



G.L. Bajaj Institute of Technology and Management
Information Technology – E Syllabus



DEPARTMENT OF INFORMATION TECHNOLOGY

E- SYLLABUS

FOR

B.TECH. INFORMATION TECHNOLOGY

EVEN SEMESTER

SESSION (2020–21)



G.L. Bajaj Institute of Technology and Management **Information Technology – E Syllabus**

ABOUT THE INSTITUTE

GL Bajaj Institute of Technology & Management is the 6th Institute established under the prestigious banner of Rajeev Memorial Academic Welfare Society (Registered Under Societies Registration Act 1860). The institute is approved by All India Council for Technical Education (AICTE), Ministry of HRD, Govt. of India and Affiliated to Dr. A.P.J. Abdul Kalam Technical University (Formerly UPTU Lucknow)

GL Bajaj Institute of Technology and Management is one of the qualities driven Educational Institute in the Greater Noida/Delhi-NCR Region. GL Bajaj stands out in its approach to assist and equip the students for their overall development, giving them a strong foundation for a successful future. The institute offers B.Tech, M.Tech, MBA, MCA.

This self-financed institute is governed by Rajeev Memorial Academic Welfare Society (Registered Under Societies Registration Act 1860). It is approved by All India Council for Technical Education (AICTE), Ministry of Human Resource Development, Government of India and affiliated to Dr. A.P.J. Abdul Kalam Technical University, Lucknow..

ABOUT THE DEPARTMENT

The Department of Information Technology at G.L. Bajaj Institute of Technology & Management was established in the year 2007 with a vision to develop competent IT professionals catering to the needs of Industry and society in a global perspective. The Department aims to foster students to attain professional excellence by providing exposure to new IT tools and technologies. Information Technology being the flagship branch of Engineering takes focus in scientific research, scientific programming, Application programming, and software engineering. The Department has well-equipped laboratories with state-of-the-art hardware and software resources, lecture halls, seminar halls, tutorial rooms and faculty sections. The Department has a blend of experienced and young faculty members who also work as mentors to the equally diligent and hardworking students.



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DEPARTMENT VISION & MISSION

VISION

To develop competent IT professionals catering to the needs of Industry and society in a global perspective.

MISSION

To attain academic & professional excellence with collective efforts of all stake holders through:

- M1** : Dissemination of basic concepts and analytical skills.
- M2** : Exposure to new tools in the area of Information technology.
- M3** : Effective interaction with industry for better employability.
- M4** : Inculcating values and professional ethics with social responsibility.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Below are the different educational objective of program:

- **PEO-1**
To provide students a strong foundation in mathematical and IT fundamentals with emphasis on different programming languages/ platforms.
- **PEO-2**
To prepare students with a strong foundation in IT tools and analytical skills.
- **PEO-3**
To analyse, design and develop efficient and cost effective IT solutions for society.
- **PEO-4**
To become a successful professional in software industry with leadership quality and value.
- **PEO-5**
To provide a supportive academic environment and guidance for life-long learning.



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PROGRAM OUTCOMES (POs)

The graduate of the program will be able to:

PO 1 - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2 - Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3 - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4 - Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 - Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6 - The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7 - Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9 - Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 - Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader.

PO 12 - Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



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PROGRAM SPECIFIC OUTCOMES (PSOs)

Program Graduates will be able to:

PSO 1: Design and develop an application/product that efficiently utilizes system software and hardware to cover current user requirement in social and economic form.

PSO 2: Apply and acquire knowledge of computer network in implementation of secure data communication and reliable network system.

PSO 3: Design and implement knowledge based discovery, machine based learning by using the concept of DBMS, soft computing, neural network, image processing and pattern recognition etc.

PSO 4: Design and develop mobile based applications which use the concepts of latest application system development technologies.



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Syllabus for Second Year (EVEN Sem.)

Department of Information Technology



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STUDY EVALUATION SCHEME

SECOND YEAR
SEMESTER –IV

SEMESTER- IV													
Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KAS402/ KOE041- 48	Maths IV/Engg. Science Course	3	1	0	30	20	50		100		150	4
2	KVE401/ KAS401	Universal Human Values/Technical Communication	3	0	0	30	20	50		100		150	3
			2	1	0								
3	KCS401	Operating Systems	3	0	0	30	20	50		100		150	3
4	KCS402	Theory of Automata and Formal Languages	3	1	0	30	20	50		100		150	4
5	KIT401	Web Designing	3	1	0	30	20	50		100		150	4
6	KCS451	Operating Systems Lab	0	0	2				25		25	50	1
7	KIT451	Web Designing Lab	0	0	2				25		25	50	1
8	KCS453	Python Language Programming Lab	0	0	2				25		25	50	1
9	KNC402/ KNC401	Python Programming/ Computer System Security	2	0	0	15	10	25		50			0
10		MOOCs (Essential for Hons. Degree)											
		Total										900	21

CT: Class Test

TA: Teacher Assessment

L/T/P: Lecture/ Tutorial/ Practical



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B.TECH. (COMPUTER SCIENCE AND ENGINEERING)
FOURTH SEMESTER (DETAILED SYLLABUS)

Operating systems (KCS401)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand the structure and functions of OS	K ₁ , K ₂
CO 2	Learn about Processes, Threads and Scheduling algorithms.	K ₁ , K ₂
CO 3	Understand the principles of concurrency and Deadlocks	K ₂
CO 4	Learn various memory management scheme	K ₂
CO 5	Study I/O management and File systems.	K ₂ ,K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction : Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multiprocess Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	08
II	Concurrent Processes : Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem; Inter Process Communication models and Schemes, Process generation.	08
III	CPU Scheduling : Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock : System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	08
IV	Memory Management : Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	08
V	I/O Management and Disk Scheduling : I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System : File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	08



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Text books:

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2. Sibsankar Halder and Alex A Aravind, “Operating Systems”, Pearson Education
3. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education
4. D M Dhamdhere, “Operating Systems : A Concept based Approach”, 2nd Edition,
5. TMH 5. William Stallings, “Operating Systems: Internals and Design Principles ”, 6th Edition, Pearson Education





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Theory of Automata and Formal Languages (KCS402)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars	K ₄ , K ₆
CO 2	Analyse and design, Turing machines, formal languages, and grammars	K ₄ , K ₆
CO 3	Demonstrate the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving	K ₁ , K ₅
CO 4	Prove the basic results of the Theory of Computation.	K ₂ ,K ₃
CO 5	State and explain the relevance of the Church-Turing thesis.	K ₁ , K ₅
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Basic Concepts and Automata Theory: Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ϵ -Transition, Equivalence of NFA's with and without ϵ -Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, Myhill-Nerode Theorem, Simulation of DFA and NFA	08
II	Regular Expressions and Languages: Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	08
III	Regular and Non-Regular Grammars: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF), Chomsky Hierarchy, Programming problems based on the properties of CFGs.	08
IV	Push Down Automata and Properties of Context Free Languages: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL), Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.	08



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V	Turing Machines and Recursive Function Theory : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post's Correspondance Problem, Introduction to Recursive Function Theory.	08
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Text books:

1. Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition, Pearson Education Asia
2. Introduction to languages and the theory of computation, J Martin, 3rd Edition, Tata McGraw Hill
3. Elements and Theory of Computation, C Papadimitrou and C. L. Lewis, PHI
4. Mathematical Foundation of Computer Science, Y.N.Singh, New Age Internationa





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Web Designing (KIT 401)		
	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand principle of Web page design and about types of websites	K ₃ , K ₄
CO 2	Visualize and Recognize the basic concept of HTML and application in web designing.	K ₁ , K ₂
CO 3	Recognize and apply the elements of Creating Style Sheet (CSS).	K ₂ , K ₄
CO 4	Understanding the basic concept of Java Script and its application.	K ₂ , K ₃
CO 5	Introduce basics concept of Web Hosting and apply the concept of SEO	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction : Basic principles involved in developing a web site, Planning process , Domains and Hosting, Responsive Web Designing , Types of Websites (Static and Dynamic Websites), Web Standards and W3C recommendations, Introduction to HTML: What is HTML , HTML Documents, Basic structure of an HTML document , Creating an HTML document , Mark up Tags , Heading-Paragraphs , Line Breaks	08
II	Elements of HTML: HTML Tags., Working with Text , Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls	08
III	Concept of CSS: Creating Style Sheet, CSS Properties , CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects , Working with Lists and Tables , CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector) , CSS Color , Creating page Layout and Site Designs.	08
IV	Introduction to Client Side Scripting , Introduction to Java Script , Javascript Types , Variables in JS, Operators in JS , Conditions Statements , Java Script Loops, JS Popup Boxes , JS Events , JS Arrays, Working with Arrays, JS Objects ,JS Functions , Using Java Script in Real time , Validation of Forms, Related Examples	08
V	Web Hosting: Web Hosting Basics , Types of Hosting Packages, Registering domains , Defining Name Servers , Using Control Panel, Creating Emails in Cpanel , Using FTP Client, Maintaining a Website Concepts of SEO : Basics of SEO, Importance of SEO, Onpage Optimization Basics	08
Text Books: <ol style="list-style-type: none"> 1. Steven M. Schafer, “HTML, XHTML, and CSS Bible, 5ed”, Wiley India 2. Ian Pouncey, Richard York, “Beginning CSS: Cascading Style Sheets for Web Design”, Wiley India 		



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Operating System Lab (KCS451)

1. Study of hardware and software requirements of different operating systems (UNIX,LINUX,WINDOWS XP,WINDOWS7/8)
2. Execute various UNIX system calls for
 - i. Process management
 - ii. File management
 - iii. Input/output Systems calls
3. Implement CPU Scheduling Policies:
 - i. SJF
 - ii. Priority
 - iii. FCFS
 - iv. Multi-level Queue
4. Implement file storage allocation technique:
 - i. Contiguous(using array)
 - ii. Linked –list(using linked-list)
 - iii. Indirect allocation (indexing)
5. Implementation of contiguous allocation techniques:
 - i. Worst-Fit
 - ii. Best- Fit
 - iii. First- Fit
6. Calculation of external and internal fragmentation
 - i. Free space list of blocks from system
 - ii. List process file from the system
7. Implementation of compaction for the continually changing memory layout and calculate total movement of data
8. Implementation of resource allocation graph RAG)
9. Implementation of Banker’s algorithm
10. Conversion of resource allocation graph (RAG) to wait for graph (WFG) for each type of method used for storing graph.
11. Implement the solution for Bounded Buffer (producer-consumer)problem using inter process communication techniques-Semaphores
12. Implement the solutions for Readers-Writers problem using inter process communication technique -Semaphore



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Web Designing Lab (KIT451)

1. To create a simple html file to demonstrate the use of different tags.
2. To create an html file to link to different html page which contains images, tables, and also link within a page.
3. To create an html page with different types of frames such as floating frame, navigation frame & mixed frame.
4. To create a registration form as mentioned below.
Procedure: Create an html page named as “registration.html”
 - a) set background colors
 - b) use table for alignment
 - c) provide font colors & size
5. To create an html file by applying the different styles using inline, external & internal style sheets.
6. To write a Javascript program to define a user defined function for sorting the values in an array.
7. To create an html page to explain the use of various predefined functions in a string and math object in java script.
8. To create an html page to explain the use of various predefined functions in a array & Date object in Javascript.
9. To create an html page to demonstrate exception handling in javascript
10. To display the calendar using javascript code by getting the year from the user.
11. To create a html registration form and to validate the form using javascript code.
12. To create a html file. To open new window from the current window using javascript.
13. To create an html page to change the background color for every click of a button using javascript.
14. To create an html page with 2 combo box populated with month & year, to display the calendar for the selected month & year from combo box using javascript.
15. To create a html page to display a new image & text when the mouse comes over the existing content in the page.

Python Language Programming Lab (KCS453)

1. To write a python program that takes in command line arguments as input and print the number of arguments.
2. To write a python program to perform Matrix Multiplication.
3. To write a python program to compute the GCD of two numbers.
4. To write a python program to find the most frequent words in a text file.
5. To write a python program find the square root of a number (Newton’s method).
6. To write a python program exponentiation (power of a number).
7. To write a python program find the maximum of a list of numbers.
8. To write a python program linear search.
9. To write a python program Binary search.



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10. To write a python program selection sort.
11. To write a python program Insertion sort.
12. To write a python program merge sort.
13. To write a python program first n prime numbers.
14. To write a python program simulate bouncing ball in Pygame.





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Syllabus for Third Year (EVEN Sem.)

Department of Information Technology



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STUDY EVALUATION SCHEME
THIRD YEAR

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

CT: Class Test

TA: Teacher Assessment

L/T/P: Lecture/ Tutorial/ Practical

Departmental Elective-III

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

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Open Elective-1

1. KOE-061 Basics of Data Base Management System
2. KOE-062 Software Project Management





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B. Tech. (Information Technology)
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: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	08



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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



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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	<p>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.</p> <p>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.</p>	08
II	<p>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.</p>	08
III	<p>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.</p>	08
IV	<p>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.</p>	08



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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
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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 Böhmann, 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



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Information Technology – E Syllabus

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

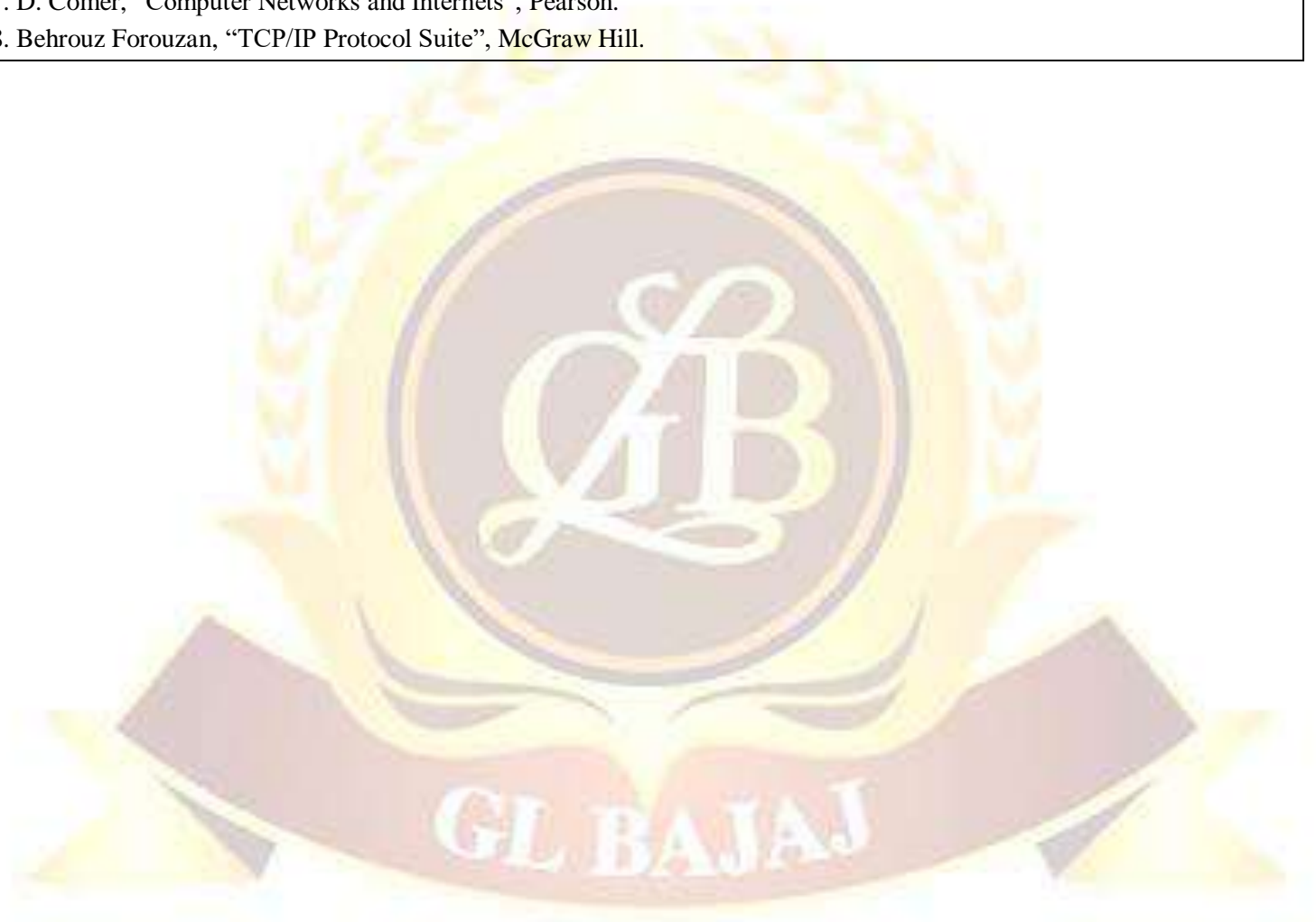


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Information Technology – E Syllabus

Text books and References:

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.





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Information Technology – E Syllabus

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



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IV	<p>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.</p> <p>NoSQL Databases: Introduction to NoSQL</p> <p>MongoDB: Introduction, data types, creating, updating and deleting documents, querying, introduction to indexing, capped collections</p> <p>Spark: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN</p> <p>SCALA: Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.</p>	09
V	<p>Hadoop Eco System Frameworks: Applications on Big Data using Pig, Hive and HBase</p> <p>Pig - Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, 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>	09

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



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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
- Pete Warden, “Big Data Glossary”, O’Reilly





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Information Technology – E Syllabus

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



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Text books:

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





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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. Mstering 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 		



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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: Moveto-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 VectorQuantizers.	08



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Text books:

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





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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		
For any given case/ problem statement do the following; 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.		
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.)		



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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





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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 normalization6. To perform dimensionality reduction operation using PCA for Houses Data Set7. To perform Simple Linear Regression with R.8. To perform K-Means clustering operation and visualize for iris data set9. 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.)		



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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		
<ol style="list-style-type: none">1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.2. Study of Socket Programming and Client – Server model3. Write a code simulating ARP /RARP protocols.4. Write a code simulating PING and TRACEROUTE commands5. 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<ol style="list-style-type: none">a. Echo client and echo serverb. Chatc. File Transfer9. Applications using TCP and UDP Sockets like<ol style="list-style-type: none">d. DNSe. SNMPf. File Transfer10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. <ol style="list-style-type: none">i. Link State routingii. Floodingiii. Distance vector12. 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)		



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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.





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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



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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 PL/SQL Cursors, stored procedures, stored function, database triggers, indices</p>	08
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
<p>Text Books and References:</p> <ol style="list-style-type: none">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.		



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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.





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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



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Text books:

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. Gopaldaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.





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Syllabus for FOURTH Year (EVEN Sem.)

Department of Information Technology



G.L. Bajaj Institute of Technology and Management
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STUDY EVALUATION SCHEME

Fourth YEAR
SEMESTER –VIII

Sl. No.	Subject Code	Subject Name	L-T-P	Th/Lab Marks	Sessional		Total	Credit
				ESE	CT	TA		
1	Open Elective-2	Open Elective Course-2	3--0--0	70	20	10	100	3
2	IT Elective-5	Deptt Elective Course-5	3--1--0	70	20	10	100	4
3	IT Elective-6	Deptt Elective Course-6	3--0--0	70	20	10	100	3
4	RIT851	Seminar	0--0--3			100	100	2
5	RIT852	Project	0--0--12	350		250	600	12
	TOTAL			560	60	380	1000	24

IT-ELECTIVE-5

1. RCS080 Machine Learning (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc17_cs17/preview
https://onlinecourses.nptel.ac.in/noc17_cs26/preview)
2. RCS081 Game Programming
3. RCS082 Image Processing (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_ee40/preview
<https://nptel.ac.in/courses/106105032/>)
4. RCS083 Parallel and Distributed Computing (Mapping with MOOCS: <https://nptel.ac.in/courses/106102114/>,
<https://nptel.ac.in/courses/106104024/>)

IT-ELECTIVE-6

1. RCS085 Speech Natural language processing (Mapping with MOOCS: <https://nptel.ac.in/courses/106101007/>
<https://nptel.ac.in/courses/106105158/>)
2. RCS086 Deep Learning (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cs41/preview)
3. RCS087 Data Compression
4. RCS088 Quantum Computing (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cy07/)



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MACHINE LEARNING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias	08
II	DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation Algorithm Convergence, Generalization;	08
III	Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;	08
IV	Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning	08
V	Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms- General to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q Learning.	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.		



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GAME PROGRAMMING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	3D GRAPHICS FOR GAME PROGRAMMING : 3D Transformations, Quaternions, 3D Modeling And Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera And Projections, Culling And Clipping, Character Animation, Physics-Based Simulation, Scene Graphs.	08
II	GAME ENGINE DESIGN: Game Engine Architecture, Engine Support Systems, Resources And File Systems, Game Loop And Real-Time Simulation, Human Interface Devices, Collision And Rigid Body Dynamics, Game Profiling.	08
III	GAME PROGRAMMING : Application Layer, Game Logic, Game Views, Managing Memory, Controlling The Main Loop, Loading And Caching Game Data, User Interface Management, Game Event Management.	08
IV	GAMING PLATFORMS AND FRAMEWORKS: 2D And 3D Game Development Using Flash, DirectX, Java, Python, Game Engines – DX Studio, Unity.	08
V	GAME DEVELOPMENT: Developing 2D And 3D Interactive Games Using DirectX Or Python – Isometric And Tile Based Games, Puzzle Games, Single Player Games, Multi Player Games.	08

Text books:

1. Mike Mc Shaffrfy And David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, “Game Engine Architecture”, CRC Press / A K Peters, 2009.
3. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach To Real-Time Computer Graphics” 2nd Editions, Morgan Kaufmann, 2006.
4. Ernest Adams And Andrew Rollings, “Fundamentals Of Game Design”, 2nd Edition Prentice Hall / New Riders, 2009.
5. Eric Lengyel, “Mathematics For 3D Game Programming And Computer Graphics”, 3rd Edition, Course Technology PTR, 2011.
6. Jesse Schell, The Art Of Game Design: A Book Of Lenses, 1st Edition, CRC Press, 2008.



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IMAGE PROCESSING

DETAILED SYLLABUS

3-1-0

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:

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



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PARALLEL AND DISTRIBUTED COMPUTING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Scope , issues, applications and challenges of Parallel and Distributed Computing Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, co-processing. Principles of Parallel Algorithm Design: Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing.	08
II	CUDA programming model: Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function.	08
III	Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time	08
IV	Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms Graph Algorithms: Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph	08
V	Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms	08
Text books: <ol style="list-style-type: none">1. A Grama, A Gupta, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003.2. C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company, 2008.3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming. Morgan Kaufmann Publishing and Elsevier, 2013.4. T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.		



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SPEECH AND NATURAL LANGUAGE PROCESSING		
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	<p>INTRODUCTION : Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance</p> <p>WORD LEVEL ANALYSIS Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.</p>	08
II	<p>SYNTACTIC ANALYSIS Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.</p>	08
III	<p>SEMANTICS AND PRAGMATICS Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.</p>	08
IV	<p>BASIC CONCEPTS of Speech Processing : Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.</p>	08



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V	<p>SPEECH ANALYSIS:</p> <p>Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.</p> <p>UNIT III : SPEECH MODELING :</p> <p>Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.</p>	08
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Text books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, “Fundamentals Of Speech Recognition”, Pearson Education, 2003.
Daniel Jurafsky And James H Martin, “Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition”, Pearson Education, 2002.
4. Frederick Jelinek, “Statistical Methods Of Speech Recognition”, MIT Press, 1997.
5. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
6. Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
7. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
8. Press, 2008.



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DEEP LEARNING

DETAILED SYLLABUS

3-0-0

Unit	Topic	Proposed Lecture
I	INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	08
II	DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	08
III	DIMENSIONALITY REDUCTION 9 Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	08
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	08
V	CASE STUDY AND APPLICATIONS : Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions	08
Text books: <ol style="list-style-type: none">1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.		



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DATA COMPRESSION

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:

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



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QUANTUM COMPUTING		
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	08
II	Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	08
III	Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	08
IV	Quantum Information: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	08
V	Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	08

Text books:

1. Micheal A. Nielsen. & Issac L. Chiang, “Quantum Computation and Quantum Information”, Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel , Wolfgang H. Polak , “Quantum Computing - A Gentle Introduction” (Scientific and Engineering Computation) Paperback – Import,
- 3 Oct 2014 3. Computing since Democritus by Scott Aaronson
4. Computer Science: An Introduction by N. David Mermin
5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.