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(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Detailed Syllabus
for
Second Year, Third Year and Final Year
B. Tech. Programme in Information Technology

Effective from
Academic Year 2018-19
Approved in the 11th meeting of Academic Council 8th June, 2018

Teaching and Evaluation Scheme Second Year B. Tech. (Information Technology)

Sr. No.	Course Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
		Semester III								
1	BTBSC301	Engineering Mathematics III	3	1	-	20	20	60	4	4
2	BTESC302	Switching Theory and Logic Design	2	1	-	20	20	60	3	3
3	BTITC303	Object Oriented Paradigm with C++	3	1	-	20	20	60	4	4
4	BTCOC304	Computer Architecture and Organization	2	1	-	20	20	60	3	3
5	BTBSCOE305A BTHSMCOE305B BTITOE305C BTITOE305D	**Elective I** A) Advanced Engineering Chemistry B) Interpersonal Communication Skills and Self Development for Engineers C) Programming in Java D) Introduction to Web Technology	2	1	-	20	20	60	3	3
6	BTHM306	Basic Human Rights	2	-	-	-	50	-	Audit	2
7	BTESCL307	Switching Theory and Logic Design Lab	-	-	2	-	60	40	1	2
8	BTITL308	Object Oriented Paradigm with C++ Lab	-	-	2	-	60	40	1	2
9	BTITL309	Programming Lab (Python)	-	1	2	-	60	40	2	3
10	BTITOEL310A BTITOEL310B BTITOEL310C BTITOEL310D	**Elective I Lab** A) Advanced Engineering Chemistry Lab B) Interpersonal Communication Skills and Self Development for Engineers Lab C) Programming in Java Lab D) Introduction to Web Technology Lab	-	-	2	-	60	40	1	2
11	BTITF311	Field Training / Internship/Industrial Training Evaluation	-	-	-	-	-	100	1	-
		Total	**14**	**6**	**8**	**100**	**390**	**560**	**23**	**28**
		Semester IV								
1	BTITC401	Microprocessors and Microcontrollers	2	1	-	20	20	60	3	3
2	BTITC402	Data Structures and Applications	3	1	-	20	20	60	4	4
3	BTITC403	Discrete Structures and Applications	2	1	-	20	20	60	3	3
4	BTITC404	Internetworking Protocols	2	1	-	20	20	60	3	3
5	BTBSCOE405A BTHMOE405B BTXXOE405C	**Elective II** A) Physics of Engineering Materials B) Organizational Behaviour C) Development Engineering	2	1	-	20	20	60	3	3
6	BTXX406	Product Design Engineering	2	-	-	20	20	60	2	2
7	BTITL407	Microprocessors and Micro-controllers Lab	-	-	2	-	60	40	1	2
8	BTITL408	Data Structures and Applications Lab	-	-	4	-	60	40	2	4
9	BTITL409	Internetworking Protocols Lab	-	-	2	-	60	40	1	2
10	BTITF410	Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in third semester and fourth semester or at one time.)						100	To be evaluated in V Semester	-
		Total	**13**	**5**	**8**	**120**	**300**	**580**	**22**	**26**

Programme Objectives:

The program educational objectives for the B. Tech. programme 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: 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.

Course Title:	**Engineering Mathematics – III**	**Semester III**	
Course Code	**BTBSC301**	**Course Type**	**Compulsory**
Prerequisite	**MATH201**	**L – T – P**	**3 – 1 – 0**
Stream	**Basic Science**	**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. To 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 t^n, 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, Heaviside-unit step function, Dirac delta 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 ; Parseval's identity for Fourier Transforms.

UNIT IV

Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of

separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

UNIT V

Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

UNIT VI

Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books:

1. B. S. Grewal, **"*Higher Engineering Mathematics*"**, Khanna Publishers, New Delhi.
2. H. K. Das, Er. RajnishVerma, **"*Higher Engineering Mathematics*"**, S. Chand & CO. Pvt. Ltd., New Delhi.
3. Dr. B. B. Singh, **"A course in Engineering Mathematics (Volume-III)"**, Synergy Knowledge ware, Mumbai.
4. B. V. Ramana, ***"Higher Engineering Mathematics"***, Tata McGraw-Hill Publications, New Delhi.

Reference Books:

1. Erwin Kreyszig, **"*Advanced Engineering Mathematics*"**, John Wiley & Sons, New York.
2. Peter O' Neil, ***"A Text Book of Engineering Mathematics"***, Thomson Asia Pvt. Ltd., Singapore.
3. C. R. Wylie, L. C. Barrett, ***"Advanced Engineering Mathematics"***, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. C. R. Wylie & L. C. Barrett, ***"Integral Transforms and their Engineering Applications"***, Synergy Knowledge ware, Mumbai.
5. I. N. Sneddon, ***"Integral Transforms"***, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch wise. Each class should be divided into three batches for the purpose.
2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

Course Title:	**Switching Theory and Logic Design**	**Semester III**	
Course Code	**BTESC302**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 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 to:

1. Illustrate theory of Boolean algebra and 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

Classification of logic families, Characteristics of digital ICs- Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements, TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs, Tri-State logic, CMOS logic, CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output, Interfacing CMOS and TTL.

UNIT IV

Combinational Functions: Realizing logical expressions using different logic gates, Design of combinational circuits using combinational IC's, 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, EPROM, EEPROM, NVRAM, SRAM, DRAM, 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:	**Object Oriented Paradigm with C++**	**Semester III**	
Course Code	**BTITC303**	**Course Type**	**Compulsory**
Prerequisite	**ICT106**	**L – T – P**	**3 – 1 – 0**
Stream	**Core**	**Credits**	**4**

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, Destructor. 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, Built-in exceptions, Creating exception subclasses, Using exceptions.

Text Books:

1. Robert Lafore, ***"Object Oriented Programming in C++"***, Pearson Education, 4th Edition, 2008.
2. E. Balagurusamy, ***"Object Oriented Programming with C++"***, Tata McGraw Hill Publication, 6th Edition, 2013.

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.

Course Title:	**Computer Architecture and Organization**	**Semester III**	
Course Code	**BTCOC304**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 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

Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.

UNIT II

Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.

UNIT III

Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.

UNIT IV

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems, External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.

UNIT V

Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming.

UNIT VI

Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O,

Direct memory access, I/O channels and processors, External interface.

Instruction pipe-lining: Concepts, Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.

Text Books:

1. William Stalling, ***"Computer Organization and Architecture: Designing for Performance"***, 8th Edition, Prentice Hall Publication, 2009.
2. Hayes, ***"Computer Architecture and Organization"***, 3rd Edition, McGraw-Hill Publication, 2012.
3. Zaky, **"*Computer Organization"***, 5th Edition, McGraw-Hill Publication, 2011.

Reference Books:

1. Morgan and Hennessy and Patterson, ***"Computer Architecture: A Quantitative Approach"***, 4th Edition, Kaufman Publication, 2007.
2. Morris Mano, ***"Computer System Architecture"***, 3rd Edition, Pearson Education India, 2007.
3. Mostafa Abd-El-Barr, Hesham El-Rewini, ***"Fundamentals of Computer Organization and Architecture"***, 1st Edition, Wiley Publication, 2004.
4. Miles J. Murdocca, Vincent P. Heuring, ***"Computer Architecture and Organization: An Integrated Approach"***, 1st Edition, Wiley Publication, 2007.

Course Title:	**Advanced Engineering Chemistry**	**Semester III**	
Course Code	**BTBSCOE305A**	**Course Type**	**Elective**
Prerequisite	**CHM103**	**L – T – P**	**2 – 1 – 0**
Stream	**Basic Science**	**Credits**	**3**

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.
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 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, Stress corrosion, methods to minimize the corrosion- Proper design, Cathodic and Anodic protection.

UNIT II

Photochemical and Thermal Reactions
Introduction, Laws of Photochemistry, Measurement of absorbed intensity, Quantum yield or efficiency, Jablonski Diagram, Photosynthesis reaction of Hydrogen Bromide, Brief discussion on Thermal Reactions- Cope Rearrangement.

UNIT III

Polymers
Introduction, Nomenclature of polymers, types of polymerisation, molecular weight determination by osmotic pressure and viscosity method. Plastic and its classification, Constituents of Plastic, Moulding of plastic by Injection method.

UNIT IV

Reaction Mechanism and Reaction Intermediates
Introduction of reaction mechanism, Brief introduction of reactivity of substrate (Inductive effect,

Mesomeric effect, Electromeric Effect, Hyperconjugative effect), Bond fission: Homolytic and Heterolytic bond fission, Reaction Intermediates: Carbocation(Structure, Stability and applications), Carbanion (Structure, Stability and applications).

Rearrangement reactions:

Intramolecular Rearrangement: Isomerisation, Beckmann Rearrangement, Benzidine Rearrangement
Intermolecular Rearrangement: Orton Rearrangement, Diazoamino Rearrangement

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, AAS (Atomic Absorption Spectroscopy)

UNIT VI

Instrumental Methods of Analysis

Introduction to Chromatography, Types of Chromatography (Adsorption and partition chromatography), 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, New Delhi, 1992.Bhal & Tuli, ***"Text book of Physical Chemistry",*** S. Chand & Company, New Delhi, 1995.
3. Chatwal Anand, **"Instrumental Methods of Analysis"**, Himalaya Publication.
4. Rakesh K. Parashar, V.K. Ahluwalia, "***Text Book of Organic Chemistry***".

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. Glasstone, ***"Physical Chemistry"***.
8. Peter Atkins, ***"Physical Chemistry"***, W.H. Freeman & Co. 9th Edition, 2009.

Course Title:	**Interpersonal Communication Skills and Self Development for Engineers**	**Semester III**	
Course Code	**BTHSMCOE305B**	**Course Type**	**Elective**
Prerequisite	**HS202**	**L – T – P**	**2 – 1 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**3**

Course Objectives:

1. To build the skills like team building so that they can work efficiently in groups.
2. To provide knowledge of conflict management while working in large organizations.
3. To develop management skills required in routine work environment.
4. To polish the personality of the learners in order to make them good leaders and employees.

Course Outcomes:

1. Learners will acquire interpersonal communication skills.
2. Learners will develop the ability to work independently.
3. Learners will develop the qualities like self-discipline, self-criticism and self-management.
4. Learners will have the qualities of time management and discipline.

UNIT I

Development of Proficiency in English

Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups), 5 Ws & 1 H & 7 Cs for effective Communication, Imbibing Etiquettes and manners, Study of different pictorial expressions of non-verbal communication and their analysis

UNIT II

Self Management

Self Management, Self Evaluation, Self discipline, Self criticism, Recognition of one's own limits and deficiencies, dependency, etc.

Self Awareness, Self Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride,- Leadership & Team Dynamics

UNIT III

Time Management Techniques

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time.

UNIT IV

Motivation/ Inspiration

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation,

Motivation techniques: Motivation techniques based on needs and field situations

UNIT V

Interpersonal Skills Development

Positive Relationship, Positive Attitudes, Empathies: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

UNIT VI

Effective Computing Skills

Designing an effective Presentation: Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation

Reference books:

1. Mitra, Barun, **"*Personality Development and Soft Skills"***, Oxford University Press, 2016.
2. Ramesh, Gopalswamy, **"*The Ace of Soft Skills: Attitude, Communication and Etiquette for Success"***, Pearson Education, 2013.
3. Covey, Stephen R., **"*Seven Habits of Highly Effective People: Powerful Lessons in Personal Change"***.
4. Osenberg Marshall B., **"*Nonviolent Communication: A Language of Life"***.

Course Title:	**Programming in Java**	**Semester III**	
Course Code	**BTITOE305C**	**Course Type**	**Elective**
Prerequisite	**ICT106**	**L – T – P**	**2 – 1 – 0**
Stream	**Professional Core**	**Credits**	**3**

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be able to use the Java SDK environment to create, debug and run simple Java programs.

Course Outcomes:

After learning the course, the students should be able to:

1. Know the structure and model of the Java programming language.
2. Use the Java programming language for various programming technologies.
3. Develop software in the Java programming language (application).

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, Labelled loops, While repetition statement, Switch statement, Break and continue statement, Arrays, Strings and Vectors: Creating one dimensional and multidimensional array, 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 and finalizes Methods.

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, Interthread 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 & 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. E. Balagurusamy, **"*Programming with Java – A Primer*"**, Tata – McGraw-Hill Publication, 4th Edition, 2010.
2. Steven Holzner et al. **"*Java 2 Programming*"**, Black Book, Dreamtech Press, 2009.

Reference Books

1. H.M. Deitel, P.J. Deitel, **"*Java - How to Program*"**, PHI Publication, 6th Edition, 2005.
2. Bruce Eckel, **"*Thinking in Java*"**, PHI Publication.
3. Patric Naughton, Michael Morrison, **"*The Java Handbook*"**, McGraw Hill Publication.
4. Tim Lindholm, Frank Yellin, Bill Joy, Kathi Walrath, **"*The Java Virtual Machine Specification*"**, Addison Wesley Publication.

Course Title:	**Introduction to Web Technology**	**Semester III**	
Course Code	**BTITOE305D**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**2 – 1– 0**
Stream	**Professional Core**	**Credits**	**3**

Course Objectives:

1. Overview of modern Web technologies.
2. To use different web scripting technology.
3. To understand web hosting, server type, debugging, and performance driven application development.
4. To understand user interface and awareness of real-world knowledge.

Course Outcomes:

1. To understand World Wide Web and latest trends in web-development.
2. Real world knowledge of design and development.
3. Design and development of web application with all industrial standards.
4. Awareness of web hosting, server type, debugging.

UNIT I

Introduction to World Wide Web, Features of web, HTTP, Web Servers, Introduction to Scripting Language, Browser, Integrated Development Environment.

UNIT II

HTML: Introduction to HTML, Basics of HTML, Formatting and fonts, Commenting code, HTML heading, Block element, Inline element, Comment, Attributes, Hyperlink, Lists, Tables, Images, Forms, Meta tags, Character entities, Frames sets.

UNIT III

Advance HTML: Overview and features of HTML5, Includes External File, Responsive Layout with Media Queries, Marquee, Semantic Tags, HTML Symbol, URL Encode, Caching, Video Tags, Audio Tags, Image Maps.

UNIT IV

CSS: Introduction To CSS, Selector, Basic Syntax And Structure, Padding, Margin, Manipulating Texts, Display, Height, Width, Border, Color, Fonts, Positioning Using CSS, Overview And Features Of CSS3.

UNIT V

PHP: Introduction to PHP, Features of PHP, Basics of PHP, Syntax, Variable, Printing Output, Array, String, Function, Data types, Operator, Loops, Conditional Statement, Introduction To Advance PHP, Form Processing, Files, PHP Cookies, PHP Sessions, Constant, PHP Magic Function, PHP Global Variable, Error Handling, Exception, Connection with Database, Curd Operation in PHP.

UNIT VI

Web Hosting, Debugging and Unit Testing, Browser Compatibility.

Text Book

1. Snehal Joglekar, **"*HTML and CSS- Web Technologies*"**, Nirali Prakashan, 2013.

Reference Books

1. Thomas Powell, **"*HTML & CSS: The Complete Reference*"**, 5th Edition, McGraw Hill Publication.
2. Steven Holzner, **"*PHP: The Complete Reference*"**, 1st Edition, McGraw Hill Publication.

Course Title:	**Basic Human Rights**	**Semester III**	
Course Code	**BTHM306**	**Course Type**	**Audit**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**Audit**

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 to:

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: It's working and impact on India, Case studies of selected national NGOs, Case studies of selected regional NGOs, The government: Role 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"***, Lokayan, Delhi, 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:	**Switching Theory and Logic Design Lab**	**Semester III**	
Course Code	**BTESCL307**	**Course Type**	**Compulsory**
Prerequisite	**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. Study of basic and Universal gates
2. Implementation of Boolean functions using Gates
3. Implementation of following code conversions:
    a) Binary to gray
    b) Gray to binary
    c) Excess –3 to BCD
    d) BCD to Excess –3.
4. Implementation of half adder, full adder
5. Implementation of half subtractor, full subtractor
6. Implementation of K-map examples
7. Implementation of Quine- McClusky examples
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

Course Title:	**Object Oriented Paradigm with C++ Lab**	**Semester III**	
Course Code	**BTITL308**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. Programming using C++

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:

   Enter coordinates for P1: 3 4
   Enter coordinates for P2: 5 7
   Coordinates of P1 + P2 are: 8, 11

   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:

   Enter first number, operator, second number: 10/ 3
   Answer = 3.333333
   Do another (Y/ N)? Y
   Enter first number, operator, second number 12 + 100
   Answer = 112
   Do another (Y/ N)? N

3. 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:

Enter your area code, exchange, and number: 415 555 1212
My number is (212) 767-8900
Your number is (415) 555-1212

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.

4. 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 (de-fault), constructor with two arguments, void reduce () that reduces the rational number by eliminating the highest common factor between the numerator and denominator.

   Overload + operator to add two rational numbers
   Overload - operator to enable input through cin
   Overload * operator to enable output through cout
   Write a main ( ) to test all the functions in the class.

5. 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.

6. 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 number, name (a string of 30 or lesser number of characters) and marks.

7. A hospital wants to create a database regarding its indoor patients. The information to store include

   Name of the patient
   Date of admission
   Disease
   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).

8. 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:	**Programming Lab (Python)**	**Semester III**	
Course Code	**BTITL309**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 1 – 2**
Stream	**Core**	**Credits**	**2**

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 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:	**Advanced Engineering Chemistry Lab**	**Semester III**	
Course Code	**BTITOEL310A**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Basic Science**	**Credits**	**1**

List of Experiments: (Perform any 8 – 9 Experiments)

1. To determine λmax of given solutions.
2. To Verify Beer's Lambert's law.
3. Experiments on Paper and Thin Layer Chromatography. (two experiments)
4. Determination of rate of corrosion of metal.
5. Experiments related with Organic Chemistry. (three experiments)
6. Experiments on pH metry.
7. Experiments on Conductometry.
8. Experiments on Flame Photometry.
9. Experiments on Solvent Extraction.
10. Estimation of Metals from Solution/ Alloys. (two experiments)
11. Synthesis of materials by various techniques. (two experiments)

Reference Books:

1. A. Sethi, "***Systematic experiments in Chemistry***", New Age International Publication, New Delhi.
2. A. I. Vogel, "***Practical Inorganic Chemistry"***, ELBS Publication.
3. S. S. Dara, ***"Practical in Engineering Chemistry"***.
4. A. I. Vogel, "***Practical Organic Chemistry***", ELBS Publication.

Course Title:	**Interpersonal Communication Skills and Self Development for Engineers Lab**	**Semester III**	
Course Code	**BTITOEL310B**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Humanities, Social Science and Management**	**Credits**	**1**

List of Experiments:

1. General etiquettes and manners
2. Team building and group dynamics
3. Presentation Skills
4. Conducting meetings
5. Leadership Development
6. Skills in dealing with difficult people/situations
7. Persuasive writing
8. Negotiation skills
9. Conflict Resolution
10. Y-O-U-R-N-M-A-M-E Activity

Course Title:	**Programming in Java Lab**	**Semester III**	
Course Code	**BTITOEL310C**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Professional Core**	**Credits**	**1**

List of Experiments:

1. To create simple application to access data base using JDBC.
2. To read and write the files.
3. To implement polymorphism and method overriding in java.
4. To write programs implementing exception handling.
5. To write programs to illustrate interfaces in java.
6. To write programs to create package in java.
7. To design multi threaded programs in java.
8. To write programs to manipulate strings.
9. To write programs to draw various shapes using java applets.

Course Title:	**Introduction to Web Technology Lab**	**Semester III**	
Course Code	**BTITOEL310D**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Professional Core**	**Credits**	**1**

List of Experiments:

1. Download XAMPP or WAMPP server, IDE, browsers to run HTML program.
2. Develop page to display fruits list with different color with heading on top of the page and link each fruit with fruit description page.
3. Develop using semantic element, page having menu bar in header section.
4. Develop user personal info form using HTML5 input control and decorate with CSS.
5. Develop responsive page layout using media queries.
6. Write a PHP program to print list of user info using array.
7. Write a PHP program to fetch user info from MYSQL database.
8. Write a PHP program to perform crud operation.
9. Write a PHP function to check palindrome string.
10. Write a PHP program using for loop to add all the integers between 0 and 30 and display the total.
11. Create a script to construct the pyramid of asterisk ('*') using nested for loop.
12. Write a program to calculate factorial of a number using for loop.
13. Write a program which will count the specific characters in the text.
14. Debug web site using developer tools, inspect element.

Course Title:	**Microprocessors and Microcontrollers**	**Semester IV**	
Course Code	**BTITC401**	**Course Type**	**Compulsory**
Prerequisite	**BTCOC304**	**L – T – P**	**2– 1 – 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 micro-controller architecture, its instruction set and 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 micro-controller interfaces & programming.
4. To experiment with MCS51 and PIC18 micro-controller.

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 coprocessor, Data types supported by 8087, Host and coprocessor 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.
4. John Uffenback**, *"8086/8088 Interfacing, Programming and Design"*,** Prentice Hall of India Publication.

Course Title:	**Data Structures and Applications**	**Semester IV**	
Course Code	**BTITC402**	**Course Type**	**Compulsory**
Prerequisite	**BTITC303**	**L – T – P**	**3 – 1 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To assess how the choice of data structures and algorithm design methods affects 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, 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:	**Discrete Structures and Applications**	**Semester IV**	
Course Code	**BTITC403**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**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. 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 formula, Functions, Sequences and summations, Definition and types of functions: Injective, subjective and bijective , Composition, Identity and inverse of function, Re-cursively defined functions, Applications of functions, 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.

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, Traveling salesman problem, Transport networks, Special types of graphs and applications: Job assignment, LAN, 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:	**Internetworking Protocols**	**Semester IV**	
Course Code	**BTITC404**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts of TCP/IP Architecture.
2. To Understand Network Layer and Applications.
3. To learn UDP and TCP applications.
4. To learn Transport Layer Reliability.

Course Outcomes:

After learning the course, the students should be able:

1. To compare and contrast TCP and UDP in terms of the application that uses them.
2. To design network-based applications using the socket mechanism.
3. To work with IPv4 addresses in terms of subnetting and supernetting.
4. To setup a host and network in terms of IP addressing.

Course Content:

UNIT I

Introduction and Underlying Technologies : ARPANET, Birth of the Internet, Transmission Control Protocol/Internetworking Protocol (TCP/IP) , MILNET , CSNET , NSFNET ,ANSNET, The Internet Today ,World Wide Web, Time Line, Growth of the Internet, Protocols and Standards, Standards Organizations: Internet Standards Internet Administration.

The OSI Model and the TCP/IP Protocol Suite:

Protocol Layers: Hierarchy Services, The OSI Model: Layered Architecture , Layer-to-Layer Communication, Encapsulation, Layers in the OSI Model, TCP/IP Protocol Suite: Comparison between OSI and TCP/IP Protocol Suite, Layers in the TCP/IP Protocol Suite, Addressing: Physical Addresses, Logical Addresses, Port Addresses, Application-Specific Addresses, Wired Local Area Networks: IEEE Standards, Frame Format, Addressing, Ethernet Evolution, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Ten-Gigabit Ethernet.

UNIT II

Wireless LANS: IEEE, MAC Sublayer, Addressing Mechanism, Bluetooth, Point-to-Point WANS, DSL Technology, Cable Modem, ATM, Connecting devices: Repeaters, Bridges and Routers.

Introduction to Network Layer: Switching: Packet Switching, Circuit Switching, Packet Switching at Network Layer, Network Layer Services, Other Network Layer Issues.

IPv4 Addresses, Address Space Notation, Range of Addresses, Operations, Classful Addressing: Classes, Classes And Blocks, Two-Level Addressing, Three-Level Addressing: Subnetting, Supernetting, Classless Addressing: Variable-Length Blocks, Two-Level Addressing, Block Allocation, Special Addresses: Special Blocks, Special Addresses in Each block, NAT, Address Translation, Translation Table.

UNIT III

Delivery and Forwarding of IP Packets: Delivery: Direct Delivery, Indirect Delivery, Forwarding: Forwarding Based on Destination Address, Forwarding Based on Label, Structure of a Router: Components.

Internet Protocol Version 4(IPv4): Datagrams, Fragmentation, Maximum Transfer Unit (MTU), Fields Related to Fragmentation, Options: Format, Option Types, Checksum: Checksum Calculation at the Sender, Checksum Calculation at the Receiver, Checksum in the IP Packet, IP PACKAGE : Header-Adding Module, Processing Module, Queues, Routing Table, Forwarding Module, MTU Table, Fragmentation Module, Reassembly Table, Reassembly Module

Address Resolution Protocol (ARP): Address Mapping: Static Mapping, Dynamic Mapping, The ARP Protocol: Packet Format, Encapsulation, Operation, Proxy ARP, ARP Package: Cache Table, Queues, Output Module, Input Module, Cache-Control Module.

UNIT IV

Internet Control Message Protocol (ICMP): Messages: Message Format, Error Reporting Messages, Query Messages, Checksum, Debugging Tools: Ping, Traceroute, ICMP Package: Input Module, Output Module.

Unicast Routing Protocols (RIP, OSPF, and BGP), Static versus Dynamic Routing Tables, Routing Protocol, Intra- And Inter-Domain Routing, Distance Vector Routing :Bellman-Ford Algorithm, Distance Vector Routing Algorithm, Count to Infinity, RIP: RIP Message Format, Requests and Responses Timers in RIP, RIP Version, Encapsulation , Link State Routing: Building Routing Tables, OSPF, Areas, Metric Types of Links, Graphical Representation OSPF Packets, Link State Update Packet, Other Packets, Encapsulation, Path Vector Routing: Reachability , Routing Tables, BGP: Types of Autonomous Systems, Path Attributes, BGP Sessions, External and Internal BGP, Types of Packets, Packet Format, Encapsulation.

UNIT V

Introduction to Transport Layer: Transport-Layer Services: Process-to-Process communication, Addressing: Port Numbers, Encapsulation and Decapsulation , Multiplexing and Demultiplexing, Flow Control, Error Control , Combination of Flow and Error Control, Congestion Control, Connectionless and Connection-Oriented Services.

User Datagram Protocol (UDP): User Datagram, UDP Services: Process-to-Process Communication, Connectionless Services, Flow Control, Error Control, Congestion Control, Encapsulation and Decapsulation, Queuing, Multiplexing and Demultiplexing, Comparison between UDP and Generic Simple Protocol, UDP Applications: UDP Features, Typical Applications, UDP Package: Control-Block Table, Input Queues, Control-Block Module, Input Module, Output Module.

UNIT VI

Transmission Control Protocol (TCP): TCP Services: Process-to-Process Communication, Stream Delivery Service, Full-Duplex Communication, Multiplexing and Demultiplexing, Connection-Oriented Service, Reliable Service. TCP Features: Numbering System, Flow Control, Error Control, Congestion Control, Segment: Format, Encapsulation, A TCP Connection: Connection Establishment, Data Transfer, Connection Termination, Connection Reset, State Transition Diagram, Scenarios ,Windows in TCP ,Send Window, Receive Window, Flow Control : Opening and Closing Windows, Shrinking of Windows, Silly Window Syndrome, Error Control :Checksum, Acknowledgment, Retransmission, Out-

of-Order Segments, Data Transfer in TCP, Some Scenarios, Congestion Control : Congestion Window, Congestion Policy, TCP Timers: Retransmission Timer, Persistence Timer, Keepalive Timer, Time-Wait Timer, TCP Package: Transmission Control Blocks (TCBs), Timers, Main Module, Input Processing Module, Output Processing Module.

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"***, Volume 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:	**Physics of Engineering Materials**	**Semester III**	
Course Code	**BTBSCOE405A**	**Course Type**	**Elective**
Prerequisite	**PHY203**	**L – T – P**	**2 – 1 – 0**
Stream	**Basic Science**	**Credits**	**3**

Course Objectives:

1. To impart the basic and advanced knowledge to the students.
2. 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 explain the concepts of Crystallography, X -rays, Conducting Materials, Magnetic Materials.

Course Content:

UNIT I

Crystallography: Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, $BaTiO_3$) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction.

UNIT II

Magnetic Materials: Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Ant ferromagnetic and Ferromagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.

UNIT III

Conducting and Superconducting Materials: Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation)

UNIT IV

Semiconducting Materials: Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell

UNIT V

Dielectric Materials: Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials

UNIT VI

Nano Materials: Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials.

Text Books:

1. C. Kittle, **"*Introduction to Solid state Physics*"**.
2. C. M. Srivastava, C. Srinivasan, **"*Science of Engineering Materials and Carbon Nanotubes*"**.
3. A. J. Dekker, **"*Solid State Physics*"**.

Reference Books:

1. V. Raghavan, **"*Material Science and Engineering*"**.
2. A. J. Dekker, **"*Electrical Engineering Materials*"**.

Course Title:	**Organizational Behavior**	**Semester IV**	
Course Code	**BTHMOE405B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**3**

Course Objectives:

1. To explore the organization as a micro-social system - a medium to facilitate and improve the interpersonal relationships in the context of organizational functioning.

Course Outcomes:

1. Students will become more self aware and will have identified areas of development for long term effectiveness.
2. Students will understand the role that individuals play collectively to perform in organizations.

Course Content:

UNIT I

Introduction to Organizational Behavior: Definition of organization and behavior, Historical Development of OB, Human relations movement, Impact of technology on organizational behavior.

Organizational Design: Key factors in organizational design, Types of organizational design, Need and significance of a sound organizational design, Organizational Structures - traditional and contemporary structures.

UNIT II

Organizational Culture: Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization, Organizational Communication - Tool and Techniques, Johari window transactional analysis, Lateral thinking, Brain storming, Delphi technique, Power of grapevine and other informal communication techniques.

UNIT III

Groups and Organizations: Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, Five stages of group/team development, Determinants of group behavior, Typical teams in organizations.
Leadership: Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations.

UNIT IV

Foundations of Individual Behavior: Factors affecting individual behavior - personal, environmental and organizational, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self Monitoring,

Personality and OB
Motivation: Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self Managed Teams.

UNIT V

Work Related Attitudes, Values and Perception: Meaning and definitions, Factors influencing perception Social and Person perception, When perception fails, Perception and OB.
Organizational Outcomes: Power and Politics, Power - Dynamics, Sources and Tactics, Politics - Essence, Types of political activities, Ethics of power and politics.

UNIT VI

Conflicts and Negotiations, Nature of conflict, Functional and Dysfunctional conflict, Conflict resolution and negotiations, Managing conflict during change initiatives.
Stress: Meaning and definition, Work stress model, Sources of stress, Stress Management - Individual and organizational strategies, Impact of stress on performance.

Text books:

1. Uma Sekaran, **"*Organization Behaviors"***, McGraw Hill Company, New Delhi, 2011.
2. LM Prasad, ***"Organization Behavior"***, S. Chand and Co. Ltd, New Delhi, 2008.
3. Nair, Banerjee, Agarwal, **"*Organization Behavior"***, Prgathi Prakashan, New Delhi, 2006.

Reference books:

1. Rosy Joshi and Sashi K Gupta, **"*Organization Behaviors"***. Kalyani publishers, New Delhi, 2005.
2. S.S. Khanka, ***"Organization Behavior"***, S. Chand and Co. Ltd, New Delhi, 2008.
3. Fred Luthans, **"*Organizational Behavior"*,** McGraw Hill Book Co., 2005.

Course Title:	**Development Engineering**	**Semester IV**	
Course Code	**BTXXOE405C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Interdisciplinary**	**Credits**	**3**

Course Objectives:

1. Development Engineering prepares students to develop, pilot, and evaluate technological interventions designed to improve human and economic development within complex, low-resource settings.
2. Students can include topics related to the application of technology to address the needs of people living in poverty.

Course Outcomes:

After learning the course, the students should be able:

1. To understand the core disciplines issues in development.
2. To understand certifications.
3. To understand the planning of developing of rural areas.

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, 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 telemedication 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.al, ***"Urban Land use 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 and Sons Inc.
6. Longley, et.al, ***"Geographic Information Systems and Science"***, John Wiley and 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 and 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:	**Product Design Engineering**	**Semester IV**	
Course Code	**BTXX406**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Interdisciplinary**	**Credits**	**2**

Course Outcomes:

After completing this programme, participants will be able to:

1. Create simple mechanical designs.
2. Create documents for knowledge sharing.
3. Manage own work to meet requirements.
4. Work effectively with colleagues.
5. Maintain a healthy, safe and secure working environment.
6. Provide data/information in standard formats.
7. Develop their knowledge, skills and competence.

Course Content:

UNIT I

Creating simple products and modules Document Creation and Knowledge Sharing

UNIT II

Self and work Management

UNIT III

Team Work and Communication

UNIT IV

Managing Health and Safety

UNIT V

Data and Information Management

UNIT VI

Learning and Self Development

Course Title:	**Microprocessors and Microcontrollers Lab**	**Semester IV**	
Course Code	**BTITL407**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn assembly language.
2. To program microprocessor and microcontroller for arithmetic operations.
3. To interface microprocessor and microcontroller 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:	**Data Structures and Applications Lab**	**Semester IV**	
Course Code	**BTITL408**	**Course Type**	**Compulsory**
Prerequisite	**BTITL308**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To implement all linear and non-linear data structures in C++/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:
   Concatenate two linked list and create third one
   Free all nodes in a linked list
   Reverse a linked list
   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()

Course Title:	**Internetworking Protocols Lab**	**Semester IV**	
Course Code	**BTITL409**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments List:

1. Conversion of IP addresses
   (e.g. I/P: 10.24.164.254 O/P: 00001010.00011000.10000000.11111110 and I/P:binary dotted O/P: decimal dotted)
2. Introduction to Wireshark
3. Wireshark Lab: Ethernet and ARP
4. Wireshark Lab: IP
5. Wireshark Lab: ICMP, study of ping and traceroute command
6. Wireshark Lab: UDP
7. Wireshark Lab: TCP
8. Study of ftp, telnet tools and network configuration files
9. DHCP server configuration
10. Socket programming for UDP and TCP

Teaching and Evaluation Scheme Third Year B. Tech. (Information Technology)

Sr. No	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
Semester V										
1	BTITC501	Database Management Systems	3	-	-	20	20	60	3	3
2	BTITC502	Design and Analysis of Algorithms	3	-	-	20	20	60	3	3
3	BTITC503	Software Engineering	3	-	-	20	20	60	3	3
4	BTITOE504	Open/Departmental Elective - Group 1	3	-	-	20	20	60	3	3
5	BTITSE505	Stream Elective - Group 1	3	-	-	20	20	60	3	3
6	BTITS506	Seminar	-	2	-	-	-	50	2	2
7	BTITL507	Programming Lab – Minor (R Programming)	-	-	2	-	25	25	1	2
8	BTHM508	Constitutions of India/ Essence of Indian Traditional Knowledge	-	-	-	-	-	-	-	Audit
9	BTITL509	Database Management Systems Lab	-	-	2	-	25	25	1	2
10	BTITL510	Design and Analysis of Algorithms Lab	-	-	2	-	25	25	1	2
Summary of Semester Assessment Marks, Credit & Hours			**15**	**2**	**6**	**100**	**175**	**425**	**20**	**23**
Semester VI										
1	BTITC601	Operating Systems	3	-	-	20	20	60	3	3
2	BTITC602	Compiler Construction	3	-	-	20	20	60	3	3
3	BTITC603	Object Oriented Software and Web Engineering	3	-	-	20	20	60	3	3
4	BTITOE604	Open/Departmental Elective Group 2	3	-	-	20	20	60	3	3
5	BTITSE605	Stream Elective - Group 2	3	-	-	20	20	60	3	3
6	BTITL606	Programming Lab – Major (Web Technologies)	-	-	4		25	25	2	4
7	BTITL607	Operating Systems Lab	-	-	2	-	25	25	1	2
8	BTITL608	Object Oriented Software and Web Engineering Lab	-	-	2	-	25	25	1	2
9	BTITSEL609	Departmental Elective - Group 2 Lab	-	-	2	-	25	25	1	2
Summary of Semester Assessment Marks, Credit & Hours			**15**	**-**	**10**	**100**	**200**	**400**	**20**	**25**

List of Open/Departmental Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITOE504A	Graph Theory	Nil
2	BTITOE504B	Human Computer Interaction	Nil
3	BTITOE504C	Probability and Queuing Theory	Engineering Mathematics III

List of Stream Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTIT SE505A	Embedded Systems	Microprocessors and Microcontrollers
2	BTIT SE505B	IT Service Management	Nil
3	BTIT SE505C	Information Storage Management	Computer Architecture &Organization
4	BTIT SE505D	Network Management	Internetworking Protocols
5	BTIT SE505E	Data Visualisation	Database Management Systems

List of Open/Departmental Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITOE604A	Enterprise Resource Planning	Database Management Systems
2	BTITOE604B	Decision Support System	Database Management Systems
3	BTITOE604C	Software Project Management	Software Engineering

List of Stream Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE605A	Software Testing	Software Engineering
2	BTITSE605B	Data Storage Technologies & Networks	Internetworking Protocols, Operating Systems
3	BTITSE605C	Service Oriented Architecture	Nil
4	BTITSE605D	Network Programming	Internetworking Protocols, Operating Systems
5	BTITSE605E	Advanced Database Technology	Database Management Systems

Course Title:	**Database Management Systems**	**Semester V**	
Course Code	**BTITC501**	**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"***, , McGraw Hill Education, 6th Edition, 2011.
2. Ramez Elmasri and Shamkant B. Navathe, ***"Fundamental Database Systems"***, Pearson Education, 7th Edition, 2015.
3. Raghu Ramkrishnan, Johannes Gehrke, ***"Database Management Systems"***, McGraw Hill Education, 3rd Edition, 2007.

Reference Books:

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

Course Title:	**Design and Analysis of Algorithms**	**Semester V**	
Course Code	**BTITC502**	**Course Type**	**Mandatory**
Pre-requisite	**Data Structures**	**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"***, MIT Press, 3rd Edition, 2009.
2. E. Horowitz, S. Sahni and S. Rajsekaran, ***"Computer Algorithms"***, Silicon Press, 2nd Edition, 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"***, Shroff Publication, 1st Edition, 2008.
3. Kyle Loudon, ***"Mastering Algorithms with C"***, Shroff Publication, 1st Edition, 2008.

Course Title:	**Software Engineering**	**Semester V**	
Course Code	**BTITC503**	**Course Type**	**Core**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**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"***, Tata McGraw-Hill, 6th Edition, 2006.
2. G. Booch, J. Rambaugh, and I. Jacobson, ***"The Unified Modeling Language User Guide"***, Addison Wesley, 2nd Edition, 2005.

Reference Books:

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

Course Title:	**Graph Theory**	**Semester V**	
Course Code	**BTITOE504A**	**Course Type**	**Elective**
Pre-requisite	**Discrete Structures and Applications**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental Elective**	**Credits**	**3**

Course Content:

UNIT I

Basics – Graphs, degree sequences, distance in graphs, complete, regular and bipartite graphs, basic properties.

UNIT II

Structure and Symmetry – Cut vertices, bridges and blocks, automorphism groups, reconstruction problem.

UNIT III

Trees and connectivity – Properties of trees, Arboricity, vertex and edge connectivity, Mengers theorem

UNIT IV

Eulerian and Hamiltonian graphs – Characterization of Eulerian graphs -Sufficient conditions for Hamiltonian graphs.

UNIT V

Colouring and planar graphs – vertex and edge colouring, perfect graphs, planar graphs, Euler's theorem, Kuratowski's theorem, Colouring of planar graphs, Crossing number and thickness.

UNIT VI

Matching, factors, decomposition and domination. Extremal Graph theory – Turan's theorem, Ramsay's theorem, Szemeredi's 97 regularity lemma, applications.

Text Books:

1. J. A. Bondy, U. S. R. Murthy, ***"Graph Theory"***, Springer Verlag, 2008.
2. D. B. West, ***"Introduction to Graph Theory"***, PHI, 2004.

Reference Books:

1. R. Diestel , ***"Graph Theory"***, Springer Verlag (Free Download available), 2003.

Course Title:	**Human Computer Interaction**	**Semester V**	
Course Code	**BTITOE504B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Content:

UNIT I

Introduction: The human, The computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories.

UNIT II

Design Process- Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support.

UNIT III

Models and Theories0 Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modeling rich interaction.

UNIT IV

Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation.

UNIT V

Design Issues- Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization.

UNIT VI

Outside the Box- Group ware, Ubiquitous computing and augmented realities, Hypertext, multimedia, and the World Wide Web

Text Books:

1. Alan Dix, Janet Finlay, ***"Human Computer Interaction"***, Pearson Education, 2004.
2. Ben Shneiderman, ***"Designing the User Interface - Strategies for Effective Human Computer Interaction"***, Pearson Education, 2010.

Reference Books:

1. M. B. Rosson, J. M. Carroll ***"Usability Engineering: Scenario-Based Development of Human-Computer Interaction"***, Elsevier, 2002.
2. Alan Cooper, ***"The Essentials of Interaction Design"***, Wiley Publishing, 2007.
3. Nielsen, J. Morgan Kaufmann, San Francisco, ***"Usability Engineering"***, 1993.
4. Heim, S., ***"The Resonant Interface: HCI Foundations for Interaction Design"***, Addison-Wesley, 2007.

Course Title:	**Probability and Queuing Theory**	**Semester V**	
Course Code	**BTITOE504C**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics-III**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental Elective**	**Credits**	**3**

Course Objectives:

1. Be through with probability concepts.
2. To acquire knowledge on Probability Distributions.
3. Get exposed to the testing of hypothesis using distributions.
4. Gain strong knowledge inn principles of Queuing theory.
5. Get exposed to Discrete time Markov chain.

Course Outcomes:

1. To acquire analytical ability in solving mathematical problems as applied to the respective branches of engineering.

Course Content:

UNIT I

Random Variables: Review of probability concepts, Types of Events, Axioms, Conditional probability, Multiplication theorem, Applications.

Discrete and continuous Random Variables – Discrete case, Probability Mass function, Cumulative distribution function, Applications, Characteristics of random variables – Continuous case, Probability density function, Cumulative distribution function, Applications, Expectation, Variance, Expectation, Variance, Moment Generating Function, Functions of Random Variable (One dimensional only)

Chebychev"s Inequality – (Statement only). Applications of Chebychev's Inequality.

UNIT II

THEORETICAL DISTRIBUTIONS:

Discrete Probability distribution: Binomial distribution – MGF, Mean, Variance, Applications of Binomial distribution, Fitting a Binomial distribution, Poisson distribution – MGF, Mean, Variance, Applications of Poisson distribution, Fitting a Poisson distribution, Geometric distribution – MGF, Mean, Variance, Memoryless Property , Applications of Geometric distribution, Continuous Probability Distributions: Uniform distribution – MGF, Mean, Variance & Applications, Exponential Distribution - MGF, Mean, Variance, Memoryless Property Applications of Exponential distribution, Normal distribution – Mean, Variance, Standard Normal distribution and Applications of Normal distribution

UNIT III

Testing of Hypothesis:

Introduction to Sampling Distributions, Population and Sample, Null Hypothesis and Alternative Hypothesis, Single and Two Tailed Test.

Testing of Hypothesis, Level of Significance, Critical Region, Procedure for Testing of Hypothesis

Large Sample Test- Test For Single Proportion, Two Sample Proportions.

Large Sample Test- Test For Single Mean, Two Sample Means.
Small Sample Tests – „t‟ Test For a Single Mean „t‟ Test For The Difference Of Means, Paired „t‟ Test
F Test – Test of Significance of the Difference between Two Population Variances.
Chi Square Test for Goodness of Fit, Independence of Attributes.

UNIT IV

Queuing Theory: Introduction to Markovian queuing models.
Single Server Model with Infinite system capacity, Characteristics of the Model (M/M/1): (∞/FIFO) Problems on Model (M/M/1): (∞/FIFO), Problems on Model (M/M/1): (∞/FIFO), Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1): (K/FIFO), Problems on Model (M/M/1): (K/FIFO).

UNIT V

Markov Chains:
Introduction to Stochastic process, Markov process, Markov chain one step & n-step Transition Probability, TPM and Applications, Chapman Kolmogorov theorem (Statement only), Applications on Chapman Kolmogorov theorem.

UNIT VI

MARKOV CHAINS: Transition probability- Applications, Classification of states of a Markov chain, Classification of states of a Markov chain – Applications.

Text Books:

1. Veerarajan T., ***"Probability, Statistics and Random Processes"***, Tata McGraw Hill, 1st Reprint 2004.
2. S.C. Gupta and V.K. Kapoor, ***"Fundamentals of Mathematical Statistics"***, Sultan Chand & Sons, 9th extensively revised Eition,1999

Reference Books:

1. Trivedi K S, ***" Probability and Statistics with reliability, Queueing and Computer Science Applications***", Prentice Hall of India, New Delhi, 1984
2. Gross.D, Harris.C.M. , ***"Fundamentals of Queuing Theory"***, John Wiley and Sons, 1985.
3. Allen.A.O., ***"Probability Statistics and Queuing Theory"***, Academic Press, 1981

Course Title:	**Embedded Systems**	**Semester V**	
Course Code	**BTITSE505A**	**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"***, TMH Publication, 3rd Edition, 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"***, Gulf Professional Publishing, 2nd Edition, 2008.
2. David E Simon, ***"An Embedded Software Primer"***, Addison Wesley Publication, 2004.

Course Title:	**IT Service Management**	**Semester V**	
Course Code	**BTITSE505B**	**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"***, S.K. Kataria and Sons, 2nd Edition, 2009.

Course Title:	**Information Storage Management**	**Semester V**	
Course Code	**BTITSE505C**	**Course Type**	**Elective**
Pre-requisite	**Computer Architecture & Organization**	**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 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"***, Wiley India, 1st Edition, 2009.

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",*** Tata McGraw Hill 2003, 2nd edition.

Course Title:	**Network Management**	**Semester V**	
Course Code	**BTITSE505D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**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

Telecommunication 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"***, Pearson Education, 2nd Edition, 2010.

Reference Books:

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

Course Title:	**Data Visualisation**	**Semester V**	
Course Code	**BTITSE505E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Learn and understand the importance of data visualization.
2. Learn what is user experience in data visualization and its importance.
3. Learn about basic and advance chart types used in data visualization.
4. Learn the psychology of visualization with Gestalt Principles.

Course Outcomes:

After learning the course the student will be able:

1. Get a solid understanding of how people work in data visualization project.

Course Content:

UNIT I

The seven stages of Data Visualization: Why data display requires planning, An example, Iteration and Combination, Principles.

Getting Started with Processing: Sketching with processing, Example and Distributing your work, Examples and references, Functions, Sketching and Scripting

Mapping: Drawing a Map, Locations on map, Data on Map, Using your own data, Next step.

UNIT II

Time series:

Milk, Tea, and Coffee (Acquire and parse), Cleaning the table(Filter and Mine), A simple plot(Represent and refine), Labeling the current data set(Refine and Interact), Drawing Axis labels(Refine), Choosing a proper representation(Represent and refine), Using rollovers to Highlights points(Interact), Ways to connect points(refine), Text labels as tabbed panes(Interact), Interpolation between data sets(Interact).

UNIT III

Connections and Correlations:

Changing data sources, Problem statement, Preprocessing, Using the processed data(Acquire, Parse Filter and Mine), Displaying the results(Represent), Returning to the questions(Refine), Sophisticated sorting: Using salary as a Tiebreaker(Mine), Moving to multiple days(Interact), Smoothing out Interaction(Refine), Deployment Consideration(Acquire, Parse, filter).

UNIT IV

Scatterplot Maps: ++Preprocessing, Loading the data(Acquire and Parse), Drawing a scatterplot of Zip codes(Mine and represent), Highlighting Points while typing(Refine and Interact), Show the currently selected points(refine), Progressively Dimming and Brightening points(Refine), Zooming In (Interact),Changing How Points are Drawn when Zooming (Refine), Development issues(Acquire and Refine)

UNIT V

Trees, Hierarchies, and Recursion: Using recursion to build a Directory Tree, Using a Queue to Load Asynchronously (Interact), An improving the TreeMaps Display (Refine), Flying through files(Interact).

Networks and Graphs: A simple graph Demo, A more complicated Graph, Approaching Network Problem, Advanced graph example, Mining additional example.

UNIT VI

Acquiring Data:Where to find data, Tools for Acquiring data from Internet, Loading files for use with processing, Loading text data, Dealing with files and folders, Listing files in folders, Asynchronous Image download, Using openStream() As a bridge to Java, Dealing with Byte arrays, Advanced web techniques, Using Databases, Dealing with large number of files.

Parsing Data**:** Levels of efforts, Tools for gathering clues, Text is Best, Text Markup language, Regular expressions(regexps), Grammars and BNF Notations, Compressed Data, Vectors and Geometry, Binary data formats, Advanced detective work.

Text Books:

1. Ben Fry, ***"Visualizing Data: Exploring and Explaining data with Processing Environment"***, Shroff/O'Reilly Media, 2016

Reference Books:

1. Scott Murray, ***"Interactive Data Visualization for the web"***, Shroff/O'Reilly Media, 2016.
2. Julia Steele, Noah Lliinsky, ***"Designing Data Visualizations"***, Shroff/O'Reilly Media, 2012.
3. Kyran Dale, ***"Data Visualization with Python and JavaScript: Scrape, Clean, Explore & Transform your data"***, Shroff/O'Reilly Media, 2016.
4. Julia Steele, Noah Lliinsky, ***"Beautiful Visualization"***, Shroff/O'Reilly Media, 2016.

Course Title:	**Seminar**	**Semester V**	
Course Code	**BTITS506**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 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(R programming)**	**Semester V**	
Course Code	**BTITL507**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

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 program 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:	**Database Management Systems Lab**	**Semester V**	
Course Code	**BTITL509**	**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:	**Design and Analysis of Algorithms Lab**	**Semester V**	
Course Code	**BTITL510**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design and 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
   (b) Implement Travelling Sales Person problem using Dynamic programming.
7. 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.
8. Design and implement a program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Title:	**Operating Systems**	**Semester VI**	
Course Code	**BTITC601**	**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:	**Compiler Construction**	**Semester VI**	
Course Code	**BTITC602**	**Course Type**	**Elective**
Pre-requisite	**Data Structures**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**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"***, Pearson, 2nd Edition, 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:	**Object Oriented Software and Web Engineering**	**Semester VI**	
Course Code	**BTITC603**	**Course Type**	**Mandatory**
Pre-requisite	**Object Oriented Paradigm with C++**	**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.
4. Understand the characteristics of web application.
5. Learn to Model web applications.
6. Be aware of Systematic methods.
7. Be familiar with the testing techniques for web applications.

Course Outcomes:

After learning the course the students should be able to:

1. Understand Object Oriented Software Development Process.
2. Gain exposure to Object Oriented Methodologies & UML Diagrams.
3. Apply Object Oriented Analysis Processes for projects.
4. Apply the characteristics of web applications.
5. Model web applications.
6. Design web applications.
7. Test web applications.

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.

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 V

Introduction to Web Engineering and requirement engineering: Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage related Characteristics, Development-related Characteristic, Evolution of web engineering – Requirements Engineering Activities RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools.

Web Application Architecture and Modelling Web Applications: Introduction- Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N-Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Relation to Content, Hypertext, and Presentation Modeling

UNIT VI

Web Application Design: Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Inter action Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.

Testing Web Applications: Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability

Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation.

Web Project Management: Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project, Introduction to node JS – web sockets.

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"***, Pearson Education, 3rd Edition, 2005.
3. Gerti Kappel, Birgit Proll, ***"Web Engineering"***, John Wiley and Sons Ltd, 2006.
4. Roger S. Pressman, David Lowe, ***"Web Engineering"***, Tata McGraw Hill Publication, 2007.
5. Guy W. Lecky-Thompson, ***"Web Programming"***, Cengage Learning, 2008.

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"***, Addision Wesley, 2nd Edition, 2005
3. Simon Bennett, Steve Mc Robb and Ray Farmer, ***"Object Oriented Systems Analysis and Design Using UML"***, McGraw Hill Education, 4th Edition, 2010.
4. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ***"Design Patterns: Elements of Reusable Object-Oriented Software"***, Addison-Wesley, 1995.
5. Chris Bates, **"Web Programming: Building Internet Applications"**, Third Edition, Wiley India Edition, 2007.
6. John Paul Mueller, **"Web Development with Microsoft Visual Studio 2005"**,Wiley Dream tech, 2006.

Course Title:	**Enterprise Resource Planning**	**Semester VI**	
Course Code	**BTITOE604A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**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 Edition.
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 Edition.

Course Title:	**Decision Support Systems**	**Semester VI**	
Course Code	**BTITOE604B**	**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"***, Pearson Education, 6th Edition,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:	**Software Project Management**	**Semester VI**	
Course Code	**BTITOE604C**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

UNIT I

Project Evaluation and Planning - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models.

UNIT II

Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

UNIT III

Monitoring And Control- Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control

UNIT IV

Software Configuration Management (SCM), Managing Contracts, Types Of Contracts, Stages In Contract Placement, Typical Terms of A Contract, Contract Management and Acceptance.

UNIT V

Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. ISO and CMMI models, Testing, and Software reliability, test automation.

UNIT VI

Overview of project management tools.

Text Books:

1. Bob Hughes, Mike Cotterell, ***"Software Project Management"***, Tata McGraw Hill, 2009.

Reference Books:

1. Royce, ***"Software Project Management"***, Pearson Education, 2005.
2. Robert K. Wysocki, ***"Effective Software Project Management"***, Wiley, 2006.

Course Title:	**Software Testing**	**Semester VI**	
Course Code	**BTITSE605A**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application & Development**	**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"***, Dreamtech press, 2nd Edition, 2014

Course Title:	**Data Storage Technologies & Networks**	**Semester VI**	
Course Code	**BTITSE605B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols,, 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, 1st Edition, 2013

Course Title:	**Service Oriented Architecture**	**Semester VI**	
Course Code	**BTITSE605C**	**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"***, TMH India, 2nd Edition, 2012.

Course Title:	**Network Programming**	**Semester VI**	
Course Code	**BTITSE605D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols, 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

Socket And Application Devlopment: 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 Optian: 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

Advanced Socket: 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

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"***, Addison-Wesley Professional, 3rd Edition,2003.
2. William Stallings, ***"SNMP, SNMPv2, SNMPv3 and RMON 1 and 2"***, Pearson Edition, 3rd Edition, 2009.

Reference Books:

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

Course Title:	**Advanced Database Technology**	**Semester VI**	
Course Code	**BTITSE605E**	**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"***, Pearson Education, 3rd Edition, 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"***, McGraw Hill, 6th Edition, 2011.
2. C. J. Date, A. Kannan and S. Swamynathan, ***"An Introduction to Database Systems"***, Pearson Education, 8th Edition,2006.
3. R. Elmasri, S. B. Navathe, ***"Fundamentals of Database Systems"***, Pearson Education/Addison Wesley, 5th Edition, 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:	**Operating Systems Lab**	**Semester VI**	
Course Code	**BTITL607**	**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:
   - Round Robin
   - SJF
   - FCFS
   - Priority
4. Implement all file allocation strategies:
   - Sequential
   - Indexed
   - Linked
5. Implement Semaphores.
6. Implement all File Organization Techniques:
   - Single level directory
   - Two level
   - Hierarchical
   - DAG
7. Implement Bankers Algorithm for Dead Lock Avoidance.
8. Implement an Algorithm for Dead Lock Detection.
9. Implement e all page replacement algorithms:
   - FIFO
   - LRU
   - LFU
10. Implement Shared memory and IPC.
11. Implement Paging Technique of memory management.
12. Implement Threading & Synchronization Applications.

Course Title:	**Object Oriented Software and Web Engineering Lab**	**Semester VI**	
Course Code	**BTITL608**	**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:	**Software Testing Lab**	**Semester VI**	
Course Code	**BTITSEL609A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application & Development**	**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 data flow 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:	**Data Storage Technologies & Networks Lab**	**Semester VI**	
Course Code	**BTITSEL609B**	**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 Lab**	**Semester VI**	
Course Code	**BTITSEL609C**	**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 Lab**	**Semester VI**	
Course Code	**BTITSEL609D**	**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) 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)

13. Trace the packet within the Simulation time and display the Trace file.

Course Title:	**Advanced Database Technology Lab**	**Semester VI**	
Course Code	**BTITSEL609E**	**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

1. Insert details in each object.
2. Display the Employee details.
3. Display Student Details.
4. Modify person details.
5. 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). Faculties 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.

b. Implement a storage structure for storing XML database and test with the above schema.

Teaching and Evaluation Scheme Final year B. Tech. (Information Technology)

Sr. No	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
Semester VII										
1	BTIT701	Cloud Computing and Storage Management	2	-	-	20	20	60	2	2
2	BTITDE702	Open / Departmental Elective - Group 3	3	-	-	20	20	60	3	3
3	BTIT DE703	Open / Departmental Elective - Group 4	3	-	-	20	20	60	3	3
4	BTIT SE704	Stream Elective - Group 3	3	-	-	20	20	60	3	3
5	BTITL705	Cloud Computing and Storage Management Lab	-	-	2		25	25	1	2
6	BTITDEL706	Open / Departmental Elective - Group 3 Lab	-	-	2	-	25	25	1	2
7	BTITSEL707	Stream Elective - Group 3 Lab	-	-	2	-	25	25	1	2
8	BTITP708	Project Phase I	-	-	8	-	50	50	4	8
9	BTIT709	Industrial Training Assessment	-	-	-	-	-	50	2	-
Summary of Semester Assessment Marks, Credit & Hours			**11**	**-**	**14**	**80**	**205**	**415**	**20**	**25**
Semester VIII										
1	BTIT DE801	Open/Departmental Elective - Group 5	3	-	-	20	20	60	3	3
2	BTITSE802	Stream Elective - Group4	3	-	-	20	20	60	3	3
3	BTIT SE803	Stream Elective - Group 5	3	-	-	20	20	60	3	3
4	BTITSE804	Stream Elective - Group 6	3	-	-	20	20	60	3	3
5	BTITDEL805	Open/Departmental Elective - Group 5 Lab	-	-	2		25	25	1	2
7	BTITSEL806	Stream Elective - Group 4 Lab	-	-	2	-	25	25	1	2
8	BTITSEL807	Stream Elective - Group 6 Lab	-	-	2	-	25	25	1	2
9	BTITP808	Project Phase II	-	-	12		50	50	5	12
Summary of Semester Assessment Marks, Credit & Hours			**12**	**-**	**18**	**80**	**205**	**365**	**20**	**30**

List of Open/Departmental Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE702A	Pattern Recognition	Nil
2	BTITDE702B	Soft Computing	Nil

List of Open/Departmental Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE703A	Natural Language Processing	Nil
2	BTITDE703B	Artificial Intelligence	Nil

List of Stream Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE704A	Real Time Systems	Operating Systems, Design and Analysis of Algorithms
2	BTITSE704B	Information Security	Internetworking Protocols
3	BTITSE704C	Management Information Systems	Decision Support Systems
4	BTITSE704D	Distributed Computing	Operating Systems
5	BTITSE704E	Data Warehousing and Data Mining	Database Management Systems

List of Open/Departmental Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE801A	Internet of Things	Microprocessor & Microcontrollers
2	BTITDE801B	E-commerce Systems	Nil

List of Stream Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE802A	Mobile Computing	Internetworking Protocols, Operating Systems
2	BTITSE802B	Cryptography	Computer Architecture and Organization
3	BTITSE802C	Information Retrieval	Design and Analysis of Algorithms
4	BTITSE802D	Network Security	Internetworking Protocols, Network Programming
5	BTITSE802E	Big Data Analytics	Database Management Systems

List of Stream Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE803A	User Experience Design	Software Engineering
2	BTITSE803B	Infrastructure Auditing & Implementation	IT Service Management
3	BTITSE803C	Cyber Law and IPR	Nil
4	BTITSE803D	Optical Networks	Internetworking Protocols
5	BTITSE803E	Web & Text Mining	Data Mining

List of Stream Electives – Group 6

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE804A	Multimedia Applications	Nil
2	BTITSE804B	Ethical Hacking	Operating Systems
3	BTITSE804C	CRM & SCM	Enterprise Resource Planning
4	BTITSE804D	Wireless Networking	Internetworking Protocols
5	BTITSE804E	Machine Learning	Engineering Mathematics

Course Title:	**Cloud Computing and Storage Management**	**Semester VII**	
Course Code	**BTIT701**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Core**	**Credits**	**2**

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 identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

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 describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

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

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, Off site 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. 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.
4. EMC Corporation, ***"Information Storage and Management"***, 1st Edition, Wiley India 2009..

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. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th Edition, November 2012.
4. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
5. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st Edition, 2001.

Course Title:	**Pattern Recognition**	**Semester VII**	
Course Code	**BTITDE702A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognition research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Course Outcomes:

1. Identify and explain detailed aspects of internal structures of pattern recognitions.
2. Compare and contrast design issues for statistical pattern recognition.
3. Develop implementation skills for building pattern recognition.

Course Content:

UNIT I

Introduction: Machine Perception, Definition of Pattern Recognition (PR), Pattern Recognition system: Sensing, Segmentation & grouping, Feature extraction, Classification and Post processing, Design cycle: Data collection, Feature choice, Model choice, Training, Evaluation and computational complexity. Learning and adaptation: Supervised learning, Unsupervised learning and Reinforcement learning. Examples of PR Applications, Pattern Recognition Extensions. Machine learning : Components of learning, Learning models, Geometric models, Probabilistic models, Logic models, Grouping and grading, Learning versus design, Theory of learning, Feasibility of learning, Error and noise, Training versus testing, Theory of generalization, Generalization bound, Approximation-generalization tradeoff, Bias and variance, Learning curve.

UNIT II

Statistical Pattern Recognition (StatPR): Introduction to StatPR, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal costs of error, Estimation of error rates, Characteristic curves, Estimating the composition of populations, Introduction to supervised parametric approaches and unsupervised approaches. Cluster analysis: Clustering techniques, Cluster analysis, Cluster validity. Feature selection & extraction: Feature selection criteria, Feature set search algorithm, Feature selection.

UNIT III

Tree Classifiers: (a) Decision Trees: CART, C4.5, ID3, (b) Random Forests, Linear Discriminants, Discriminative Classifiers: the Decision Boundary, (a) Separability, (b) Perceptrons, (c) Support Vector Machines.

UNIT IV

Parametric Techniques: Generative methods grounded in Bayesian Decision Theory (a) Maximum Likelihood Estimation (b) Bayesian Parameter Estimation (c) Sufficient Statistics. Non-Parametric Techniques :(a) Kernel Density Estimators (b) Parzen Window (c) Nearest Neighbor Methods.

UNIT V

Syntactic (Structural) Pattern Recognition (Syntpr): Introduction to SyntPR, Syntactic PR: primitive selection & pattern grammars, Higher dimensional grammars, Syntactic recognition, Automata, Error – correcting parsing, Shape & texture analysis, Image database management. Structural analysis using constraint satisfaction and structural matching, The Formal Language-based approach to SyntPR, Learning/Training in the Language-based Approach (Grammatical Inference). Problem solving methods for PR: Problem solving models, Problem solving algorithms.

UNIT VI

Unsupervised Methods : Exploring the Data for Latent Structure :(a) Component Analysis and Dimension Reduction: i. The Curse of Dimensionality, ii. Principal Component Analysis, iii. Fisher Linear Discriminant, iv. Locally Linear Embedding, (b) Clustering: i. K-Means, ii. Expectation Maximization, iii. Mean Shift. Classifier Ensembles : (a) Bagging, (b) Boosting / AdaBoost, Algorithm Independent, Topics Theoretical Treatments in the Context of Learned Tools: (a) No Free Lunch Theorem, (b) Ugly Duckling Theorem, (c) Bias-Variance Dilemma, (d) Jacknife and Bootstrap Methods.

Text Books:

1. Duda, R.O., Hart, P.E., Stork, D.G. ***"Pattern Classification",*** Wiley, 2nd Edition, 2001.
2. Eart Gose, Richard Johnsonburg and Steve Joust, ***"Pattern Recognition and Image Analysis"***, Prentice-Hall of India-2003.

Reference Books:

1. Bishop, C. M. ***"Pattern Recognition and Machine Learning"*** Springer, 2nd Edition, 2007.
2. Marsland, S., ***"Machine Learning: An Algorithmic Perspective"***, CRC Press. 2009.
3. Theodoridis, S. and Koutroumbas, K., ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
4. Russell, S. and Norvig, N., ***"Artificial Intelligence: A Modern Approach",*** Prentice Hall, Series in Artificial Intelligence, 2003.

Course Title:	**Soft Computing**	**Semester VII**	
Course Code	**BTITDE702B**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

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: 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: Multilayer perceptron (MLP) and back propagation algorithm, 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: 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: 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, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design, Fuzzy Logic Controllers, 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, 2008.
2. Timothy Ross, "***Fuzzy Logic With Engineering Applications"***, 3rd Edition, 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"***, 2nd 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:	**Natural Language Processing**	**Semester VII**	
Course Code	**BTITDE703A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Open/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, ***"Natural Language Understanding"***, 2nd Edition, Benjamin/Cummings, 1996.

Reference Books:

1. Bharathi, A., Vineet Chaitanya and Rajeev Sangal, ***"Natural Language Processing-A Pananian Perspective",*** Prentice Hall India, 1995.
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:	**Artificial Intelligence**	**Semester VII**	
Course Code	**BTITDE703B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**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 techniques, 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"***, PHI, 2005.

Reference Book:

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

Course Title:	**Real Time Systems**	**Semester VII**	
Course Code	**BTITSE704A**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems, Design and Analysis of 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: Fixed 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-Queuing 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. Prasad, ***"Embedded Real Time System Concept Design and Programming"***, Wiley India.

Course Title:	**Information Security**	**Semester VII**	
Course Code	**BTITSE704B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**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 and untrusted 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, 2008.
4. Mark Stamp, ***"Information Security: Principles and Practice"***, 2nd Edition, , Wiley, 2011.

Reference Books:

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

Course Title:	**Management Information Systems**	**Semester VII**	
Course Code	**BTITSE704C**	**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 and Firm level Strategy.

UNIT III

Information systems in the enterprise: Systems from Management and functional perspective and their relationship: Executive Information System, Decision support system sales and Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance and 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 and 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 and social issues.

Text Book:

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

Reference Books:

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

Course Title:	**Distributed Computing**	**Semester VII**	
Course Code	**BTITSE704D**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**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 Edition, 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 Edition, 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 Edition, Prentice-Hall, 2004.

Course Title:	**Data Warehousing and Data Mining**	**Semester VII**	
Course Code	**BTITSE704E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Introduce the concepts, techniques, design and applications of data warehousing and data mining.
2. Enable students to understand and implement classical algorithms in data mining and data warehousing.
3. Enable students to learn how to analyze the data, identify the problems and choose the relevant algorithms to apply.

Course Outcomes:

After learning the course the student will be able:

1. Understand the functionality of the various data mining and data warehousing components.
2. Appreciate the strengths and limitations of various data mining and data warehousing models.
3. Compare the various approaches to data warehousing and data mining implementations.
4. Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications.

Course Content:

UNIT I

Introduction to data warehousing, Evolution of decision support systems, Modeling a data warehouse, granularity in the data warehouse, Data warehouse life cycle, building a data warehouse, Data Warehousing Components, Data Warehousing Architecture.

UNIT II

On Line Analytical Processing, Categorization of OLAP Tools, Introduction to Data mining and knowledge discovery, Relation to Statistics, Databases, Data Mining Functionalities, Steps In Data Mining Process, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems.

UNIT III

Overview of Data Mining Techniques, Data Preprocessing, Data Cleaning, Data Integration, Data Transformation and Data Reduction, Data Generalization and Summarization Based Characterization, Mining Association Rules In Large Databases.

UNIT IV

Classification and Prediction, Issues Regarding Classification and Prediction, Classification By Decision Tree Induction, Bayesian Classification, Other Classification Methods.

UNIT V

Prediction, Clusters Analysis, Types of Data In Cluster Analysis, Categorization of Major Clustering Methods, Partitioning methods, Hierarchical Methods.

UNIT VI

Applications of Data Mining, Social Impacts of Data Mining, Case Studies, Mining WWW, Mining Text Database, Mining Spatial Databases.

Text Books:

1. Adriaans, ***" Data mining"***, Addison- Wesley, 1996.
2. Margaret Dunham, ***"Data Mining: Introductory and Advanced Topics"***, Published by Prentice Hall.
3. Weiss, Sholom M.,***"Predictive data mining : a practical guide",*** Kaufmann Publishers, 1998.

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:	**Cloud Computing and Storage Management Lab**	**Semester VII**	
Course Code	**BTITL705**	**Course Type**	**Compulsory**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credit**	**1**

Lab Experiments Objectives:

Learner will be able to...

1. Appreciate cloud architecture.
2. Create and run virtual machines on open source OS.
3. Implement Infrastructure, storage as a Service.
4. Install and appreciate security features for cloud.

Lab Experiments List:

1. Study of Cloud Computing & Architecture.
2. Study and implementation of Infrastructure as a Service.
3. Implementation of Private cloud using Eucalyptus or Open stake.
   - Working with KVM to create VM.
   - Installation and configuration of Private cloud.
   - Bundling and uploading images on a cloud.
   - Creating web based UI to launch VM.
   - Working with Volumes – Attached to the VM.

Course Title:	**Pattern Recognition Lab**	**Semester VII**	
Course Code	**BTITDEL706A**	**Course Type**	**Elective**
Pre-requisite	**NIL**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Lab Experiments List:

1. Feature Representation.
2. Mean and Covariance.
3. Linear Perceptron Learning.
4. Generation of Random Variables.
5. Bayesian Classification.
6. MLE: Learning the classifier from data.
7. Data Clustering: K-Means, MST-based.

Course Title:	**Soft Computing – Lab**	**Semester VII**	
Course Code	**BTITDEL706B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objectives:

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 regression 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:	**Real Time Systems Lab**	**Semester VII**	
Course Code	**BTITSEL707A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application and Development**	**Credit**	**1**

Lab Experiments Objectives:

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 vs. 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 learned in the course.

Course Title:	**Information Security – Lab**	**Semester VII**	
Course Code	**BTITSEL707B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure and Security Management**	**Credit**	**1**

Lab Experiments Objectives:

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 - Lab**	**Semester VII**	
Course Code	**BTITSEL707C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

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-Lab**	**Semester VII**	
Course Code	**BTITSEL707D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

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-Lab**	**Semester VII**	
Course Code	**BTITSEL707E**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objectives:

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	**BTITP708**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0–0 – 8**
Stream	**Core**	**Credits**	**4**

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	**BTIT709**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 0**
Stream	**Core**	**Credits**	**2**

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:	**Internet of Things**	**Semester**	**VIII**
Course Code	**BTITDE801A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Micro-controllers**	**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, 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 Book:

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"***, Academic Press, 1st Edition, 2014.

Reference Books:

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

Course Title:	**E-commerce Systems**	**Semester**	**VIII**
Course Code	**BTITDE801B**	**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 E-commerce: B2B, B2C, C2C, B2G and other models of E-commerce.

UNIT II

Mobile commerce: Introduction to M-Commerce, History and 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 and Electronic Commerce, Collaborative Computing: Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management: Definition of content, Authoring Tools and Content Management, Content: partnership, repositories, convergence, providers, Web Traffic and 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: Relationship Between E-Commerce and Networking, Different Types of Networking for E-Commerce, Internet, Intranet and 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"***, Himalaya Publication House.
2. Nidhi Dhawan, ***"E-Commerce Concepts and Applications"***, International book house Pvt. Ltd.
3. Kalkota and Whinston, ***"Frontiers of Electronic Commerce"***, Pearson publication.

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"***, Wiley publication, 3rd Edition, 2009.
5. B.V. Kumar, S.V. Subrahmanya, ***"Web Services: An Introduction"***, Tata McGraw Hill, 2008.

Course Title:	**Mobile Computing**	**Semester**	**VIII**
Course Code	**BTITSE802A**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols , Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

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 Mobility 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 Outcomes:

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 and 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 and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and 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 Asymmetry, 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 Books:

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

Reference Books:

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 Publication.
4. P.Stavronlakis, ***"Third Generation Mobile Telecommunication Systems"***, Springer Publishers.

Course Title:	**Cryptography**	**Semester**	**VIII**
Course Code	**BTITSE802B**	**Course Type**	**Elective**
Pre-requisite	**Computer Architecture & Organization**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

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 Outcomes:

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 Book:

1. William Stallings, ***"Cryptography and Network Security - Principles and Practices"***, Prentice Hall of India, 3rd Edition, 2003.

Reference Books:

1. Atul Kahate, ***"Cryptography and Network Security"***, Tata McGraw-Hill, 2003.
2. Bruce Schneier, ***"Applied Cryptography"***, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, ***"Security in Computing"***, Pearson Education, 3rd Edition, 2003.

Course Title:	**Information Retrieval**	**Semester**	**VIII**
Course Code	**BTITSE802C**	**Course Type**	**Elective**
Pre-requisite	**Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

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 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 Books:

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"***, 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:	**Network Security**	**Semester VIII**	
Course Code	**BTITSE802D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols, Network Programming**	**L – T – P**	**3 – 0 – 0**
Stream	**Networks**	**Credits**	**3**

Course Objectives:

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 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 DoS 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, Fermat'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, 4th Edition, 2010.

Reference Books:

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

Course Title:	**Big Data Analytics**	**Semester**	**VIII**
Course Code	**BTITSE802E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

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

Course 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 techniques.
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 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:	**User Experience Design**	**Semester**	**VIII**
Course Code	**BTITSE803A**	**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; Necessity of User Experience Design; Definition of User Experience (UX) Design.

UNIT II

Elements of UX Design: Core elements of User Experience, Working of elements, UX Design Process: Defining the UX Design Process and Methodology.

UNIT III

UX Design Process: Research and define: importance of research, Research methods and tools, Understanding the User needs and goals, Understanding the business goals, Deliverables of the research and 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 and story-boarding, UI elements and widgets, Screen design and layouts, Hands-on assignments and quiz.

UNIT V

UX Design Process: PROTOTYPE and TEST: Necessity of testing your design, Usability testing, Types of usability testing, Usability testing process, Plan for the usability tests, Prototype your design to test, Introduction of prototyping tools, Conduction and preparation of 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: Communication with implementation team UX Deliverables to be given to implementation team.

Text Books:

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**	**VIII**
Course Code	**BTITSE803B**	**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 and 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 and 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.

References:

1. www.netwrix.com
2. www.rbi.org

Course Title:	**Cyber Law and IPR**	**Semester**	**VIII**
Course Code	**BTITSE803C**	**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 and 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 cyber crime 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"***, John Wiley & Sons, 3rd Edition, 2011.
2. Syed Shakil Ahmed, 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)"***, Universal Book Traders, 2nd Edition, Reprint: 2002.

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"***, Bharat Law House, 2nd Edition, 2001.
4. Prasad T.V.R. Satya, ***"Law Relating to Information Technology (Cyber Laws)"***, Asia Law House , 1st Edition, 2001.
5. Reed Chris, ***"Computer Law"***, 3rd Edition, Universal Law Publishing Co. Pvt. Ltd., 1996 (First Indian Reprint 2000).
6. P. Narayanan, ***"Intellectual Property (Trade Marks & the Emerging concepts of Cyber property rights (HB)"***, 3rd Edition. (HB), 2002.

Course Title:	**Optical Networks**	**Semester**	**VIII**
Course Code	**BTITSE803D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
3. To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes.
4. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
5. To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM to acquire knowledge about fault and congestion management.

Course Outcomes:

The student will be able to:

1. Design a system, component or process as per needs and specification.
2. Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
3. Gain the knowledge on methodologies of optical network design optimization.
4. Explore techniques of optical network survivability.
5. Solve the Problems in the discipline of optical networks.

Course Content

UNIT I

Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH physical layer, Elements of a SONET/SDH infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic framing procedure Ethernet: Frame structure, Switches, Ethernet Physical layer, Carrier transport IP: Routing and forwarding, Quality of service. Multiprotocol label switching: Labels and forwarding, Quality of service, Signaling and routing, Carrier transport, Resilient packet ring: Quality of service, Node structure, Fairness storage area networks: Fiber channel.

UNIT II

WDM Network Elements: Optical line terminals, Optical line amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs, Optical cross connects: All-Optical OXC configurations.

UNIT III

Control and Management: Network management functions: Management framework, Information model, Management protocols. Optical layer services and interfacing, Layers within the Optical layer, Multi vendor Interoperability.

UNIT IV

Performance and Fault Management: The Impact of transparency, BER measurement, Optical trace, Alarm management, Data Communication Network (DCN) and Signaling, Policing, Optical layer overhead, Client layers. Configuration management: Equipment management, Connection management, Adaptation management. Optical Safety: Open Fiber Control protocol.

UNIT V

Protection in SONET/SDH: Point-to-Point links, Self-healing rings, Unidirectional line-switched rings, Bidirectional line-switched rings, Ring Interconnection and dual homing. Protection in the client layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer protection: Service classes based on protection. Optical Layer protection schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between layers.

UNIT VI

WDM Network Design: Cost Trade-OFFS: A detailed ring network example LTD and RWA problems, Light path topology design, Routing and wavelength assignment, Wavelength conversion. Dimensioning, Wavelength- routing networks, Statistical dimensioning models: First-passage model, Blocking model, Maximum load dimensioning models: Offline light path requests, Online RWA in rings.

Text Book:

1. Rajeev Ramaswamy, Kumar N Sivarajan, "***Optical Networks***" , Elsevier Publication, 3rd Edition, 2009.

Reference Book:

1. Uyless Black," ***Optical Networks-Third generation transport system***" Pearson Publication, 2013.

Course Title:	**Web & Text Mining**	**Semester**	**VIII**
Course Code	**BTITSE803E**	**Course Type**	**Elective**
Pre-requisite	**Data Warehouse and 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 and 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 w.r.t. 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, Lmmatization, 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, 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

Feedback: 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"***, 1st Edition, Pearson Education.

Course Title:	**Multimedia Applications**	**Semester**	**VIII**
Course Code	**BTITSE804A**	**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 softwares.
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, Llossless 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:	**Ethical Hacking**	**Semester**	**VIII**
Course Code	**BTITSE804B**	**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, Types of hacker, Ethical hacker.

UNIT II

Hacktivism - role of security and penetration tester, Penetration testing methodology, Networking and 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 and backdoors, Virus and worms, Proxy and 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 and Honeypots, IDS and 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 and 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"***, CENGAGE Learning, 2nd Edition, 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:	**CRM & SCM**	**Semester**	**VIII**
Course Code	**BTITSE804C**	**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 Book:

1. Kristin Anderson and Carol Kerr, ***"Customer Relationship Management"***, Tata McGraw Hill.

Course Title:	**Wireless Networking**	**Semester**	**VIII**
Course Code	**BTITSE804D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**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 3rd Edition,
2. Eldad Perahia, Robert Stacey, ***"Next Generation Wireless LANs"***, Cambridge University Press, 2nd 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:	**Machine Learning**	**Semester VIII**	
Course Code	**BTITSE804E**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics 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:	**Internet of Things Lab**	**Semester VIII**	
Course Code	**BTITDEL805A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessors and Microcontrollers Lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

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:	**E-commerce Systems Lab**	**Semester VIII**	
Course Code	**BTITDEL805B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Web Technologies**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objective:

1. To design an E-commerce website.
2. To develop the various modules for a B2C E-commerce 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 an ecommerce.

List of Lab Experiments:

1. Students can choose any online retail business on the B2C model of e-commerce business.
2. Creating the Website Layout for E-Commerce.
3. Inserting & Displaying the Products & Categories.
4. Creating the Shopping Cart.
5. Creating the User Registration & Login Systems.
6. Creating the Checkout System.
7. Creating the Payment Integration System.
8. Creating the Admin Panel for E-commerce.
9. Uploading the E-Commerce to Online Server.

Course Title:	**Mobile Computing - Lab**	**Semester VIII**	
Course Code	**BTITSEL806A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credit**	**1**

Lab Experiments Objectives:

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 Lab**	**Semester VIII**	
Course Code	**BTITSEL806B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credit**	**1**

Lab Experiments Objectives:

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

Course Title:	**Information Retrieval- Lab**	**Semester VIII**	
Course Code	**BTITSEL806C**	**Course Type**	**Elective**
Pre-requisite	**Design and Analysis of Algorithms lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

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 - Lab**	**Semester VIII**	
Course Code	**BTITSEL806D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networks**	**Credit**	**1**

Lab Experiments Objectives:

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 Cryptography 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 - Lab**	**Semester VIII**	
Course Code	**BTITSEL806E**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++ / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

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:	**Multimedia Applications-Lab**	**Semester VIII**	
Course Code	**BTITSEL807A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credit**	**1**

Lab Experiments Objectives:

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 program to embed multimedia files on a webpage and stream them.
7. Write programs to transfer multimedia files from one device to another.

Course Title:	**Ethical Hacking- Lab**	**Semester VIII**	
Course Code	**BTITSEL807B**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credit**	**1**

Lab Experiments Objectives:

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 – Lab**	**Semester VIII**	
Course Code	**BTITSEL807C**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

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 – Lab**	**Semester VIII**	
Course Code	**BTITSEL807D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objectives:

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 – Lab**	**Semester VIII**	
Course Code	**BTITSEL807E**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**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	**BTITP808**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 12**
Stream	**Core**	**Credits**	**5**

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.