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(Formerly West Bengal University of Technology)
Syllabus for B. Tech in CSE (Data Science)
(Applicable from the academic session 2020-2021)

Semester-VI

Artificial Intelligence
Code: PCC-DS 601
Contacts: 3L

Name of the Course:	**Artificial Intelligence**	
Course Code**:** PCC-DS 601	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 [2]** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. **Intelligent Agents [2]** Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. **Problem Solving [2]** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6	
2.	**Search techniques [5]** Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. **Heuristic search strategies [5]** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search,	13	
	genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. **Adversarial search [3]** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.		

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3	**Knowledge & reasoning [3]** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	3	
4	**Using predicate logic [2]** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. **Probabilistic reasoning [4]** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6	
5	**Natural Language processing [2]** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning [2]** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. **Expert Systems [2]** Representing and using domain knowledge, expert system shells, knowledge acquisition.	6	

Text book and Reference books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. M.C. Trivedi, Artificial Intelligence, Khanna Publishing House, New Delhi
(AICTE Recommended Textbook – 2018)

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Data Communication and Computer Networks

Code:PCC- DS602

 Contact: 3L

Name of the Course:	**Data Communication and Computer Networks**	
Course Code: PCC-DS602	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: hrs./week	End Semester Exam:70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Data communication Components: Representation of data and its flow Networks,Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	9	
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking,	8	
	Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA		
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	14	

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4.	**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	8	
5	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8	

Text book and Reference books:
1. Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi

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Name of the Course:		**Big Data Technology**	
Course Code: PCC- DS603		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: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		

Big data definition, structured and unstructured data. Need for analytics, Big data programming (Hadoop, Map-Reduce), Application Data store (NoSQL), OLAP.
Optimization Techniques, Data flow framework.
Programming Map-Reduce, Best practices.

Text Books: 1. Handbook of big data technology by Zomaya and Sakr.
2. Real time Big Data Analytics Book by Sumit Gupta
3. Big Data and Hadoop, V.K. Jain, Khanna Publishing House

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Advanced Algorithms
Code: PEC-DS601 A
  Contact: 3L

Name of the Course:	**Advanced Algorithms**	
Course Code: PEC-DS601 A	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	**Sorting:** Review of various sorting algorithms, topological sorting **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	6	
2	**Matroids:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. **Graph Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	8	
	Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. **Matrix Computations:** Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	9	

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3	**Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. **Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm	10	
4.	**Linear Programming:** Geometry of the feasibility region and Simplex algorithm **NP-completeness:** Examples, proof of NP-hardness and NP-completeness. **One or more of the following topics based on time and interest** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	10	
5	Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5	

Text book and Reference books:
1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi

Distributed Systems

Code: PEC-DS601B
   Contact: 3L

Name of the Course:	**Distributed Systems**	
Course Code: PEC-DS601B	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	

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Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**INTRODUCTION** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts **DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	8	
2	**DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control QUERY **PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	11	
3	**DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms **TRANSACTION MANAGEMENT** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models **CONCURRENCY CONTROL** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	11	
4.	Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm	8	
5	**PARALLEL DATABASE** SYSTEMS Parallel architectures; parallel query processing and	6	

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6	ADVANCED TOPICS Mobile Databases, Distributed Object Management, Multi-databases	4	

Text book and Reference books:
1. Principles of Distributed Database Systems, M.T. Ozsu and PValduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Image Processing
Code:PEC-IT601 D
Contact: 3L

Name of the Course:	Image Processing	
Course Code: PEC-IT601D	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 [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	

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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

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Machine Learning
Code:PEC-DS601 E
Contact: 3L

Name of the Course:	Machine Learning	
Course Code: PEC-DS601E	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	

Supervised Learning, Decision Tree, Linear Discriminant Functions (SVM)
Neural Network, Deep belief network, Density elimination Methods
Bayes Decision Theory
Expectation and Minimization
Ensemble Methods
Feature Engineering
Association Rule Mining
Clustering Techniques
Text Books:
1. Machine Learning and Knowledge Discovery edited by Walter Daelemans, Katharina Morik
2. Pattern Recognition and Machine Learning by Christopher Bishop
3. Introduction to Machine learning with python by Andreas C. Müller and Sarah Guido
4. Machine Learning by Rajiv Chopra, Khanna Publishing House
5. Machine Learning using Python, Jeeva Jose, Khanna Publishing House

Parallel and Distributed Algorithms
Code: PEC-DS602A
Contacts: 3L

Name of the Course:	**Parallel and Distributed Algorithms**	
Course Code **PEC-DS602A**	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	

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Unit	Content	Hrs/Unit	Marks/Unit
1	**UNIT-I :**Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing	8	
2	**UNIT-II :**Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples	8	
3	UNIT-III :Pipelining- Techniques computing platform, pipeline programs examples	8	
4.	**UNIT-IV:**Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelist sharing data parallel programming languages and constructs, open MP	11	
5	**UNIT-V :**Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.	9	

Text book and Reference books:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.
2. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

Data Warehousing and Data Mining
Code: PEC-DS602B
Contacts: 3L

Name of the Course:	**Data Warehousing and Data Mining**	
Course Code **PEC-DS602B**	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
	Unit 1:		
1	Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;	8	

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2	**Unit 2:** Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,	8	
3	**Unit 3:** Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;	8	
4.	**Unit 4:** Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis; modulation for communication, filtering, feedback control systems.	11	
	Unit 5: Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.	9	
	Unit 6: Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	5	

Text book and Reference books:

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
2. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
3. Data warehouse Toolkit by Ralph Kimball, Wiley India
4. Data Mining & Warehousing by Ikvinderpal Singh, Khanna Publishing House
5. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
6. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.
7. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

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Human Computer Interaction
Code:PEC-DS602C
Contact: 3L

Name of the Course:	Human Computer Interaction	
Course Code: PEC-DS602C	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	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements –interactivity- Paradigms.	9	
2	Interactive Design basics – process – scenarios – navigation – screen design – 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 of Mobile 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, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8	
6.	Recent Trends: Speech Recognition and Translation, Multimodal System	3	

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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 Software Security,
Addison Wesley.

Data Analysis and Modeling Technique
Code: PEC-DS602D
Contact: 3L

Name of the Course:	Data Analysis and Modeling Technique	
Course Code: PEC-DS602D	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	Basic probability: Discrete and continuous random variables, independence, covariance, central limit theorem, Chebyshev inequality, diverse continuous and discrete distributions.	6	
2	Statistics, Parameter Estimation, and Fitting a Distribution: Descriptive statistics, graphical statistics, method of moments, maximum likelihood estimation	9	
3	Random Numbers and Simulation: Sampling of continuous distributions, Monte Carlo methods	7	
4.	Hypothesis Testing: Type I and II errors, rejection regions; Z-test, T-test, F-test, Chi-Square test, Bayesian test	9	
5	Stochastic Processes and Data Modeling: Markov process, Hidden Markov Models, Poisson Process, Bayesian Network, Regression, Queuing systems	9	

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Numerical Methods
Code: OEC-DS601A
Contact: 3L

Name of the Course:	**Numerical Methods**	
Course Code: **OEC-DS601A**	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 divided difference Interpolation.	8	
3	Numerical integration: Trapezoidal rule, Simpson's 1/3 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.

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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.

Human Resource Development and Organizational Behaviour
Code: OEC-DS601 B
Contact: 3L

Name of the Course:	**Human Resource Development and Organizational Behaviour**		
Course Code: **OEC-DS601 B**	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	Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. **[2]** Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.	4	
2	Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. **[2]** 4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.	8	
3	Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision	4	

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	Making. **[2]** Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. **[2]** Leadership: Definition, Importance, Theories of Leadership Styles.		
4.	Organizational Politics: Definition, Factors contributing to Political Behaviour. **[2]** Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. **[2]** Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.	8	

Text book and Reference books:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.

3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources,
 PHI, 10th Edn.

Research Methodology
Code: PROJ- DS601
Contact: 3L

Name of the Course:	**Research Methodology**	
Course Code: **PROJ- CS601**	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

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(Applicable from the academic session 2020-2021)

1	**RESEARCH FORMULATION AND DESIGN** Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.	9	
2	**DATA COLLECTION AND ANALYSIS** Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools,data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.	9	
3	**RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING** Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.	9	
4.	**INTERPRETATION AND REPORT WRITING** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.	9	

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Text book and Reference books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Additional reading

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual propertyrights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.

Course code	Course Title	L	T	P	Credits
PEC-DS 601C	**Information Security**	**3**	**0**	**0**	**3**
Pre- requisite	**NIL**	**Syllabus version**			
		**v. 1.0**			

Course Objectives:

1. To study and practice fundamental techniques in developing secure applications
2. To understand the policy, procedures and guidelines to protect the computing resources

Expected Course Outcome:

1. To understand security parameters and access control methods.
2. To understand the fundamental policies and design principle of computing resources
3. To recognize system design, logic-based system
4. To study the security architecture of database, operating system and associated vulnerabilities

Module:1		4 hours

Overview of Security Parameters: Confidentiality, integrity and availability; Security violation and threats; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle.

Module:2		3 hours

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Access Control Models: Discretionary, mandatory, roll-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models.

Module:3		5 hours

Security Policies: Confidentiality policies, integrity policies, hybrid policies, non-interferenceand policy composition, international standards.

Module:4		5 hours

Systems Design: Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.

Module:5		6 hours

Logic-based System: Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security.Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.

Module:6		3 hours

Operating Systems Security: Security Architecture, Analysis of Security in Linux/Windows.

Module:7		2 hours

Database Security: Security Architecture, Enterprise security, Database auditing.

Module:8	Contemporary issues	2 hours

	Total Lecture hours:	30 hours

Text Book(s)	
1.	Anderson, R. Security engineering. John Wiley & Sons, 2008.
2.	Bishop, M. Computer Security: Art and Science. Pearson Education, Boston, US, 2003.
3.	Stamp, M. Information security: principles and practice. John Wiley & Sons, 2014.
Reference Book(s)	
1.	Pfleeger, C. P., Pfleeger, S. L., and Margulies, J. Security in Computing,ProQuest Safari Tech Books Online, 2017.
2.	Wheeler, D. A. Secure programming HOWTO, 2017.
3.	Zalewski, M. Google browser security handbook, 2009.
4.	Gertz, M., & Jajodia, S. (Eds.). Handbook of database security: applications andtrends. Springer Science & Business Media, 2007.

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Data Communication andComputer Networks Lab
Code: PCC-DS692
Contacts: 4P

Name of the Course:	Data Communication and Computer Networks Lab
Course Code: PCC-DS692	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

Laboratory Experiments:

1) NIC Installation & Configuration (Windows/Linux)
2) Understanding IP address, subnet etc
Familiarization with
   - Networking cables (CAT5, UTP)
   - Connectors (RJ45, T-connector)
   - Hubs, Switches
3) TCP/UDP Socket Programming
   - Simple, TCP based, UDP based
   - Multicast & Broadcast Sockets
   - Implementation of a Prototype Multithreaded Server
4) Implementation of
   ☐☐Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
   ☐☐Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
   ☐☐Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
5) Server Setup/Configuration
   FTP, TelNet, NFS, DNS, Firewall

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

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Big DataTechnology & OLAP Lab
Code: PCC-DS693
Contacts: 4P

Name of the Course:	Big Data Technology and OLAP Lab
Course Code: PCC-DS693	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

A. NoSQL Lab using (MongoDB/Redis/Cassandra/CouchDB/Hbase using HDFs etc): Introduction
to Nosql, Difference between RDBMS to NOSQL,JSON and BSON
documents, Introduction to MongoDB/.. and its Features, Database, Collection and
Documents,Various Data Types in MongoDB/..,Introduction to mongo/.. shell, CRUD
Operations, Database Operations, Read and Write Operations, Aggregation, Data
Modeling Introduction, Data Modeling Concept,Storage Engine,Indexing,Replication
Concept, Failover & Recovery
B. Multidimensional Data Modeling using OLAP:
Introduction of Data Warehousing and OLAP, example of a Data Warehouse and
Data mart, Data Cleaning

Artificial Intelligence Lab
Code: PCC- DS691
Contacts: 4P

LIST OF EXPERIMENTS:

1. Study of Prolog.

2. Write simple fact for the statements using PROLOG.

3. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.

4. Write a program to solve the Monkey Banana problem.

5. WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.

6. WAP to implement factorial, fibonacci of a given number.

7. Write a program to solve 4-Queen problem.

8. Write a program to solve traveling salesman problem.

9. Write a program to solve water jug problem using LISP Any experiment specially designed by the college.

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