Property Law

UNIT VI

Copyright issues in Cyberspace: Relevant provisions under Copyright Act, 1957, regulating copyright issues in Cyberspace; Online Software Piracy – legal issues involved; Analysis of sufficiency of provisions of Copyright Act to deals with Online Software

Piracy: Trademark issues in Cyberspace – Domain Name; Cyber squatting as a form of Domain Name dispute; Case law.

Case studies: Highlight the cybercrimes, cyber laws and Intellectual property Rights with the help of minimum 5 cases with reference to Indian IT act for better understanding.

Text Books

1. Herman T. Tavani, ***"Ethics & Technology, Ethical Issues in an Age of Information and Communication Technology"***, 3rd Edition, John Wiley & Sons, Inc., 2011
2. Syed Shakil Ahmed and Reheja Rajiv, ***"A Guide to Information Technology (Cyber Laws & E-commerce)"***, Capital Law House, 2001
3. Kamath Nandan, ***"Law Relating to Computers Internet & E-commerce (A guide to Cyber Laws & the Information Technology Act, 2000 with Rules & Notification)"***, 2nd Edition, Reprint: 2002:- Universal Book Traders.

Reference Books

1. Ahmad Tabrez, "***Cyber law , E-commerce & M-Commerce"***, A. P. H. Publishing Corporation, 2003
2. Bakshi P.M and Suri R.K, ***"Cyber and E-commerce Laws"***, Bharat Publishing House, 1st edition, 2002.
3. Vishwanathan Suresh T, ***"The Indian Cyber Law"***, 2nd Edition 2001, Bharat Law House.
4. Prasad T.V.R. Satya, ***"Law Relating to Information Technology (Cyber Laws)"***, 1st edition 2001- Asia Law House,
5. Reed Chris, ***"Computer Law"***, 3rd Edition 1996 (First Indian Reprint 2000), Universal Law Publishing Co. Pvt. Ltd.
6. P. Narayanan, ***"Intellectual Property (Trade Marks & the Emerging concepts of Cyber property rights (HB)"***, 3rd Edition. (HB), 2002, Universal Book Traders,

Course Title:	**Internetworking Protocols**	**Semester VII**	
Course Code	**IT803SE-04**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks**	**L – T – P**	**3 – 0 – 0**
Stream	**Networks**	**Credits**	**3**

Course Objectives:

1. To Understand Network Layer and Applications
2. To learn UDP and TCP applications
3. To learn Transport Layer Reliability
4. To understand the basic concepts of TCP/IP Architecture

Course Outcomes

After learning the course the students should be able:

1. To describe the cyber world and cyber law in general
2. To compare and contrast TCP and UDP in terms of the application that use them
3. To design network-based applications using the socket mechanism
4. To work with IPv4 addresses in terms of subnetting, VLSM and supernetting
5. To setup a host and network in terms of IP addressing

Course Content

UNIT I

Review of Networking Technologies and Internetworking Concepts and Architectural Model: Application level and network level interconnection, Properties of the internet, Internet architecture, Interconnection through IP routers.

UNIT II

Internet Addresses, Mapping Internet Addresses to Physical Addresses (ARP) & Determining an Internet Addresses at Startup (RARP):

Universal identifiers, Three primary classes of IP addresses, Network and broadcast addresses, Limited broadcast, Dotted decimal notation, Weakness in internet addressing, Loopback addresses, Address resolution problem, Two types of physical addresses, Resolution through direct mapping, Resolution through dynamic binding, Address resolution cache, ARP to other protocols, Reverse address resolution protocol, Timing RARP transaction, Primary and backup RARP servers.

UNIT III

Internet Protocol: Connectionless Datagram Delivery and Internet Protocol: Routing IP Datagram: The concepts of unreliable delivery, Connectionless delivery system, Purpose of the internet protocol, The internet datagram, Routing in an internet, Direct and indirect delivery, Table driven IP routing, Next hop routing, Default routes, Host specific routes, The IP routing algorithm, Handling incoming data-grams , Establishing routing tables.

UNIT IV

Internet Protocol: Error and Control Message (ICMP) and Subnet and Supernet Address Extension: The internet, Control message protocols, Error reporting versus error detection, ICMP message format, Detecting and reporting various network problems through ICMP, Transparent router, Proxy ARP, Subnet addressing, Implementation of subnets with masks representation, Routing in the presence of subnets, A unified algorithm.

UNIT V

User Datagram Protocol (UDP): Format of UDP message, UDP pseudo header, UDP encapsulation and protocols layering and the UDP checksum computation, UDP multiplexing, De-multiplexing and ports.

UNIT VI

Reliable Stream Transport Service (TCP): The transmission control protocol, Ports, Connections and endpoint, Passive and active opens, The TCP segment format, TCP implementation issues.

Text Books

1. Douglas E. Comer, ***"Internetworking with TCP/IP: Principles, Protocols and Architecture, Volume 1"***, 6th edition, PHI publication, 2013.
2. Behrouz A. Forouzan, ***"TCP-IP Protocol Suite"***, 4th edition, McGraw Hill Publication, 2010.

Reference Books

1. Comer, ***"Internetworking with TCP-IP Vol. 3"***, 5th edition, Pearson publication, 2013.
2. W. Richard Stevens, ***"UNIX Network Programming: Interprocess Communications, Volume 2"***, 2nd edition, PHI publication, 1999.
3. William Stalling, ***"SNMP SNMPv2, SNMPv3, and RMON 1 and 2"***, 2nd edition, Pearson Education publication, 2001.
4. Hunt Craig, ***"TCP-IP Network Administration"***, 3rd edition, O'Reilly publication, 2002.
5. Loshin, Harwurt, ***"TCP-IP Cleanly Explained"***, BPB publication.

Course Title:	**Web & Text Mining**	**Semester VII**	
Course Code	**IT803SE-05**	**Course Type**	**Elective**
Pre-requisite	**Data Mining**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives

1. To learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications
2. To learn the essential techniques of data and text mining
3. To understand data mining standard predictive methods to unstructured text
4. To discuss the standard techniques of preparation and handling methods to transform that can be mined

Course Outcomes

After learning the course the students should be able:

1. To examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system
2. To explore DWH and OLAP, and devise efficient & cost effective methods for maintaining DWHs.
3. To discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems , make predictions of outcomes
4. To comprehend the roles that data mining plays in various fields and manipulate different data mining techniques
5. To evaluate systematically supervised and unsupervised models and algorithms wrt their accuracy.

Course Content

UNIT I

Introduction to Information Retrieval, Inverted indices and boolean queries. Query optimization, The nature of unstructured and semi-structured text.

UNIT II

Text encoding: tokenization, stemming, lemmatization, stop words, phrases, Further optimizing indices for query processing, Proximity and phrase queries, Positional indices.

UNIT III

Index compression: lexicon compression and postings lists compression, Gap encoding, amma codes, Zipf's Law.Blocking. Extreme compression, Query expansion: spelling correction and synonyms. Wild-card queries, permuterm indices, n-gram indices. Edit distance, soundex, language detection. Index construction. Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes, real-world issues.

UNIT IV

Parametric or fielded search, Document zones, the vector space retrieval model, tf.idf weighting, Scoring documents, Vector space scoring, the cosine measure, Efficiency considerations, Nearest neighbor techniques, reduced dimensionality approximations, random projection. Results summaries: static and dynamic, Evaluating search engines.

User happiness, precision, recall, F-measure, Creating test collections: kappa measure, interjudge agreement. Relevance, approximate vector retrieval.

UNIT V

Relevance feedback, Pseudo relevance feedback, Query expansion, Automatic thesaurus generation, Sense-based retrieval, Experimental results of performance effectiveness.

Probabilistic models for text problems. Classical probabilistic IR, Language models, Introduction to text classification, Naive Bayes models. Spam filtering. Probabilistic language models for IR. Bayesian nets for IR.

UNIT VI

Introduction to the problem, Partitioning methods, K-means clustering, Mixture of Gaussians model, Clustering versus classification, Hierarchical agglomerative clustering, Clustering terms using documents, Labelling clusters, Evaluating clustering, Text-specific issues, Reduced dimensionality/spectral methods, Latent semantic indexing (LSI), Applications to clustering and to information retrieval.

Vector space classification using hyperplanes; centroids; k Nearest Neighbors, Support Vector machine classifiers, Kernel functions, Text classification, Exploiting text-specific features, Feature selection, Evaluation of classification, Micro- and macro averaging, Comparative results.

Text Books

1. Michael Geatz and Richard Roiger, ***"Data Mining: A Tutorial Based Primer"***, Pearson Education
2. Thomas W. Miller, ***"Data and Text Mining: A Business Applications Approach"***, Pearson Education
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education

Reference Books

1. R. Baeza-Yates and B. Ribeiro-Neto, ***"Modern Information Retrieval"***, Pearson Education, 1999
2. D.A. Grossman, O. Frieder, ***"Information Retrieval: Algorithms and Heuristics"***, Springer, 2004.
3. W. Frakes and R. Baeza-Yates, ***"Information Retrieval: Data Structures and Algorithms"***, Pearson Education, 1st Edition.

Course Title:	**Multimedia Applications**	**Semester VIII**	
Course Code	**IT804SE-01**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To understand the overview of basic topics in multimedia
2. To learn the software technologies of non-traditional interfaces
3. To learn the development of interactive multimedia applications

Course Outcomes:

After learning the course the students should be able:

1. To understand basic concepts related to MM including data standards, algorithms and software
2. To experience development of multimedia software by utilizing existing libraries and descriptions of algorithms
3. To demonstrate cutting-edge multimedia topics through independent study and presentations in class

Course Content:

UNIT I

Introduction: Components of Multimedia, Multimedia and Hypermedia multimedia building blocks, communication and information transfer model, multimedia information systems, application purposes of multimedia, electronics performance support systems. Interaction Technologies and devices: Human Computer Interface, Input/output technologies, combined I/O device, storage technologies, processing technologies.

UNIT II

Multimedia Authoring and data representation: Multimedia Authoring: Production, presentation, and auto authoring. Image data types, image representation, image acquisition, picture display, working with image.

UNIT III

Compression Technologies for multimedia: need for data compression, compression basics, lossless and lossy compression, image compression standards, video compression standards, basic audio compression standards.

UNIT IV

Text, Hypertext and Hypermedia, and Digital audio: Visual representation of text, digital representation of characters, Formatting aspect text, Hypertext and hypermedia, producing digital audio, Psychoacoustics, processing sound, representation of audio files, digitization of sound, MIDI, quantization and transmission of audio.

UNIT V

Designing multimedia: Development phases and teams, analysis phase, design phase, development phase, implementation phase, evaluation and testing.

UNIT VI

Multimedia networks and communication: Multimedia in the Internet, streaming stored audio/video, streaming live audio/video, real-time interactive audio/video, Real-time interactive protocols: RTP, RTCP, Session Initialization protocol (SIP), H.323, SCTP. QoS: Data flow, flow classes, flow control, Integrated services, Differentiated services. Multimedia content management systems, multimedia indexing, multimedia retrieval.

Text Books:

1. Li. Z., Drew M., ***"Fundamentals of Multimedia"***, Pearson Education publishers, 2004

2. Chow V. W. S., ***"Multimedia Technology and Applications"***, Springer

Reference Books:

1. Banerji A., and Ghosh A.M., ***"Multimedia Technologies"***, McGraw Hill International, 2009
2. Stamou G., and Kollias S., ***"Multimedia Contents and the Semantic Web"***, John Wiley & Sons., 2005

Course Title:	**Multimedia Applications Laboratory**	**Semester VIII**	
Course Code	**IT804SE-01L**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credits**	**1**

Lab Experiments Objective:

1. To write programs to edit and modify multimedia files into different formats
2. To write programs to service multimedia information on demand through streaming
3. To transfer multimedia data from one system to other

Lab Experiments List:

1. Assignment on: Image editing using Photoshop (or other image editing software)
2. Audio editing using Sound Forge or Audacity (or other sound editing software)
3. Animation using Flash Video editing using Premier or Adobe
4. Write a program to convert audio files from one format to other
5. Write a program to convert video files from one format to other
6. Write a programs to embed multimedia files on a webpage and stream them
7. Write programs to transfer multimedia files from one devices to another

Course Title:	**Ethical Hacking**	**Semester VIII**	
Course Code	**IT804SE-02**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To understand how intruders escalate privileges.
2. To understand Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and different types of Attacks and their protection mechanisms
3. To learn about ethical laws and tests

Course Outcomes:

After successful completion of the course, the student will be able:

1. To understand the core concepts related to malware, hardware and software vulnerabilities and their causes
2. To understand ethics behind hacking and vulnerability disclosure
3. To appreciate the Cyber Laws and impact of hacking
4. To exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies

Course Content:

UNIT I

Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and Non-Repudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker,

UNIT II

Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking & Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors.

UNIT III

Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking.

UNIT IV

Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking.

UNIT V

Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking.

UNIT VI

An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

Text Books:

1. Michael T. Simpson, Kent Backman, James E., ***"Corley, Hands - On Ethical Hacking and Network Defense"***, Second Edition, CENGAGE Learning, 2010.
2. Patrick Engebretson, ***"The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy"***, Syngress Basics Series – Elsevier, August 4, 2011.

Reference Books:

1. Steven DeFino, Barry Kaufman, Nick Valenteen, ***"Official Certified Ethical Hacker Review Guide"***, CENGAGE Learning, 2009-11-01.
2. Whitaker & Newman, ***"Penetration Testing and Network Defense"***, Cisco Press, Indianapolis, IN, 2006.

Course Title:	**Ethical Hacking Laboratory**	**Semester VIII**	
Course Code	**IT804SE-02L**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credits**	**1**

Lab Experiments Objective:

1. To understand the different kinds of hacker attacks to information and computer systems
2. To simulate hacker attacks
3. To change system parameters to prevent hacker attacks
4. To write programs to prevent attacks and make system more resilient

Lab Experiments List:

1. Use any 2 of the following hacking tools to expose system vulnerability (Nmap, Nessus, John the Ripper, Cain & Abel, Netstumbler, SQLMap)
2. Conduct and experiment to crack a password of an Application using the Cain & Abel tool
3. Simulate a Denial of Service attack
4. Execute a network sniffing exercise using Wireshark
5. Discover vulnerabilities in a web server
6. Create a simple website and write programs protect it from hacks such as (SQL injection, DoS, Cross Site Scripting XSS, Cookie/Session Poisoning, Form Tampering, Code injection and Defacement)

Course Title:	**CRM & SCM**	**Semester VIII**	
Course Code	**IT804SE-03**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management and Quality Control**	**Credits**	**3**

Course Objectives:

1. To make students understand the how IT is an enabler for SCM and CRM.
2. To understand supply chain strategy framework and supply chain strategies
3. To comprehend the functionalities of CRM in service sector

Course Outcomes:

After learning the course the students should be able:

1. To understand the concept of logistics and supply chain management.
2. To appreciate the importance of logistics function in overall success of any business/industrial sector.
3. To understand the interrelationship between logistics and supply chain management.
4. To understand the importance and dynamics of supply chain management in any business/industrial sector.
5. To know the world class best practices being carried out in supply chain management.
6. To understand the procurement and outsourcing strategies.
7. To understand the impact of customer relationship management in effective supply chain management.
8. To know how to measure the performance of supply chain operations.

Course Content:

UNIT I

Introduction to CRM: What is CRM? Why we need CRM? Definition of CRM, Architecture of CRM, Technology considerations of CRM, Technology Components of CRM, Customer Life Cycle, Customer Lifetime Value computation, Implications of Globalization on Customer Relationship Management

UNIT II

Introduction to e-CRM: Definition of e-CRM, Its Need, features, Framework of e-CRM, Six e's of e-CRM, CRM Vs e-CRM, Architecture of e-CRM, Implementing a Technology Based CRM Solution

UNIT III

Introduction to Supply Chain: What is SCM?, Why SCM? Generic types of Supply chain, Major drivers of Supply chain, Supply Chain Strategies, Value in Supply Chain- quality, delivery, flexibility, Core competencies in Supply Chain

UNIT IV

Source management in Supply Chain: Insourcing, outsourcing, partner selection, sourcing strategies, procurement strategies, Managing Inventory in Supply chain, Definition of inventories, selective inventory control, vendor managed inventory systems, inventory performance measures- financial, operational & inventory turnover ratio (ITR), Transportation Decisions in a Supply Chain – Transportation Strategy, transportation selection, mode of transportation, Transportation management system (TMS)

UNIT V

e- SCM: Information technology in Supply Chain – Typical IT solutions- EDI, Intranet, Extranet, Data Warehousing, E- commerce, E – procurement, Bar coding technology, GPS, RFID

UNIT VI

Information Systems in Supply Chain Case Study – A live case of use of IT, Case Studies for SCM & CRM, For SCM: Mumbai Tiffinwala, For CRM: Sales Force

Text Books:

1. Bowersox, Closs & Cooper , ***"Supply Chain & Logistic Management"***, Tata McGraw Hill, 2nd Edition
2. Paul Greenberg, ***"CRM at the speed of light"***, YMH 2nd Edition.

Reference Books:

1. Kristin Anderson and Carol Kerr, ***"Customer Relationship Management"***, TMGH

Course Title:	**CRM & SCM Laboratory**	**Semester VIII**	
Course Code	**IT804SE-03L**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credits**	**1**

Lab Experiments Objective:

1. To understand CRM and SCM as candidates to understand ERP applications deployed in organization
2. To demonstrate the workings of various sub functions of CRM and SCM as learned in theory

Lab Experiments List:

Students can download any open source CRM and SCM systems available to conduct the lab assignments

1. Set up an organizations customers, sales, product/services, departments and markets in the CRM/SCM system
2. Enter data for orders, customers, products, orders, quotes, invoices, payments in the CRM/SCM
3. Generate various CRM reports and alert with all the data entered

Course Title:	**Wireless Networking**	**Semester VIII**	
Course Code	**IT804SE-04**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To study the evolving wireless technologies and standards
2. To understand the architectures of various access technologies such as 3G, 4G, WiFi etc.
3. To understand various protocols and services provided by next generation netwoks.

Course Outcomes:

After learning the course the students should be able:

1. To keep himself updated on latest wireless technologies and trends in the communication field
2. To understand the transmission of voice and data through various networks.

Course Content:

UNIT I

Introduction, Technology and service trends of Emerging Wireless technologies, The Amazing Growth of Mobile Communications, A Little History, Mobile Communications Fundamentals, Mobile Data, WiFi, Bluetooth, Cable Systems, Wireless Migration Options, Harmonization Process.

UNIT II

WiFi (802.11), 802.11 Standards, WiFi Protocols, Frequency Allocation, Modulation and Coding Schemes, Network Architecture, Typical WiFi Configurations, Security, 802.11 Services, Hot Spots, Virtual Private Networks (VPNs), Mobile VPN, VPN Types, WiFi Integration with 3G/4G, Benefits of Convergence of WiFi and Wireless Mobile.

UNIT III

Introduction, Universal Mobile Telecommunications Service (UMTS), UMTS Services, The UMTS Air Interface, Overview of the 3GPP Release 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5, All-IP Network Architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA, CDMA2000, TD-CDMA, and TD-SCDMA

UNIT IV

LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, User Equipment (UE), Enhanced Node B (eNodeB), Core Network (EPC), Radio Channel Components, TD-LTE, Multiple Input Multiple Output, LTE Scheduler, Carrier Aggregation, Cell Search, Cell Reselection, Attach and Default Bearer Activation, Handover (X2, S1, Inter-MME), Self-Organizing Networks (SONs), Relay Cells, Heterogeneous Network (HetNET), Remote Radio Heads (RRH), VoLTE, LTE Advanced

UNIT V

Introduction, Standards, Generic WiMAX Architecture, Core Network, Radio Network, WiMAX Spectrum, Modulation, Channel Structure, Mixed Mode, Interference Mitigation Techniques, Frequency Planning, Features and Applications, Security, QoS, Profiles, Origination, Handover, Femto and SON

UNIT VI

Why VoIP?, The Basics of IP Transport, VoIP Challenges, H.323, The Session Initiation Protocol (SIP), Distributed Architecture and Media Gateway Control, VoIP and SS7, VoIP Quality of Service.

Text Books:

1. Clint Smith, P.E., Daniel Collins, ***"Wireless Networks: Design and Integration for LTE, EVDO, HSPA, and WiMAX"***, McGraw Hill Education, Third Edition
2. Eldad Perahia, Robert Stacey, ***"Next Generation Wireless LANs"***, Cambridge University Press, Second Edition.

Reference Books:

1. Yi-Bang Lin, Imrich Chlamtac, ***"Wireless and Mobile Network Architecture"***, Wiley India Edition.
2. Dipankar Ray chaudhary, Maria Gerla, ***"Emerging Wireless Technologies and the Future Mobile Internet"***, Cambridge University Press..

Course Title:	**Wireless Networking Laboratory**	**Semester VIII**	
Course Code	**IT804SE-04L**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credits**	**1**

Lab Experiments Objective:

1. To give the practical exposure on wireless networks
2. To configure and understand real issues in maintaining wireless networks.
3. To understand administrator functions

Lab Experiments List:

1. Wireless Component and Media Identification
2. Install a WLAN Adapter Card
3. Wireless Mathematics
4. Topology Design with Cisco Network Designer (CND)
5. Configuring Basic AP Settings
6. Resetting the Bridge
7. Antenna Setup
8. Wireless Attacks and Countermeasures
9. WLAN Design
10. Site Survey Active Mode

Course Title:	**Machine Learning**	**Semester VIII**	
Course Code	**IT804SE-05**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics – II, III**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts and methods of machine learning
2. To make use of some elementary machine learning techniques in the design of computer systems
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings, and assumptions that underlies them.
5. To possess insights concerning the relative strengths and weaknesses of various common machine learning methods

Course Outcomes:

After learning the course the student will be able:

1. To demonstrate knowledge of the machine learning literature
2. To describe how and why machine learning methods work
3. To demonstrate results of parameter selection
4. To explain relative strengths and weaknesses of different machine learning methods
5. To select and apply appropriate machine learning methods to a selected problem
6. To implement machine learning algorithms on real datasets
7. To suggest ways to improve results

Course Content:

UNIT-I

Introduction: Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning

Concept Learning and General-to-specific Ordering: A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis, Version Spaces and Candidate elimination algorithm, Inductive Bias

UNIT-II

Decision Tree Learning: Decision tree learning algorithm, Hypothesis space search in decision tree

Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, Deriving confidence intervals, Hypothesis testing, comparing learning algorithms

UNIT-III

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier

Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, The VC dimension, the mistake bound model for learning

UNIT-IV

Linear Models for Regression: Linear basis function models, The Bias-Variance decomposition, Bayesian Linear Regression, Bayesian Model comparison

Kernel Methods: Constructing kernels, Radial basis function networks, Gaussian Processes

UNIT-V

Approximate Inferencing: Variational inference, Variational mixture of Gaussians, Variational linear regression, Variational logistic regression

Hidden Markov Models: Learning algorithms for HMM, the Viterbi algorithm, Linear Dynamical Systems

UNIT-VI

Reinforcement Learning: The learning task, Q learning, Non-deterministic rewards and action, Temporal difference learning, Generalizing from examples

Text Books:

1. Mitchell, Tom. M., *"Machine Learning"*, McGraw-Hill Education, 1st edition, May 2013.
2. Segaran, Toby. ***"Programming Collective Intelligence- Building Smart Web 2.0 Applications",*** O'Reilly Media, August 2007.

Reference Books:

1. Miroslav, Kubat. ***"An Introduction to Machine Learning",*** Springer Publishing.
2. Bishop, C. M., ***"Pattern Recognition and Machine Learning"***, Springer Publishing.
3. Conway, Drew and White, John Myles, ***"Machine Learning for Hackers"***, O'Reilly Media, February 2012.

Course Title:	**Machine Learning Laboratory**	**Semester VIII**	
Course Code	**IT804SE-05L**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credits**	**1**

Lab Experiments Objective:

1. To implement various machine learning techniques to solve problems

Lab Experiments List:

1. Learn the data preprocessing steps to start a machine learning method for a practical
2. Solve a stated problem using the simple linear regression method
3. Use the multiple linear regression method for a stated issue
4. Implement a polynomial regression solution
5. Use the support vector regression to implement a ML solution
6. Solve a stated problem using the decision tree regression method
7. Implement a random forest regression solution
8. Implement a reinforcement learning program to demonstrate ML concepts

Course Title:	**Project Phase - II**	**Semester VIII**	
Course Code	**IT805**	**Course Type**	**Mandatory**
Pre-requisite		**L – T – P**	**2 – 4 – 8**
Stream	**Core**	**Credits**	**8**

This is continuous work to the project phase I. Every students will have to submit a completed report (3 copies)* of the project work. Report preparation guidelines should be followed as per given format. The students will prepare a power point presentation of the work. Panel of examiners comprising of guide, internal examiner, senior faculty, external examiner, etc. will assess the performance of the students considering their quality of work.

Phase II

1. Coding/Implementation.
2. Use cases.
3. Testing/Trouble shooting.
4. Data dictionary/ Documentation.
5. Finalization of project in all respect.

*(For guide, Personal copy, Departmental library.)

In a presentation, the students should focus to clarify problem definition and analysis of the problem.