

INSTITUTE OF ENGINEERING AND TECHNOLOGY LUCKNOW

(An Autonomous Constituent Institute of Dr. A.P.J. Abdul Kalam Technical University, Lucknow)



Evaluation Scheme & Syllabus For B. Tech. Third Year (Information Technology)

**AS PER
AICTE MODEL CURRICULUM
[Effective from the Session: 2020-21]**

B.TECH (INFORMATION TECHNOLOGY AND CSI) CURRICULUM STRUCTURE

[illegible]

*The Mini Project or internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.

SEMESTER- VI													
Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KCS601	Software Engineering	3	1	0	30	20	50		100		150	4
2	KIT601	Data Analytics	3	1	0	30	20	50		100		150	4
3	KCS603	Computer Networks	3	1	0	30	20	50		100		150	4
4	Deptt-Elective-III	Departmental Elective-III	3	0	0	30	20	50		100		150	3
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	KCS661	Software Engineering Lab	0	0	2				25		25	50	1
7	KIT661	Data Analytics Lab	0	0	2				25		25	50	1
8	KCS663	Computer Networks Lab	0	0	2				25		25	50	1
9	NC ⁺	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		Total	0	3	6							900	21

Departmental Elective-I

1. KIT-051 Statistical Computing
2. KIT-052 Compiler Design
3. KCS-053 Computer Graphics
4. KCS -054 Object Oriented System Design

Departmental Elective-II

5. KCS-055 Machine Learning Techniques
6. KCS -056 Application of Soft Computing
7. KCS-057 Augmented & Virtual Reality
8. KCS-058 Human Computer Interface

Departmental Elective-III

1. KCS-061 Big Data
2. KCS-062 Image Processing
3. KIT -061 Blockchain Architecture Design
4. KCS-064 Data Compression

B.TECH. (INFORMATION TECHNOLOGY and CSI)**FIFTH SEMESTER (DETAILED SYLLABUS)**

Database Management System (KCS-501)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Apply knowledge of database for real life applications.	K ₃
CO 2	Apply query processing techniques to automate the real time problems of databases.	K ₃ , K ₄
CO 3	Identify and solve the redundancy problem in database tables using normalization.	K ₂ , K ₃
CO 4	Understand the concepts of transactions, their processing so they will familiar with broad range of database management issues including data integrity, security and recovery.	K ₂ , K ₄
CO 5	Design, develop and implement a small database project using database tools.	K ₃ , K ₆
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	08
II	Relational data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	08
III	Data Base Design & Normalization: Functional dependencies, normal forms, first, second, 8 third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	08
IV	Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	08
V	Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	08
Text books: <ol style="list-style-type: none"> 1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill 2. Date C J, "An Introduction to Database Systems", Addison Wesley 3. Elmasri, Navathe, " Fundamentals of Database Systems", Addison Wesley 4. O'Neil, Databases, Elsevier Pub. 5. RAMAKRISHNAN"Database Management Systems",McGraw Hill 6. Leon & Leon,"Database Management Systems", Vikas Publishing House 7. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications 8. Majumdar & Bhattacharya, "Database Management System", TMH 		

Web Technology (KIT -501)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Apply the knowledge of the internet and related internet concepts that are vital in understanding web application development and analyze the insights of internet programming to implement complete application over the web.	K ₃ , K ₆
CO 2	Understand, analyze and apply the role of mark up languages like HTML, DHTML, and XML in the workings of the web and web applications.	K ₂ , K ₃
CO 3	Use web application development software tools i.e. XML, Apache Tomcat etc. and identifies the environments currently available on the market to design web sites.	K ₃ , K ₆
CO 4	Understand, analyze and build dynamic web pages using client side programming JavaScript and also develop the web application using servlet and JSP.	K ₂ , K ₄ , K ₆
CO 5	Understand the impact of web designing by database connectivity with JDBC in the current market place where everyone use to prefer electronic medium for shopping, commerce, fund transfer and even social life also.	K ₂ , K ₃ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction: Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, Writing Web Projects, Connecting to Internet, Introduction to Internet services and tools, Introduction to client-server computing. Core Java: Introduction, Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Event handling, Introduction to AWT, AWT controls, Layout managers	08
II	Web Page Designing: HTML: List, Table, Images, Frames, forms, CSS, Document type definition, XML: DTD, XML schemes, Object Models, presenting and using XML, Using XML Processors: DOM and SAX, Dynamic HTML	08
III	Scripting: Java script: Introduction, documents, forms, statements, functions, objects; introduction to AJAX, Networking : Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagram.	08
IV	Enterprise Java Bean: Preparing a Class to be a JavaBeans, Creating a JavaBeans, JavaBeans Properties, Types of beans, Stateful Session bean, Stateless Session bean, Entity bean Java Database Connectivity (JDBC): Merging Data from Multiple Tables: Joining, Manipulating, Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.	08
V	Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries..	08
Text books: <ol style="list-style-type: none"> 1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley 2. Xavier, C, " Web Technology and Design" , New Age International 3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication 4. Bhave, "Programming with Java", Pearson Education 5. Herbert Schildt, "The Complete Reference:Java", TMH. 6. Hans Bergsten, "Java Server Pages", SPD O'Reilly 7. Margaret Levine Young, "The Complete Reference Internet", TMH 8. Naughton, Schildt, "The Complete Reference JAVA2", TMH 9. Balagurusamy E, "Programming in JAVA", TMH 		

Design and Analysis of Algorithm (KCS-503)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	K ₄ , K ₆
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	K ₅ , K ₆
CO 3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.	K ₂ , K ₅
CO 4	Apply classical sorting, searching, optimization and graph algorithms.	K ₂ , K ₄
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	K ₂ , K ₃
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics - Shell Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time.	08
II	Advanced Data Structures: Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List	08
III	Divide and Conquer with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. Greedy Methods with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms.	08
IV	Dynamic Programming with Examples Such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.	08
V	Selected Topics: Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms	08
Text books: <ol style="list-style-type: none"> 1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India. 2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms", 3. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008. 4. LEE "Design & Analysis of Algorithms (POD)", McGraw Hill 5. Richard E. Neapolitan "Foundations of Algorithms" Jones & Bartlett Learning 6. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005. 7. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006. 8. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997 9. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011. 10. Harsh Bhasin, "Algorithm Design and Analysis", First Edition, Oxford University Press. 11. Gilles Brassard and Paul Bratley, Algorithmics: Theory and Practice, Prentice Hall, 1995. 		

Statistical Computing (KIT-051)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand and apply the probability distributions, random number generation and density estimations to perform analysis of various kinds of data	K2, K ₄ , K ₆
CO 2	Understand and manipulate data, design and perform simple Monte Carlo experiments, and be able to use resampling methods	K ₅ , K ₆
CO 3	Perform statistical analysis on variety of data	K ₂ , K ₅
CO 4	Perform appropriate statistical tests using R and visualize the outcome	K ₂ , K ₄
CO 5	Discuss the results obtained from their analyses after creating customized graphical and numerical summaries	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Descriptive Statistics: Diagrammatic representation of data, measures of central tendency, measures of dispersion, measures of skewness and kurtosis, correlation, inference procedure for correlation coefficient, bivariate correlation, multiple correlations, linear regression and its inference procedure, multiple regression. Probability: Measures of probability, conditional probability, independent event, Bayes' theorem, random variable, discrete and continuous probability distributions, expectation and variance, markov inequality, chebyshev's inequality, central limit theorem.	08
II	Inferential Statistics: Sampling & Confidence Interval, Inference & Significance. Estimation and Hypothesis Testing, Goodness of fit, Test of Independence, Permutations and Randomization Test, t-test/z-test (one sample, independent, paired), ANOVA, chi-square. Linear Methods for Regression Analysis: multiple regression analysis, orthogonalization by Householder transformations (QR); singular value decomposition (SVD); linear dimension reduction using principal component analysis (PCA).	08
III	Pseudo-Random Numbers: Random number generation, Inverse-transform, acceptance-rejection, transformations, multivariate probability calculations. Monte Carlo Integration: Simulation and Monte Carlo integration, variance reduction, Monte Carlo hypothesis testing, antithetic variables/control variates, importance sampling, stratified sampling Markov chain Monte Carlo (MCMC): Markov chains; Metropolis-Hastings algorithm; Gibbs sampling; convergence	08
IV	Resampling Methods: Cross-validation, Bootstrapping, Jackknife resampling, percentile confidence intervals, permutation tests Density Estimation: Univariate density estimation, kernel smoothing, multivariate density estimation Numerical Methods: Root finding; more on numerical integration; numerical maximization/minimization; constrained and unconstrained optimization; EM (Expectation-Maximization) algorithm; simplex algorithm	08
V	Introduction to R programming: History of R programming, starting and ending R, R as a scientific calculator , handling package, workspace, inspecting variables, operators and expressions in R, data objects and types, vectors, matrices and arrays, lists and data frames, built-in and user-defined functions , strings and factors, flow control and loops, advanced looping, date and times.	08

	<p>Using R for statistical analysis: Importing data files, exporting data, outputting results, exporting graphs, graphics in R, interactively adding information of plot, performing data analysis tasks.</p> <p>R commands for descriptive statistics, data aggregation, representation of multivariate data, code factorization and optimization, statistical libraries in R.</p>	
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References:

1. S.C. Gupta & V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons
2. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Press.
3. Dudewicz, E.J., Mishra, S.N., "Modern Mathematical Statistics", Willy
4. Purohit S. G., Gore S. D., Deshmukh S. K., "Statistics using R, Narosa
5. Rizzo, M. L., "Statistical Computing with R", Boca Raton, FL: Chapman & Hall/CRC Press
6. Normal Maltoft, The Art of R programming, William
7. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media
8. M. D. Ugarte, A. F. Militino, A. T. Arnholt, "Probability and Statistics with R", CRC Press
9. Kundu, D. and Basu, A., "Statistical computing – existing methods and recent developments", Narosa
10. Gentle, James E., Härdle, Wolfgang Karl, Mori, Yuich, "Handbook of Computational Statistics", Springer
11. Givens and Hoeting, "Computational Statistics", Wiley Series in Prob. and Statistics
12. Michael J. Crawley "The R Book", John Wiley and Sons.
13. Richard Cotton, "Learning R", O'Reilly
14. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, LLC
15. Randall E. Schumacker, "Learning Statistics Using R", Sage.
16. Jared P. Lander, "R for Everyone" Addison Wesley.
17. Monahan, J.F., "Numerical methods of statistics", Cambridge University Press.
18. Robert, C. and Casella, G., "Introducing Monte Carlo Methods with R", Springer Verlag, New York.

Compiler Design (KIT-052)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.	K ₃ , K ₆
CO 2	Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.	K ₂ , K ₆
CO 3	Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.	K ₄ , K ₅
CO 4	Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.	K ₂ , K ₃
CO 5	Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.	K ₂ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to Compiler: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	08
II	Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.	08
III	Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.	08
IV	Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	08
V	Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	08
Text books: <ol style="list-style-type: none"> 1. K. Muneeswaran, Compiler Design, First Edition, Oxford University Press. 2. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill, 2003. 3. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001. 4. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education 5. V Raghvan, " Principles of Compiler Design", TMH 6. Kenneth Loudon, " Compiler Construction", Cengage Learning. 7. Charles Fischer and Ricard LeBlanc, " Crafting a Compiler with C", Pearson Education 		

Computer Graphics (KCS-053)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand the graphics hardware used in field of computer graphics.	K ₂
CO 2	Understand the concept of graphics primitives like lines and circle based on different algorithms.	K ₂ , K ₄
CO 3	Apply the 2D graphics transformations, composite transformation and Clipping concepts.	K ₄
CO 4	Apply the concepts of and techniques used in 3D computer graphics, including viewing transformations.	K ₂ , K ₃
CO 5	Perform the concept of projections, curve and hidden surfaces in real life.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	08
II	Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping	08
III	Three Dimensional: 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.	08
IV	Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	08
V	Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	08
Text books: <ol style="list-style-type: none"> 1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education 2. Foley, Vandam, Feiner, Hughes – “Computer Graphics principle”, Pearson Education. 3. Rogers, “ Procedural Elements of Computer Graphics”, McGraw Hill 4. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – Tata MCGraw Hill. 5. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, Tata MCGraw Hill. 6. R.K. Maurya, “Computer Graphics ” Wiley Dreamtech Publication. 7. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited. 8. Donald Hearn and M Pauline Baker, “Computer Graphics with OpenGL”, Pearson education 		

Object Oriented System Design (KCS-054)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	To Understand the application development and analyze the insights of object oriented programming to implement application	K ₂ , K ₄
CO 2	To Understand, analyze and apply the role of overall modeling concepts (i.e. System, structural)	K ₂ , K ₃
CO 3	To Understand, analyze and apply oops concepts (i.e. abstraction, inheritance)	K ₂ , K ₃ , K ₄
CO 4	To know the concepts of C++ for understanding the implementation of object oriented concepts	K ₂ , K ₃
CO 5	To understand and apply object oriented paradigm concepts to implement real world problems.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.	08
II	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.	08
III	Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD). Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.	08
IV	C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	08
V	Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointes and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism	08
Text Books		
<ol style="list-style-type: none"> 1. James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI 2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education 3. Object Oriented Programming With C++, E Balagurusamy, TMH 4. C++ Programming, Black Book, Steven Holzner, dreamtech 5. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia 6. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson 7. The Complete Reference C++, Herbert Schilitz, TMH 		

Machine Learning Techniques (KCS-055)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able:		
CO 1	To understand the need for machine learning for various problem solving	K ₁ , K ₂
CO 2	To understand a wide variety of learning algorithms and how to evaluate models generated from data	K ₁ , K ₃
CO 3	To understand the latest trends in machine learning	K ₂ , K ₃
CO 4	To design appropriate machine learning algorithms and apply the algorithms to a real-world problems	K ₄ , K ₆
CO 5	To optimize the models learned and report on the expected accuracy that can be achieved by applying the models	K ₄ , K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION – Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	08
II	REGRESSION: Linear Regression and Logistic Regression BAYESIAN LEARNING - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. SUPPORT VECTOR MACHINE: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussian kernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.	08
III	DECISION TREE LEARNING - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	08
IV	ARTIFICIAL NEURAL NETWORKS – Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; DEEP LEARNING - Introduction, concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function , pooling , fully connected) , Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	08
V	REINFORCEMENT LEARNING –Introduction to Reinforcement Learning , Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process , Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning. GENETIC ALGORITHMS: Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications.	08
Text books: <ol style="list-style-type: none"> 1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. 2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004. 3. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009. 4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 		

Application of Soft Computing (KCS- 056)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Recognize the feasibility of applying a soft computing methodology for a particular problem	K ₂ , K ₄
CO 2	Know the concepts and techniques of soft computing and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.	K ₄ , K ₆
CO 3	Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem.	K ₃ , K ₅
CO 4	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems	K ₃ , K ₄
CO 5	Apply genetic algorithms to combinatorial optimization problems	K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Neural Networks-I (Introduction & Architecture) : Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetero-associative memory.	08
II	Neural Networks-II (Back propagation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propagation learning methods, effect of learning rule coefficient ;back propagation algorithm, factors affecting backpropagation training, applications.	08
III	Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.	08
IV	Fuzzy Logic –II (Fuzzy Membership, Rules) : Membership functions, inference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzifications, Fuzzy Controller, Industrial applications	08
V	Genetic Algorithm(GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.	08
Text books: <ol style="list-style-type: none"> 1. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications” Prentice Hall of India. 2. N.P.Padhy,”Artificial Intelligence and Intelligent Systems” Oxford University Press. Reference Books: 3. Siman Haykin,”Neural Networks”Prentice Hall of India 4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India. 5. Kumar Satish, “Neural Networks” Tata Mc Graw Hill 		

Augmented & Virtual Reality (KCS- 057)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To understand the basic concept and apply framework of virtual reality.	K1 , K2, K3
CO 2	To understand and analyze the principles and multidisciplinary features of virtual reality.	K ₂ , K ₄
CO 3	To understand and apply the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.	K ₂ , K ₃
CO 4	To understand and apply the technology for managing large scale VR environment in real time.	K ₂ , K ₃
CO 5	To know an introduction to the AR system framework and apply AR tools in software development.	K ₂ , K ₃ ,
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces.	08
II	3D USER INTERFACE INPUT HARDWARE: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.	08
III	SOFTWARE TECHNOLOGIES: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market	08
IV	3D INTERACTION TECHNIQUES: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry . DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies for Designing and	08

	Developing Guidelines and Evaluation. VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.	
V	Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	08
Text books: <ol style="list-style-type: none"> 1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009. 2. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005. 3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005. 4. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Merging Real and Virtual Worlds”, 2005. 5. Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003. 6. John Vince, “Virtual Reality Systems”, Addison Wesley, 1995. 7. Howard Rheingold, “Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society”, Simon and Schuster, 1991. 8. William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002 9. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013. 		

Human Computer Interface (KCS- 058)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Critically discuss common methods in the user-centered design process and the appropriateness of individual methods for a given problem.	K ₂ , K ₄
CO 2	Use, adapt and extend classic design standards, guidelines, and patterns.	K ₃ , K ₅
CO 3	Employ selected design methods and evaluation methods at a basic level of competence.	K ₄ , K ₅
CO 4	Build prototypes at varying levels of fidelity, from paper prototypes to functional, interactive prototypes.	K ₄ , K ₅
CO 5	Demonstrate sufficient theory of human computer interaction, experimental methodology and inferential statistics to engage with the contemporary research literature in interface technology and design.	K ₃ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction : Importance of user Interface – definition, importance of 8 good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface	08
II	Design process: Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions. III Screen Designing : Design goals – Scre	08
III	Screen Designing : Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.	08
IV	Windows : New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors	08
V	Software tools : Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.	08
Text books:		
1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.		
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in HumanComputer Interaction, Wiley, 2010.		
3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0- 321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.		

Database Management Systems Lab (KCS-551)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand and apply oracle 11 g products for creating tables, views, indexes, sequences and other database objects.	K ₂ , K ₄
CO 2	Design and implement a database schema for company data base, banking data base, library information system, payroll processing system, student information system.	K ₃ , K ₅
CO 3	Write and execute simple and complex queries using DDL, DML, DCL and TCL.	K ₄ , K ₅
CO 4	Write and execute PL/SQL blocks, procedure functions, packages and triggers, cursors.	K ₄ , K ₅
CO 5	Enforce entity integrity, referential integrity, key constraints, and domain constraints on database.	K ₃ , K ₄
DETAILED SYLLABUS		
1. Installing oracle/ MYSQL 2. Creating Entity-Relationship Diagram using case tools. 3. Writing SQL statements Using ORACLE /MYSQL: a)Writing basic SQL SELECT statements. b) Restricting and sorting data. c)Displaying data from multiple tables. d)Aggregating data using group function. e)Manipulating data. e)Creating and managing tables. 4. Normalization 5. Creating cursor 6. Creating procedure and functions 7. Creating packages and triggers 8. Design and implementation of payroll processing system 9. Design and implementation of Library Information System 10. Design and implementation of Student Information System 11. Automatic Backup of Files and Recovery of Files 12. Mini project (Design & Development of Data and Application) for following : a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System		
Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (MySQL , SQL server , Oracle ,MongoDB ,Cubrid ,MariaDBetc)		

Database Management Systems Lab (KCS-551): Mapping with Virtual Lab

Name of the Lab	Name of the Experiment
Database Management Lab(KCS-551)	Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)
	Data Manipulation Language(DML) Statements
	Data Query Language(DQL) Statements: (Select statement with operations like Where clause, Order by, Logical operators, Scalar functions and Aggregate functions)
	Transaction Control Language(TCL) statements: (Commit(make changes permanent), Rollback (undo)
	Describe statement: To view the structure of the table created

Web Technology Lab (KIT-551)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand fundamentals of web development and Java, including defining classes, invoking methods, using class libraries, Applet, AWT.	K ₂ , K ₄
CO 2	Understand, analyze and apply the role of scripts/languages like HTML, DHTML, CSS, XML, DOM, and SAX to solve real world problems.	K ₂ , K ₃ , K ₅
CO 3	Understand, analyze and design the role of JavaScript for dynamic web pages.	K ₂ , K ₄ , K ₅
CO 4	Design and deploy different components using EJB, and database tables using JDBC and produce various results based on given query.	K ₄ , K ₅
CO 5	Design and deploy a server-side java application called Servlet & JSP tools to catch form data sent from client, process it and store it on database.	K ₃ , K ₄
DETAILED SYLLABUS		
<p>This lab is based on the Web Technologies. Some examples are as follows:</p> <ol style="list-style-type: none"> 1. Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject 2. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access. 3. Write programs using Java script for Web Page to display browsers information. 5. Write a Java applet to display the Application Program screen i.e. calculator and other. 6. Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document in internet explorer. 7. Program to illustrate JDBC connectivity. Program for maintaining database by sending queries. Design and implement a simple servlet book query with the help of JDBC & SQL. Create MS Access Database, Create an ODBC link, Compile & execute JAVA JDVC Socket. 8. Install TOMCAT web server and APACHE. Access the above developed static web pages for books web site, using these servers by putting the web pages developed . 9. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies. 10. Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page. 11. Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database 12. Design and implement a simple shopping cart example with session tracking API. 		
<p>Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (Java , JSP , Bootstrap Firebug , WampServer , MongoDB, etc)</p>		

Design and Analysis of Algorithm Lab (KCS-553)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand and implement algorithm to solve problems by iterative approach.	K ₂ , K ₄
CO 2	Understand and implement algorithm to solve problems by divide and conquer approach.	K ₃ , K ₅
CO 3	Understand and implement algorithm to solve problems by Greedy algorithm approach.	K ₄ , K ₅
CO 4	Understand and analyze algorithm to solve problems by Dynamic programming, backtracking.	K ₄ , K ₅
CO 5	Understand and analyze the algorithm to solve problems by branch and bound approach.	K ₃ , K ₄
DETAILED SYLLABUS		
<p>1. Program for Recursive Binary & Linear Search.</p> <p>2. Program for Heap Sort.</p> <p>3. Program for Merge Sort.</p> <p>4. Program for Selection Sort.</p> <p>5. Program for Insertion Sort.</p> <p>6. Program for Quick Sort.</p> <p>7. Knapsack Problem using Greedy Solution</p> <p>8. Perform Travelling Salesman Problem</p> <p>9. Find Minimum Spanning Tree using Kruskal's Algorithm</p> <p>10. Implement N Queen Problem using Backtracking</p> <p>11. 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> 5000 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 using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.</p> <p>12. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, 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.</p> <p>13.6. Implement , the 0/1 Knapsack problem using</p> <p>(a) Dynamic Programming method</p> <p>(b) Greedy method.</p> <p>14. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.</p> <p>15. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.</p> <p>16. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.</p> <p>17. Write programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.</p> <p>(b) Implement Travelling Sales Person problem using Dynamic programming.</p> <p>18. Design and implement to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ 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 $\{1,2,6\}$ and $\{1,8\}$. Display a suitable message, if the given problem instance doesn't have a solution.</p> <p>19. Design and implement to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.</p>		
<p>Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner</p> <p>It is also suggested that open source tools should be preferred to conduct the lab (C, C++ etc)</p>		

B.TECH. (INFORMATION TECHNOLOGY AND CSI)**SIXTH SEMESTER (DETAILED SYLLABUS)**

Software Engineering (KCS-601)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Explain various software characteristics and analyze different software Development Models	K ₁ , K ₂
CO 2	Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards	K ₁ , K ₂
CO 3	Compare and contrast various methods for software design.	K ₂ , K ₃
CO 4	Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing	K ₃
CO 5	Manage software development process independently as well as in teams and make use of Various software management tools for development, maintenance and analysis.	K ₅
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	08
II	Software Requirement Specifications (SRS): Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	08
III	Software Design: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	08
IV	Software Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, TopDown and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.	08
V	Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	08

Text books:

1. RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Pankaj Jalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
4. KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
5. Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
6. Ian Sommerville, Software Engineering, Addison Wesley.
7. Kassem Saleh, "Software Engineering", Cengage Learning.
8. P fleeger, Software Engineering, Macmillan Publication

Data Analytics(KIT 601)

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Discuss various concepts of data analytics pipeline	K ₁ , K ₂
CO 2	Apply classification and regression techniques	K ₃
CO 3	Explain and apply mining techniques on streaming data	K ₂ , K ₃
CO 4	Compare different clustering and frequent pattern mining algorithms	K ₄
CO 5	Describe the concept of R programming and implement analytics on Big data using R.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to Data Analytics: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. Data Analytics Lifecycle: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.	08
II	Data Analysis: Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	08
III	Mining Data Streams: Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions.	08
IV	Frequent Itemsets and Clustering: Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	08
V	Frame Works and Visualization: MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. Introduction to R - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	08

Text books and References:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with Advanced

Analytics, John Wiley & Sons.

4. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
5. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley
6. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series
7. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier
8. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer
9. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill
10. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer
11. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication
12. Pete Warden, Big Data Glossary, O'Reilly
13. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons
14. Pete Warden, Big Data Glossary, O'Reilly.
15. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press
16. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier

Computer Networks(KCS- 603)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission	K ₁ ,K ₂
CO 2	Apply channel allocation, framing, error and flow control techniques.	K ₃
CO 3	Describe the functions of Network Layer i.e. Logical addressing, subnetting & Routing Mechanism.	K ₂ ,K ₃
CO 4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism.	K ₂ ,K ₃
CO 5	Explain the functions offered by session and presentation layer and their Implementation.	K ₂ ,K ₃
CO 6	Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP, TELNET and VPN.	K ₂
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introductory Concepts: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. Physical Layer: Network topology design, Types of connections, Transmission media, Signal transmission and encoding, Network performance and transmission impairments, Switching techniques and multiplexing.	08
II	Link layer: Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges (learning bridge and spanning tree algorithms).	08
III	Network Layer: Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6.	08
IV	Transport Layer: Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	08
V	Application Layer: Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – basic concepts.	08
Text books and References: <ol style="list-style-type: none"> 1. Behrouz Forouzan, “Data Communication and Networking”, McGraw Hill 2. Andrew Tanenbaum “Computer Networks”, Prentice Hall. 3. William Stallings, “Data and Computer Communication”, Pearson. 4. Kurose and Ross, “Computer Networking- A Top-Down Approach”, Pearson. 5. Peterson and Davie, “Computer Networks: A Systems Approach”, Morgan Kaufmann 6. W. A. Shay, “Understanding Communications and Networks”, Cengage Learning. 7. D. Comer, “Computer Networks and Internets”, Pearson. 8. Behrouz Forouzan, “TCP/IP Protocol Suite”, McGraw Hill. 		

Big Data(KCS-061)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Demonstrate knowledge of Big Data Analytics concepts and its applications in business.	K ₁ ,K ₂
CO 2	Demonstrate functions and components of Map Reduce Framework and HDFS.	K ₁ ,K ₂
CO 3	Discuss Data Management concepts in NoSQL environment.	K ₆
CO 4	Explain process of developing Map Reduce based distributed processing applications.	K ₂ ,K ₅
CO 5	Explain process of developing applications using HBASE, Hive, Pig etc.	K ₂ ,K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lectures
I	Introduction to Big Data: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	06
II	Hadoop: History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. Map Reduce: Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	08
III	HDFS (Hadoop Distributed File System): Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	08
IV	Hadoop Eco System and YARN: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features - NameNode high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. NoSQL Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleting documents, querying, introduction to indexing, capped collections Spark: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN SCALA: Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	09
V	Hadoop Eco System Frameworks: Applications on Big Data using Pig, Hive and HBase Pig - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators,	09

	<p>Hive - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries.</p> <p>HBase – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper.</p> <p>IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.</p>	
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Text books and References:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
2. Big-Data Black Book, DT Editorial Services, Wiley
3. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill.
4. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
5. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons
6. ArshdeepBahga, Vijay Madiseti, "Big Data Science & Analytics: A HandsOn Approach ", VPT
7. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP
8. Tom White, "Hadoop: The Definitive Guide", O'Reilly.
9. Eric Sammer, "Hadoop Operations", O'Reilly.
10. Chuck Lam, "Hadoop in Action", MANNING Publishers
11. Deepak Vohra, "Practical Hadoop Ecosystem: A Definitive Guide to Hadoop-Related Frameworks and Tools", Apress
12. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly
13. Lars George, "HBase: The Definitive Guide", O'Reilly.
14. Alan Gates, "Programming Pig", O'Reilly.
15. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer
16. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons
17. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons
18. Pete Warden, "Big Data Glossary", O'Reilly

Image Processing (KCS-062)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able:		
CO 1	Explain the basic concepts of two-dimensional signal acquisition, sampling, quantization and color model.	K ₁ , K ₂
CO 2	Apply image processing techniques for image enhancement in both the spatial and frequency domains.	K ₂ , K ₃
CO 3	Apply and compare image restoration techniques in both spatial and frequency domain.	K ₂ , K ₃
CO 4	Compare edge based and region based segmentation algorithms for ROI extraction.	K ₃ , K ₄
CO 5	Explain compression techniques and descriptors for image processing.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	DIGITAL IMAGE FUNDAMENTALS: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	08
II	IMAGE ENHANCEMENT: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	08
III	IMAGE RESTORATION: Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	08
IV	IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	08
V	IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.	08
Text books: <ol style="list-style-type: none"> 1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Third Edition, 2010 2. Anil K. Jain, Fundamentals of Digital Image Processing Pearson, 2002. 3. Kenneth R. Castleman, Digital Image Processing Pearson, 2006. 4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011. 5. D.E. Dudgeon and R.M. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990. 6. William K. Pratt, Digital Image Processing John Wiley, New York, 2002 7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999 		

Blockchain Architecture Design (KIT-062)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Describe the basic understanding of Blockchain architecture along with its primitive.	K ₁ , K ₂
CO 2	Explain the requirements for basic protocol along with scalability aspects.	K ₂ , K ₃
CO 3	Design and deploy the consensus process using frontend and backend.	K ₃ , K ₄
CO 4	Apply Blockchain techniques for different use cases like Finance, Trade/Supply and Government activities.	K ₄ , K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to Blockchain: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms	08
II	Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains	08
III	Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation Hyperledger Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool	08
IV	Use case 1 : Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc	08
V	Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain	08
Text books: <ol style="list-style-type: none"> 1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos 2. Blockchain by Melanie Swa, O'Reilly 3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric 4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html 		

Data Compression (KCS-064)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Describe the evolution and fundamental concepts of Data Compression and Coding Techniques.	K ₁ , K ₂
CO 2	Apply and compare different static coding techniques (Huffman & Arithmetic coding) for text compression.	K ₂ , K ₃
CO 3	Apply and compare different dynamic coding techniques (Dictionary Technique) for text compression.	K ₂ , K ₃
CO 4	Evaluate the performance of predictive coding technique for Image Compression.	K ₂ , K ₃
CO 5	Apply and compare different Quantization Techniques for Image Compression.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.	08
II	The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.	08
III	Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Move-to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markov Compression.	08
IV	Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.	08
V	Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured Vector Quantizers.	08
Text books: <ol style="list-style-type: none"> 1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers 2. Elements of Data Compression, Drozdek, Cengage Learning 3. Introduction to Data Compression, Second Edition, Khalid Sayood, The Morgan Kaufmann Series 4. Data Compression: The Complete Reference 4th Edition by David Salomon, Springer 5. Text Compression 1st Edition by Timothy C. Bell Prentice Hall 		

Software Engineering Lab (KCS-661)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement	K ₂ , K ₄
CO 2	Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship	K ₃ , K ₅
CO 3	Draw a class diagram after identifying classes and association among them	K ₄ , K ₅
CO 4	Graphically represent various UML diagrams , and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially	K ₄ , K ₅
CO 5	Able to use modern engineering tools for specification, design, implementation and testing	K ₃ , K ₄
DETAILED SYLLABUS		
<p>For any given case/ problem statement do the following;</p> <ol style="list-style-type: none"> 1. Prepare a SRS document in line with the IEEE recommended standards. 2. Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case. 3. Draw the activity diagram. 4. Identify the classes. Classify them as weak and strong classes and draw the class diagram. 5. Draw the sequence diagram for any two scenarios. 6. Draw the collaboration diagram. 7. Draw the state chart diagram. 8. Draw the component diagram. 9. Perform forward engineering in java. (Model to code conversion) 10. Perform reverse engineering in java. (Code to Model conversion) 11. Draw the deployment diagram. 		
<p>Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (Open Office , Libra , Junit, Open Project , GanttProject , dotProject, AgroUML, StarUML etc.)</p>		

Software Engineering Lab (KCS-661): Mapping with Virtual Lab

Name of the Lab	Name of the Experiment
Software Engineering Lab (KCS-661)	Identifying the Requirements from Problem Statements
	Estimation of Project Metrics
	Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
	E-R Modeling from the Problem Statements
	Identifying Domain Classes from the Problem Statements
	Statechart and Activity Modeling
	Modeling UML Class Diagrams and Sequence diagrams
	Modeling Data Flow Diagrams
	Estimation of Test Coverage Metrics and Structural Complexity
	Designing Test Suites

Data Analytics Lab (KIT-661)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Implement numerical and statistical analysis on various data sources	K ₃
CO 2	Apply data preprocessing and dimensionality reduction methods on raw data	K ₃
CO 3	Implement linear regression technique on numeric data for prediction	K ₃
CO 4	Execute clustering and association rule mining algorithms on different datasets	K ₃
CO 5	Implement and evaluate the performance of KNN algorithm on different datasets	K ₃ , K ₄
DETAILED SYLLABUS		
<ol style="list-style-type: none"> 1. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R. 2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R. 3. To get the input matrix from user and perform Matrix addition, subtraction, multiplication, inverse transpose and division operations using vector concept in R. 4. To perform statistical operations (Mean, Median, Mode and Standard deviation) using R. 5. To perform data pre-processing operations i) Handling Missing data ii) Min-Max normalization 6. To perform dimensionality reduction operation using PCA for Houses Data Set 7. To perform Simple Linear Regression with R. 8. To perform K-Means clustering operation and visualize for iris data set 9. Write R script to diagnose any disease using KNN classification and plot the results. 10. To perform market basket analysis using Association Rules (Apriori). 		
Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (R , Python etc.)		

Computer Networks Lab (KCS-663)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Simulate different network topologies.	K ₃ ,K ₄
CO 2	Implement various framing methods of Data Link Layer.	K ₃ ,K ₄
CO 3	Implement various Error and flow control techniques.	K ₃ ,K ₄
CO 4	Implement network routing and addressing techniques.	K ₃ , K ₄
CO 5	Implement transport and security mechanisms	K ₃ , K ₄
DETAILED SYLLABUS		
1. Implementation of Stop and Wait Protocol and Sliding Window Protocol. 2. Study of Socket Programming and Client – Server model 3. Write a code simulating ARP /RARP protocols. 4. Write a code simulating PING and TRACEROUTE commands 5. Create a socket for HTTP for web page upload and download. 6. Write a program to implement RPC (Remote Procedure Call) 7. Implementation of Subnetting . 8. Applications using TCP Sockets like a. Echo client and echo server b. Chat c. File Transfer 9. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer 10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS 11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. i. Link State routing ii. Flooding iii. Distance vector 12. To learn handling and configuration of networking hardware like RJ-45 connector, CAT-6 cable, crimping tool, etc. 13. Configuration of router, hub, switch etc. (using real devices or simulators) 14. Running and using services/commands like ping, traceroute, nslookup, arp, telnet, ftp, etc. 15. Network packet analysis using tools like Wireshark, tcpdump, etc. 16. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc. 17. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)		
Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (C , C++ , Java , NS3, Mininet, Opnet, TCP Dump, Wireshark etc.		

Open Electives to be offered by the CSE/CS/IT/CSI Branches

Open Elective-1	
KOE-061	Basics of Data Base Management System
KOE-062	Software Project Management

Basics of Data Base Management System (KOE-061)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Describe the features of a database system and its application and compare various types of data models.	K ₂
CO 2	Construct an ER Model for a given problem and transform it into a relation database schema.	K ₅ , K ₆
CO 3	Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.	K ₅ , K ₆
CO 4	Explain the need of normalization and normalize a given relation to the desired normal form.	K ₂ , K ₃
CO 5	Explain different approaches of transaction processing and concurrency control.	K ₂
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	<p>Introduction: An overview of database management system, database system vs file system, database system concepts and architecture, views of data – levels of abstraction, data models, schema and instances, data independence, database languages and interfaces, data definition languages, DML, overall database structure, transaction management, storage management, database users and administrator.</p> <p>Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.</p>	08
II	<p>Relational Database Concepts: Introduction to relational database, relational database structure, relational model terminology – domains, attributes, tuples, relations & relational database schema, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, Relational algebra - relational calculus, tuple and domain calculus, basic operations – selection and projection, set-theoretic operations, join operations.</p> <p>Data Base Design & Normalization: Functional dependencies, normal forms, first, second, & third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design</p>	08
III	<p>Structured Query Language (SQL): Basics of SQL, DDL, DML, DCL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables – creation & alteration, defining constraints, views and indexes, queries and sub queries, aggregate functions, built-in functions, insert, update and delete operations, joins, unions, intersection, minus, transaction control commands.</p> <p>PL/SQL: Introduction, features, syntax and constructs, SQL within PL/SL, DML in</p>	08

	PL/SQL Cursors, stored procedures, stored function, database triggers, indices	
IV	<p>Transaction Processing Concepts: Transaction concepts, properties of transaction, testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, two-phase commit protocol, log based recovery, checkpoints, deadlock handling.</p> <p>Concurrency Control Techniques: Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity, multi-version schemes, recovery with concurrent transaction.</p>	08
V	<p>Database Security – Types of security, system failure, backup & recovery techniques, authorization & authentication, system policies, levels of security – physical, OS, network & DBMS, privileges – grant & revoke.</p> <p>Recent Trends in Database Management Systems: Centralized and Client-Server Architectures, Distributed Databases, Object-Oriented Database, Spatial & Temporal Databases, Decision Support Systems, Data Analysis, Data Mining & Warehousing, Data Visualization, Mobile Databases, OODB & XML Databases, Multimedia & Web Databases, Spatial and Geographical Databases, Web and Mobile Databases, Active Databases</p>	08

Text Books and References:

1. Elmasri, Navathe, “Fundamentals of Database System”, Addison Wesley.
2. Korth, Silbertz, Sudarshan, “Database Concepts”, Mc Graw Hill.
3. Bipin C. Desai, “An Introduction to Database System”, Galgotia Publication.
4. Majumdar & Bhattacharya, “Database Management System”, TMH.
5. Date C.J., “An Introduction to Database System”, Addison Wesley.
6. Ramakrishnan, Gehrke, “Database Management System”, Mc Graw Hill.
7. Atul Kahate, “Introduction to Database Management Systems”, Pearson Education.
8. Paul Beynon Davies, “Database System”, Palgrave Macmillan.
9. Bharti P.K., “An Introduction to Database Systems”, JPNP.
10. Rajesh Narang, “Database Management System”, PHI.
11. Singh, S.K., “Database System Concepts – design & application”, Pearson Education.
12. Leon & Leon, “Database Management Systems”, Vikas Publishing House.
13. O’Neil, “Databases”, Elsevier Pub.
14. Ivan Bayross, “SQL, PL/SQL – The Programming Language of Oracle”, BPB Publications.
15. P.S. Deshpande, “SQL and PL/SQL for Oracle 10g, Black Book”, Dreamtech Press.
16. George Koch, Kevin Loney, “Oracle: The Complete Reference”, TMH/Oracle Press.
17. Coronel, Morris and Rob, “Database Principles: Fundamentals of Design, Implementation and Management”, Cengage Learning.
18. Gillenson, Paulraj Ponniah, “Introduction to Database Management”, Wiley.
19. G. K. Gupta, “Database Management Systems”, McGraw Hill.
20. Shraman Shah, “Oracle for Professional”, SPD.

Software Project Management (KOE-062)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	Identify project planning objectives, along with various cost/effort estimation models.	K ₃
CO 2	Organize & schedule project activities to compute critical path for risk analysis.	K ₃
CO 3	Monitor and control project activities.	K ₄ , K ₅
CO 4	Formulate testing objectives and test plan to ensure good software quality under SEI-CMM.	K ₆
CO 5	Configure changes and manage risks using project management tools.	K ₂ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Project Evaluation and Project Planning : Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	08
II	Project Life Cycle and Effort Estimation : Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.	08
III	Activity Planning and Risk Management : Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.	08
IV	Project Management and Control: Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.	08
V	Staffing in Software Projects : Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.	08
Text books: <ol style="list-style-type: none"> 1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012. 2. Robert K. Wysocki —Effective Software Project Management – Wiley Publication, 2011. 3. Walker Royce: —Software Project Management- Addison-Wesley, 1998. 4. Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013. 		

B.Tech. VI Semester

OPEN ELECTIVE-I

KOE-061	REAL TIME SYSTEMS
KOE-062	EMBEDDED SYSTEM
KOE-063	INTRODUCTION TO MEMS
KOE-064	OBJECT ORIENTED PROGRAMMING
KOE-065	NUMERICAL TECHNIQUES
KOE066	GIS & REMOTE SENSING
KOE-067	UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY- HUMAN ASPIRATIONS AND ITS FULFILLMENT

KOE-061 REAL TIME SYSTEMS

Unit	Topics	Lectures
I	Introduction Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	8
II	Real Time Scheduling Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	8
III	Resources Sharing Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.	8
IV	Real Time Communication Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.	
V	Real Time Operating Systems and Databases Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.	8

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

Reference Books:

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Describe concepts of Real-Time systems and modeling.
2. Recognize the characteristics of a real-time system in context with real time scheduling.
3. Classify various resource sharing mechanisms and their related protocols.
4. Interpret the basics of real time communication by the knowledge of real time models and protocols.
5. Apply the basics of RTOS in interpretation of real time systems.

KOE-062 EMBEDDED SYSTEM

COURSE OBJECTIVE: *After completion of the course student will be able to:*

1. Attain the knowledge of embedded system and its development environment.
2. Gain the knowledge of RTOS based embedded system design and its applications.

COURSE OUTCOME: *After completion of the course student will be able to:*

CO1: Understand the basics of embedded system and its structural units.

CO3: Analyze the embedded system specification and develop software programs.

CO3: Evaluate the requirements of the programming embedded systems, related software architecture.

CO3: Understand the RTOS based embedded system design.

CO3: Understand all the applications of the embedded system and designing issues.

KOE-062 EMBEDDED SYSTEM		
Unit	Topic	Lectures
1	Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.	8
2	Embedded Networking: Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.	8
3	Embedded Firmware Development Environment: Embedded Product Development Life Cycle objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.	8
4	RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, µC/OS-II, RT Linux.	8
5	Embedded System Application Development: Design issues and techniques Case Study of Washing Machine- Automotive Application- Smart card System Application.	8

Text Books:

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education , 2007.
3. Steve Heath, “Embedded System Design”, Elsevier, 2005.
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, “The 8051
5. Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007.

KOE-063 INTRODUCTION TO MEMS

COURSE OBJECTIVE: *After completion of the course student will be able to:*

1. Understand the Basic concept of MEMS, Mechanics of Beam and Diaphragm Structures, Air Damping and Electrostatic Actuation.
2. Know the knowledge of Thermal Effects and the Applications of MEMS in RF.

COURSE OUTCOME: *After completion of the course student will be able to:*

- CO1: Understand the Basic concept of MEMS Fabrication Technologies, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.
- CO2: Explain Mechanics of Beam and Diaphragm Structures.
- CO3: Understand the Basic concept of Air Damping and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.
- CO4: Know the concept of Electrostatic Actuation.
- CO5: Understand the applications of MEMS in RF

KOE-063 INTRODUCTION TO MEMS		
Unit	Topic	Lectures
1	Introduction to MEMS: MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors/Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.	8
2	Mechanics of Beam and Diaphragm Structures: Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.	8
3	Air Damping: Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.	8
4	Electrostatic Actuation: Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.	8
5	Thermal Effects: Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors. Applications of MEMS in RF MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Microresonator Modeling, Micromechanical Resonator Limitations.	8

Text & Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.
2. S.M. Sze, "Semiconductor Sensors", John Wiley & Sons Inc., Wiley Interscience Pub.
3. M.J. Usher, "Sensors and Transducers", McMillian Hampshire.
4. RS Muller, Howe, Senturia and Smith, "Micro sensors", IEEE Press.

KOE-064 OBJECT ORIENTED PROGRAMMING

COURSE OBJECTIVE: After completion of the course student will be able to:

1. Understand the Basic concept of Object Orientation, object identity and Encapsulation.
2. Know the knowledge of Basic Structural Modeling, Object Oriented Analysis and C++ Basics.

COURSE OUTCOME: After completion of the course student will be able to:

CO1: Understand the Basic concept of Object Orientation, object identity and Encapsulation.

CO2: Understand the Basic concept of Basic Structural Modeling.

CO3: Know the knowledge of Object oriented design, Object design.

CO4: Know the knowledge of C++ Basics.

CO5: Understand the Basics of object and class in C++.

KOE-064 OBJECT ORIENTED PROGRAMMING		
Unit	Topic	Lectures
1	Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.	8
2	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine, Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams	8
3	Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD). Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.	8
4	C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	8
5	Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointers and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism	8

Text Books:

1. James Rumbaugh et. al, “Object Oriented Modeling and Design”, PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education
3. Object Oriented Programming with C++, E Balagurusamy, TMH

Reference Books:

1. R. S. Salaria, Mastering Object Oriented Programming with C++, Khanna Publishing House
2. C++ Programming, Black Book, Steven Holzner, dreamtech
3. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia
4. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson
5. The Complete Reference C++, Herbert Schlitz, TMH
6. C++ and Object Oriented Programming Paradigm, PHI
7. C++ : How to Program, 9th Edition, Deitel and Deitel, PHI

KOE 065 NUMERICAL TECHNIQUES

COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Understand about the basics of numerical techniques and its applications to Engineering Problems.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Understand about the basics of Ordinary Differential Equations, Separable equations, Equations made separable by change of variables.

CO2: Retrieve the information content of Power series method.

CO3: Apply problem specific Bessel's equation, Bessel Functions to engineering applications.

CO4: Understand about the basics of matrix, Eigen values and eigen vectors.

CO5: Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction.

KOE 065 NUMERICAL TECHNIQUES		
Unit	Topic	Lectures
1	Ordinary Differential Equations, Separable equations, Equations made separable by change of variables, Homogeneous Equations, Equations with first order and first degree with linear coefficients, Exact equations, Linear equation of first order, Bernoulli's equation, Other integrating factors, Integration of Exact equations, Equations of first order and higher degree, Clairaut's equation, Singular solutions, Equations with missing terms, General properties of Linear equations, Linear equations with constant coefficients, Determination of the complementary function, exponential functions, Determination of the particular integral, the Euler equation, Simultaneous Linear Differential equations.	8
2	Power series method, theory of the power series method, Legendre's equation, Legendre's Polynomials, Frobenius Method.	8
3	Bessel's equation, Bessel Functions $J_v(x)$, Bessel Functions $J_v(x)$ for any $v \geq 0$. Gamma Function, Solution $J_{-v}(x)$ of the Bessel Equation, Backbones of Bessel's Theory, $J_v(x)$ with $v = \pm 1/2, \pm 3/2, \pm 5/2$.	8
4	Definition of matrix, Some special definitions and operations involving matrices, Determinants, Theorems on determinants, Inverse of a matrix, Orthogonal and unitary matrix. Orthogonal vectors, System of linear equations, Systems on n equations with n unknowns, Cramer's Rule, Eigen values and eigen vectors.	8
5	Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction, Solution of Difference Equations, Stirred-Tank Reactor System, Distillation in a Plate Column, Unsteady-state Operation, Starting a Stirred-tank Reactor, Rate at which a Plate Absorber Approaches Steady State.	8

Text & Reference books:

1. Mickley, Reid and Sherwood, "Applied Mathematics in Chemical Engineering", Tata McGraw Hill, New Delhi (1981).
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th edition, John Wiley and Sons (1999).
3. M. R. Spiegel, "Advanced Mathematics for Engineers and Scientists", Schaum Outline Series, McGraw Hill, (1971).
4. Chandrika Prasad, Reena Garg, "Advanced Engineering Mathematics", Khanna Publishing house

KOE 066 GIS & REMOTE SENSING

COURSE OBJECTIVE: *Students undergoing this course are expected to-*

1. Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Understand about the principles of Remote Sensing and its advantages and limitations.

CO2: Retrieve the information content of remotely sensed data.

CO3: Apply problem specific remote sensing data for engineering applications.

CO4: Analyze spatial and attribute data for solving spatial problems.

CO5: Create GIS and cartographic outputs for presentation

KOE-066 GIS & REMOTE SENSING		
Unit	Topic	Lectures
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water, spectral signatures.	8
2	Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements;	8
3	Photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices.	8
4	Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	8
5	Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	8

Text & Reference Books:

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.

KOE-067 UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY – HUMAN ASPIRATIONS AND ITS FULFILLMENT

Course Objectives:

1. To help the students having the clarity about human aspirations, goal, activities and purpose of life.
2. To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.
3. To help the students to develop the understanding of human tradition and its various components.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.

KOE-067 UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY- HUMAN ASPIRATIONS AND ITS FULFILLMENT		
Unit	Topic	Lectures
1	Introduction: The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	8
2	Understanding Human being and its expansion: The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	8
3	Activities of the Self: Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.	8
4	Understanding Co-existence with other orders: The need and the process of inner evolution (through self-exploration, selfawareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	8
5	Expansion of harmony from self to entire existence: Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.	8

Reference Books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8-174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

B.Tech. V & VI Semester

1	KNC501/ KNC601	CONSTITUTION OF INDIA, LAW AND ENGINEERING
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Module 1--Introduction and Basic Information about Indian Constitution:

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2-Union Executive and State Executive:

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3- Introduction and Basic Information about Legal System:

The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4- Intellectual Property Laws and Regulation to Information:

Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information-Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5 -Business Organizations and E-Governance:

Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up.

E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

COURSE OBJECTIVE:

- To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
- To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
- To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
- To acquaint students with latest intellectual property rights and innovation environment with related regulatory framework.
- To make students learn about role of engineering in business organizations and e-governance.

COURSE OUTCOME: At the end of the course, learners should be able to-

1. Identify and explore the basic features and modalities about Indian constitution.
2. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
3. Differentiate different aspects of Indian Legal System and its related bodies.
4. Discover and apply different laws and regulations related to engineering practices.
5. Correlate role of engineers with different organizations and governance models

Pedagogy: Lecture, Problem based learning, Group discussions, Visual media, Films, Documentaries, Debate forums.

Suggested Readings:

- Brij Kishore Sharma: *Introduction to the Indian Constitution*, 8th Edition, PHI Learning Pvt. Ltd.
- Granville Austin: *The Indian Constitution: Cornerstone of a Nation (Classic Reissue)*, Oxford University Press.
- Subhash C. Kashyap: *Our Constitution: An Introduction to India's Constitution and constitutional Law*, NBT, 2018.
- Madhav Khosla: *The Indian Constitution*, Oxford University Press.
- PM Bakshi: *The Constitution of India*, Latest Edition, Universal Law Publishing.
- V.K. Ahuja: *Law Relating to Intellectual Property Rights* (2007)
- Suresh T. Viswanathan: *The Indian Cyber Laws*, Bharat Law House, New Delhi-88
- P. Narayan: *Intellectual Property Law*, Eastern Law House, New Delhi
- Prabudh Ganguli: *Gearing up for Patents: The Indian Scenario*, Orient Longman.
- BL Wadehra: *Patents, Trademarks, Designs and Geological Indications Universal Law Publishing - LexisNexis*.
- *Intellectual Property Rights: Law and Practice, Module III* by ICSI (only relevant sections)
- Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36). <https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf>
- Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/e-Governance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf
- Companies Act, 2013 Key highlights and analysis by PWC. <https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlights-and-analysis.pdf>

Referred Case Studies:

- Keshavanand Bharati V. State of Kerala, AIR 1973 SC 1461.
- Maneka Gandhi V. Union of India AIR, 1978 SC 597.
- S.R. Bammai V. Union of India, AIR 1994 SC 1918.
- Kuldeep Nayyar V. Union of India, AIR 2006 SC312.
- A.D.M. Jabalpur V. ShivkantShakla, AIR 1976 SC1207.
- Remshwar Prasad V. Union of India, AIR 2006 SC980.
- Keshav Singh in re, AIR 1965 SC 745.
- Union of India V. Talsiram, AIR 1985 SC 1416.
- Atiabari Tea Estate Co.V. State of Assam, AIR 1961SC232.
- SBP & Co. Vs. Patel Engg. Ltd. 2005 (8) SCC 618.
- Krishna Bhagya Jala Nigam Ltd. Vs. G. Arischandra Reddy (2007) 2 SCC 720.
- Oil & Natural Gas Corporation Vs. Saw Pipes Ltd. 2003 (4) SCALE 92 – 185.

**** (Other relevant case studies can be consulted by the teacher as per the topic).**

Prescribed Legislations:

1. Information Technology Act, 2000 with latest amendments.
2. RTI Act 2005 with latest amendments.
3. Information Technology Rules, 2000
4. Cyber Regulation Appellate Tribunal Rules, 2000

Suggested aid for Students and Pedagogic purpose

- RSTV debates on corporate law, IPR and patent issues
- NPTEL lectures on IPR and patent rights

Episodes of 10 -part mini TV series “Samvidhan: The Making of Constitution of India” by RSTV.

B.Tech. V & VI Semester

2	KNC502/ KNC602	INDIAN TRADITION, CULTURE AND SOCIETY
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INDIAN TRADITIONS, CULTURAL AND SOCIETY

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Module 1- Society State and Polity in India

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Module 2- Indian Literature, Culture, Tradition, and Practices

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali, Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature, Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

Module 3- Indian Religion, Philosophy, and Practices

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

Module 4-Science, Management and Indian Knowledge System

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times

Module 5- Cultural Heritage and Performing Arts

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema

COURSE OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inference to identify the roots and details of some of the contemporary issues faced by our nation and try to locate possible solutions to these challenges by digging deep into our past.
- To enable the students to understand the importance of our surroundings and encourage the students to contribute towards sustainable development.
- To sensitize students towards issues related to 'Indian' culture, tradition and its composite character.

- To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
- To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

COURSE OUTCOMES: Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Suggested Pedagogy for Teachers

- Project based learning
- Case studies
- Group discussion
- Presentations

Suggested Text & Reference Books

1. V. Sivaramakrishna (Ed.), *Cultural Heritage of India-Course Material*, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, *Indian Art and Culture*, Oxford University Press, India
3. Swami Jitatanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
4. Romila Thapar, *Readings In Early Indian History* Oxford University Press , India
5. Fritz of Capra, *Tao of Physics*
6. Fritz of Capra, *The wave of Life*
7. V N Jha (English Translation), *Tarkasangraha of Annam Bhatta*, International Chinmay Foundation, Velliarnad, Amaku, am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakasham, Delhi, 2016
10. RN Jha, *Science of Consciousness Psychotherapy and Yoga Practices*, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), *Shodashang Hridayam*
12. Basham, A.L., *The Wonder that was India* (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., *Aspects of Political Ideas and Institutions in Ancient India*(fourth edition), Delhi, Motilal Banarsidass,