Semester-VI

Design and Analysis of Algorithms
Code: PCC-CSBS601

Name of the Course:	**Design and Analysis of Algorithms**		
Course Code: PCC-CSBS601	Semester: VI		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hr./week		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them		
2	Through the complexity measures, different range of behaviors of algorithmsand the notion of tractable and intractable problems will be understood.		
Pre-Requisite:			
1	To know data-structure and basic programming ability		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Characteristics of algorithm.Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method andMasters' theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and theirapplication domains.	8	
3	Graph and Tree Algorithms: Traversal algorithms:Depth First Search (DFS) and Breadth First Search(BFS); Shortest path algorithms, Transitiveclosure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6	

	Tractable and Intractable Problems: Computability		
4.	of Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10	
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4	

Text books/ reference books:

Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, RonaldL Rivest and Clifford Stein, MIT Press/McGraw-Hill.
Fundamentals of Algorithms – E. Horowitz et al.
Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,Michael T Goodrich and Roberto Tamassia, Wiley.
Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading,MA
Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018)
Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai

Course Outcomes

On completion of the course students will be able to
PCC-CSBS601.1 For a given algorithms analyze worst-case running times of algorithmsbased on asymptotic analysis and justify the correctness of algorithms.
PCC-CSBS601.2 Describe the greedy paradigm and explain when an algorithmic designsituation calls for it. For a given problem develop the greedy algorithms.
PCC-CSBS601.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Deriveand solve recurrence relation.
PCC-CSBS601.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and
PCC-CSBS601.5 develop the dynamic programming algorithms, and analyze it to determineits computational complexity.
PCC-CSBS601,6 For a given model engineering problem model it using graph and write thecorresponding algorithm to solve the problems.
PCC-CSBS601.7 Explain the ways to analyze randomized algorithms (expected runningtime, probability of error).
PCC-CSBS601.8 Explain what an approximation algorithm is. Compute the approximationfactor of an approximation algorithm (PTAS and FPTAS).

Operating Systems
Code: PCC-CSBS602

Name of the Course:	**Operating Systems**		
Course Code: PCC-CSBS602	Semester: VI		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hr/week		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: hrs./week		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	To learn the mechanisms of OS to handle processes and threads and their communication		
2	To learn the mechanisms involved in memory management in contemporary OS		
3	To gain knowledge on distributed operating system concepts that includes architecture,Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols		
4	To know the components and management aspects of concurrency management		
Pre-Requisite:			

1	Computer Organization &Architecture

Unit	Content	Hrs/Unit	Marks/ Unit
1	**Introduction:** Concept of Operating Systems,Generations of Operating systems, Types of Operating Systems, OS Services, System Calls,Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	3	

2	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling**: Foundation and Schedulingobjectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	10	
3.	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems:Reader's & Writer Problem, Dinning Philosopher Problemetc.	5	
4.	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	5	
5.	**Memory Management:** Basic concept, Logical andPhysical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality ofreference, Page fault , Working Set , Dirty page/Dirtybit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently	8	
	used(LRU).		

6.	**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals ofInterrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms **File Management**: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector,linked list, grouping), directory implementation (linear list, hash table), efficiency andperformance. **Disk Management:** Disk structure, Disk scheduling -FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Diskformatting, Boot-block, Bad blocks	6	

Text book and Reference books:

Operating System Concepts Essentials, 9th Edition by AviSilberschatz,Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
Operating Systems: Internals and Design Principles, 5th Edition, WilliamStallings, Prentice Hall of India.
Operating System Concepts, Ekta Walia, Khanna Publishing House(AICTE Recommended Textbook – 2018)
Operating System: A Design-oriented Approach, 1st Edition by CharlesCrowley, Irwin Publishing
Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
Design of the Unix Operating Systems, 8th Edition by Maurice Bach,Prentice-Hall of India
Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, MarcoCesati, O'Reilly and Associates

Course Outcomes:

On completion of the course students will be able to
Create processes and threads.
Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
For a given specification of memory organization develop the techniquesfor optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement filemanagement system.

For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Pattern Recognition
Code: ESC-CSBS601

Name of the Course:	**Pattern Recognition**		
Course Code: ESC-CSBS601	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hr/ week		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Basics of pattern recognition	2	
2	**Bayesian decision theory 8L** Classifiers, Discriminant functions, Decisionsurfaces Normal density and discriminant functionsDiscrete features	8	
3	**Parameter estimation methods 6L** Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation	6	
4.	**Hidden Markov models for sequential patternclassification 8L** Discrete hidden Markov models Continuous density hidden Markovmodels	8	
5	**Dimension reduction methods 3L** Fisher discriminant analysis, Principal component analysis, Parzen-window method, K-Nearest Neighbour method	3	
6	Non-parametric estimation techniques for Density estimation	2	

7	**Linear discriminant function based classifier 5L** Perceptron Support vector machines	5	
8	**Non-metric methods for pattern classification 4L** Non-numeric data or nominal dataDecision trees	4	
9	**Unsupervised learning and clustering 2L** Criterion functions for clustering Algorithms for clustering: K-means, Hierarchical and other methods	2	

Text book and Reference books:

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Information Security
Code: PEC-CSBS601 A

Name of the Course:	Information Security		
Course Code: PEC-CSBS601A	Semester: VI		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hr/Week		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		

Unit	Content	Hrs/Unit	Marks/Unit

1	Introduction: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyberwarfare, CIA Triad, Cyber Terrorism, Cyber Security of CriticalInfrastructure, Cybersecurity - Organizational Implications.	6	
2	Hackers and Cyber Crimes: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7	
3	Ethical Hacking and Social Engineering: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.	8	
4.	Cyber Forensics and Auditing: Introduction to CyberForensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Networkbased Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013	10	
5	Cyber Ethics and Laws: Introduction to Cyber Laws,E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	5	

Text book and Reference books:

1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security and Cyber Laws, Pankaj Agarwal
3. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How toBuild a Successful Cyberdefense Program

Against Advanced Threats, A-press
4. Nina Godbole, SumitBelapure, Cyber Security, Willey
5. Hacking the Hacker, Roger Grimes, Wiley
6. Cyber Law By Bare Act, Govt Of india, It Act 2000.
7. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House, (AICTERecommended Textbook- 2018)

Human Computer Interaction
Code: PEC-CSBS601B

Name of the Course:	**Human Computer Interaction**	
Course Code: PEC-CSBS601B	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hr/Week		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	
Objective:		
1	Learn the foundations of Human Computer Interaction	
2	Be familiar with the design technologies for individuals and persons with disabilities	
3	Be aware of mobile Human Computer interaction	
4	Learn the guidelines for user interface.	
Pre-Requisite:		
1	Computer Organization &Architecture	

Unit	Content	Hrs/ Unit	Marks /Unit
1	Human: I/O channels – Memory – Reasoning and problem solving;The computer: Devices – Memory – processing and networks;	9	
	Interaction: Models – frameworks – Ergonomics – styles – elements –interactivity- Paradigms.		

2	Interactive Design basics – process – scenarios – navigation – screendesign – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques –Universal Design.	11	
3.	Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models- Hypertext,Multimedia and WWW.	8	
4.	Mobile Ecosystem: Platforms, Application frameworks- Types ofMobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8	
5.	Designing Web Interfaces – Drag & Drop, Direct Selection, ContextualTools, Overlays, Inlays and Virtual Pages, Process Flow. CaseStudies.	8	
6.	Recent Trends: Speech Recognition and Translation, Multimodal System	3	

Text book and Reference books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise SoftwareSecurity,
Addison Wesley.

Course Outcomes:

On completion of the course students will be able to

1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

Cloud Computing
Code: PEC-CSBS601C

Name of the Course:	**Cloud Computing**		
Course Code: PEC-CSBS601C	Semester: VI		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hr/ Week		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	**Definition of Cloud Computing and itsBasics (Lectures)**. Defining a Cloud, Cloud Types – NIST model, Cloud Cube	9	
	model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning ofvirtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics,Open SaaS and SOA, examples of SaaSplatform Identity as a Service (IDaaS) Compliance as a Service (CaaS)		

2	**Use of Platforms in Cloud Computing** Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU,storage), Mobility patterns (P2V, V2V, V2P,P2P, D2C, C2C, C2D, D2D) Load Balancingand Virtualization: Basic Concepts, Networkresources for load balancing, Advanced loadbalancing (including Application DeliveryController and Application Delivery Network),Mention of The Google Cloud as an exampleof use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mentionof Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks,	12	

	Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure,		

	and Windows Live services,		
3	**<u>Cloud Infrastructure</u>**: Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management ofcloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)	7	
4.	**<u>Concepts of Services and Applications :</u>** Service Oriented Architecture: Basic conceptsof message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloudtransactions, functionality mapping,	8	
	Application attributes, Cloud service attributes, System abstraction and CloudBursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, WindowsLive Hotmail, Yahoo mail, concepts of Syndication services		

Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited,2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Data Mining & Analytics
Code: PEC-CSBS601D

Name of the Course:	**Data Mining & Analytics**
Course Code: PEC-CSBS601D	Semester: VI
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1 hr/ Week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical:	End Semester Exam: 70 Marks
Credit Points:	3

PURPOSE	To acquire knowledge of Data mining techniques
At the end of the course, students will be able to	
1	Understand the concepts of Data Mining
2	Familiarize with association rule mining
3	Familiarize various classification algorithms
4	Understand the concepts of Cluster analysis
5	Implement the Data mining concepts with various domains

Session	**Description of Topic**	**Contact hours**
	UNIT I: Introduction	9
1	Introduction to Data Mining – Kinds of Data	2
2	Data mining Functionalities – Interesting Patterns	2
3	Task Primitives	1
4	Issues in Data Mining	1
5	Data Preprocessing	3

	UNIT II: Association Rules	8
6	Basic Concepts	1
7	Frequent Item Set Mining Methods	3
8	Association Rules	2
9	Correlation analysis	2
	UNIT III: Classification and Prediction	9
10	Issues Regarding Classification and Prediction	1
11	Decision Tree Induction Classification	2
12	Bayesian and Rule Based Classification	3
13	Support Vector Machine	2
14	Prediction	1
	UNIT IV: Cluster Analysis	9
15	What is Cluster Analysis	1
16	Types of Data in Cluster Analysis	2
17	Categorization of Clustering Methods	3
18	Hierarchical Methods	3
	UNIT V: PLASTIC ANALYSIS	10
19	Applications and Trends in Data Mining	3
20	Machine learning	3
21	Big data	2
22	Cloud computing	2
	Total contact hours	45

LEARNING RESOURCES

Sl. No.	**TEXT BOOKS**
1.	Jiawei Han and Micheline Kamber,"Data Mining – Concepts and Techniques", Second Edition, Morgan Kaufmann Publishers, 2006.
REFERENCE BOOKS/OTHER READING MATERIAL	
2.	M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education. 2001.
3.	D. Hand, H. Mannila and P. Smyth, "Principles of Data Mining", Prentice Hall. 2001.
4.	I H. Witten and E. Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann. 2000.

5.	Nathan Marz, James Warren, “Big Data-Principles and best practices of scalable real-time data systems”, DreamTech Press, 2015
6.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", University Press, 2016

Compiler Design
Code: PEC-CSBS602A

Name of the Course:	**Compiler Design**	
Course Code: PEC-CSBS602A	Semester: VI	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hr/Week		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Objective:	
1	To understand and list the different stages in the process of compilation.
2	Identify different methods of lexical analysis
3	Design top-down and bottom-up parsers
4	Identify synthesized and inherited attributes
5	Develop syntax directed translation schemes
6	Develop algorithms to generate code for a target machine

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Compiling** [3L] Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.	3	
2	**Lexical Analysis** [6L] The role of the lexical analyzer, Tokens, Patterns,	6	
	Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expressionto an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).		

3	**Syntax Analysis** [9L] The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recoverystrategies for different parsing techniques.	9	
4	**Syntax directed translation** [5L] Syntax director definitions, Construction of syntaxtrees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	**Type checking** [4L] Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	4	
6	**Run time environments** [5L] Source language issues (Activation trees, Controlstack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameterpassing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5	
7	**Intermediate code generation** [4L] Intermediate languages, Graphical representation,Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).	4	
8	**Code optimization** [5L] Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representationof basic blocks, The principle sources of optimization, Loops in flowgraph, Peephole optimization.	5	
9	**Code generations** [4L] Issues in the design of code generator, a simple code generator, Register allocation & assignment.	4	

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Course Outcomes:

On completion of the course students will be able to

1. Understand given grammar specification develop the lexical analyser
2. Design a given parser specification design top-downand bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

Image Processing
Code: PEC-CSBS602 B

Name of the Course:	Image Processing	
Course Code: PEC-CSBS602 B	Semester: VI	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hr/ Week		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction [3L]** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	9	
2	**Digital Image Formation [4L]** A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization -Uniform & Non uniform.	4	
3	**Mathematical Preliminaries[9L]** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform.	9	

4.	**Image Enhancement [8L]** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High- pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8	
5	**Image Restoration [7L]** Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	7	
6	**Image Segmentation [7L]** Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	7	

Text book and Reference books:

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" –TMH

Robotics and Embedded Systems
Code: PEC-CSBS602 C

Name of the Course:	Robotics and Embedded Systems	
Course Code: PEC-CSBS602 C	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hr./week		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	3	

Objective:

1	In engineering courses students read subjects like; C/C++, Basic Electronics/Electrical, different types Sensors and Actuators, Microcontrollers and Microprocessors, different types of communication protocols and about many more. But they do not get scope to use that knowledge during their course. This course is especially designed to bridge that gap by providing an opportunity to the students, so that they can write embedded C/C++ programs to interface different types of input/output devices with the Microcontroller to do different projects. Now robotics is an emerging field of technology. In many sectors in our industry, robots are replacing humans very rapidly. That is why in this course students will also get some insight of robotics.

Course outcome

After completion of the training, students will able to:

- Understand the importance of embedded systems and robotics in our daily life.
- Identify different embedded devices.
- Co-related embedded systems with their university courses.
- Identify different components of embedded systems and robotics.
- Know about different features of a microcontroller.
- Write embedded C/C++ programs in different embedded systems programming platforms.
- Interfaced different input/output devices with a microcontroller.
- Design mechanical structure of a robot.
- Understand the robot configuration and sub-systems
- Interface different components of robot with microcontroller.
- Understand principle of robot programming.

	• Design different types of robots for different purposes. • Design wide varieties of embedded systems projects. • Do their Diploma/B Tech projects themselves.

Unit	Content	Hrs/Unit	Marks/Unit
1	AVR Microcontroller Introduction to AVR Microcontroller, Mega AVR Microcontroller series, Introduction to ATmeg16/32, Features, Architecture, Pin configurations, I/O ports, Port operation registers, Interrupts, ADC, Timers/counters, SPI, USART, Memory programming, etc.	10	
2	Embedded C/C++ Introduction to C/C++, Use of Loops, Array, Function, etc in C/C++, Introduction to Embedded C/C++ platform like; Atmel Studio and Proteus, Introduction to port operation registers programming, Programming to interface LED with ATmega16, etc.	10	
3	Robotics – Interfacing of Sensors, Motors, Display devices, etc : Introduction concept and mechanism of Robotics, Applications of Robotics, Introductions to Robotics components like; Motors, Sensors, Display devices, etc, Programming and interfacing of DC Motors, Stepper Motor, Servo Motors, Sensors (Analog & Digital), LCD, Communications modules like; Bluetooth, Xbee, etc.	8	
	Application: Digital notice board, Object counter, Digital temperature monitoring system, Range finder, Project using external interrupts, Stopwatch, Velocity control of DC Motor, Line follower Robot, Object avoider Robot, Intelligent home automation system, Solar seeker Robot, Robot communication using Bluetooth, RF Module, Xbee module, etc.	8	

SOFTWARE DESIGN USING UML
Code: PEC-CSBS602D

Name of the Course:	SOFTWARE DESIGN USING UML	
Course Code: PEC-CSBS602D	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hr./week		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	3	

Objective:

1	To understand the fundamentals of object modeling • To understand and differentiate Unified Process from other approaches • To design with static UML diagrams. • To design with the UML dynamic and implementation diagrams • To improve the software design with design patterns. • To test the software against its requirements specification

Course outcome

	Upon Completion of the course, the students should be able to: • Express software design with UML diagrams • Design software applications using OO concepts. • Identify various scenarios based on software requirements • Transform UML based software design into pattern based design using design patterns • Understand the various testing methodologies for OO software

Unit	Content	Hrs/Unit	Marks/Unit
1	**UNIFIED PROCESS AND USE CASE DIAGRAMS** Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.	**8**	
2	**STATIC UML DIAGRAMS** Class Diagram–– Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams. .	8	
3	**DYNAMIC AND ARCHITECTURAL MODELING UML DIAGRAMS** Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling – When to use State Diagrams - Activity diagram – When to use activity diagrams Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams.	8	
4	**DESIGN PATTERNS AND ELEMENTS DESIGN PATTERNS** GRASP-Designing objects with responsibilities – Applying GoF design patterns – Creational Patterns, Structural Patterns , Behavioral Patterns, Design Elements: Architectural design elements - Interface design elements - Component level diagram elements - Deployment level design elements, Mapping design to code.	8	

5.	**AGILE METHODOLOGY** Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values	8	

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Big Data Analytics

Code: OEC-CSBS601A
Contacts: 3L

Name of the Course:	**Big Data Analytics**	
Course Code :OEC-CSBS601A	Semester:VI	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Total Number of Lectures: 48

COURSE OBJECTIVE	
□ Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools	
LECTURE WITH BREAKUP	**NO. OF LECTUR**
Unit 1: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
Unit 2: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
Unit 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9

Unit 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
Unit 5:	7
Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandradata model, Cassandra examples,Cassandra clients, Hadoop integration.	
Unit 6: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL datamanipulation, HiveQL queries.	6

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the EmergingWorld of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

Cyber Law and Ethics

Code: OEC-CSBS601B
Contacts: 3L

Name of the Course:	**Cyber Law and Ethics**	
Course Code: OEC-CSBS601B	Semester:VI	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction of Cybercrime:** What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion[4L]. **Category of Cybercrime:** how criminals plan attacks, passive attack, Active attacks, cyberstalking. [4L]	8	
2	**Cybercrime Mobile & Wireless devices:** Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop [8L]	8	
3	**Tools and Methods used in Cyber crime:** Proxy servers, panword checking, Random checking, TrojanHorses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow. [8L]	8	
4.	**Phishing & Identity Theft:** Phising methods, IDTheft; Online identity method. [4L] **Cybercrime & Cybersecurity:** Legal aspects, indianlaws, IT act, Public key certificate. [4L]	8	

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

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Mobile Computing

Code: OEC-CSBS601C
Contacts: 3L

Name of the Course:	**Mobile Computing**	
Course Code: OEC-CSBS601C	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: 3L		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.	5	
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.	5	
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	7	
4.	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G	7	
5	Global Mobile Satellite Systems; case studies of theIRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks,Blue tooth technology, Blue tooth Protocols.	7	
6	Server-side programming in Java, Pervasive web application architecture, Device independent example	8	

	application		

Text book and Reference books:

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley& Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall ofIndia, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning,Vikas Publishing House, 2001.
6. "Wireless Web Development", Ray Rischpater, Springer Publishing,
7. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
8. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,
9. Brijesh Gupta “Mobile Computing”, Khanna Publishing House, New Delhi

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Bio Informatics
Code: OEC-CSBS601D
Contacts: 3L

Name of the Course:	**Bio Informatics**	
Course Code: OEC-CSBS601D	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**INTRODUCTION TO MOLECULAR BIOLOGY** Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Typesof RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways.	5	
2	**Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomybrowser, PubMed;	2	
3	**DNA SEQUENCE ANALYSIS** DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.	14	

4.	**Introduction Probabilistic models used in Computational Biology** Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.	8	
5.	**Biological Data Classification and Clustering** Assigning protein function and predicting splice sites:Decision Tree	6	

Numerical Methods
Code: OEC-CSBS601E
Contact: 3L

Name of the Course:	**Numerical Methods**	
Course Code: OEC-CSBS601E	Semester: VI	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	2	
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divideddifference Interpolation.	8	
3	Numerical integration: Trapezoidal rule, Simpson's1/3 rule, Expression for corresponding error terms.	3	

4.	Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	8	
5	Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method,Newton-Raphson method.	3	
6	Numerical solution of ordinary differential equation:Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.	2	

Text book and Reference books:

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

Introduction to Industrial Management (Humanities III)

Code: HSMC-CSBS601

Contacts: 2L

Name of the Course:	**Introduction to Industrial Management (Humanities III)**	
Course Code: HSMC-CSBS601	Semester: VI	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:2 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	2	

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Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** System- concept, definition, types, parameters, variables and behavior. Management – definition andfunctions. Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulatingstructure. iv. Types. v. Advantages and disadvantages. vi. Applications. Concept, meaning and importance ofdivision of labor, scalar & functional processes, span of control, delegation ofauthority, centralization and decentralization in industrial management. Organizational culture and climate –meaning, differences and factors affecting them. Moral-factors affecting moral. Relationship between moral andproductivity. Job satisfaction- factors influencingjob satisfaction. Important provisions of factory actand labor laws.	6	
2	**Critical Path Method (CPM) andProgramme Evaluation Review Technique (PERT):** 2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. Draw network diagram for a real lifeproject containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). Determination of critical path onnetwork. Floats, its types and determination offloats. Crashing of network, updating andits applications.	6	

3	**Materials Management:** Material management-definition, functions, importance, relationship withother departments. Purchase - objectives, purchasing systems, purchase procedure, terms andforms used in purchase department. Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. Functions of store, types of records maintained by store, various types and applications of storage equipment, needand general methods for codification ofstores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis andother modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model.(Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages availablein market.	6	

4	**Production planning and Control(PPC):** Types and examples of production.PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach foreach type of production. Scheduling- meaning and need forproductivity and utilisation. Gantt chart- Format and method toprepare. Critical ratio scheduling-method andnumeric examples. Scheduling using Gantt Chart (for atleast 5-7 components having 5-6	6	
	machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessarydata), At least two examples. 4.7 Bottlenecking- meaning, effect andways to reduce.		
5	**Value Analysis (VA) and Cost Control:** 5.1 VA-definition, terms used, process andimportance. 5.2 VA flow diagram. DARSIRI method of VA. Case study of VA-at least two. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.	3	
6	**Recent Trends in IM:** ERP (Enterprise resource planning) - concept,features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits.	3	

Text book and Reference books:

1. L.S. Srinath– "CPM & PERT principles and Applications".
2. Buffa – "Modern Production Management".
3. N. Nair – "Materials Management".
4. O. P. Khanna – " Industrial Engineering & Management".
5. Mikes – "Value Analysis".
6. S.C. Sharma, "Engineering Management – Industrial Engineering & Management",Khanna Book Publishing Company, New Delhi

Course Outcomes:

On completion of the course students will be able to

1. Interpret given organization structure, culture, climate and major provisions of factoryacts and laws.
2. Explain material requirement planning and store keeping procedure.
3. Plot and analyze inventory control models and techniques.
4. Prepare and analyze CPM and PERT for given activities.
5. List and explain PPC functions.

Design and Analysis of Algorithms Lab
Code: PCC-CSBS691
Contact: 4P

Name of the Course:	**Design and Analysis of Algorithms Lab**
Course Code: PCC-CSBS691	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Pre-Requisite:	
Pre-Requisite as in : PCC-CSBS601	

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix

4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	
11	Implement Breadth First Search (BFS)
	Implement Depth First Search (DFS)

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Operating System Lab
Code: PCC-CSBS692
Contacts: 4P

Name of the Course:	Operating System Lab
Course Code: PCC-CSBS692	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

1 1. **Managing Unix/Linux Operating System [8P]:**
Creating a bash shell script, making a script executable, shell syntax (variables, conditions,control structures, functions,

commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks,Making file systems, Superblock, I-nodes, File system checker, Mounting file systems,
Logical Volumes, Network File systems, Backup schedules and
methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Passwordfile management, Password
security, Shadow file, Groups and the group file, Shells, restricted shells, user-managementcommands, homes and
permissions, default files, profiles, locking accounts, setting passwords, Switching user,Switching group, Removing users &user groups.

2. **Process [4P]**: starting new process, replacing a process image, duplicating a processimage, waiting for a process,
zombie process.
3. **Signal [4P]**: signal handling, sending signals, signal interface, signal sets.
4. **Semaphore [6P]**: programming with semaphores (use functions semctl, semget, semop,set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads [6P]**: programming with pthread functions (viz. pthread_create,pthread_join, pthread_exit,
pthread_attr_init, pthread_cancel)
6. **Inter-process communication [6P]**: pipes(use functions pipe, popen, pclose), namedpipes(FIFOs, accessing FIFO),
message passing & shared memory(IPC version V).

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)