Syllabus for Autonomous Batch 2021-2025
for
B. TECH
in
Computer Science and Engineering

INSTITUTE OF ENGINEERING & MANAGEMENT

Semester IV (Second year) Curriculum								
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**				**Credits**
				Lecture	**Tutorial**	**Practical**	**sessional**	
Theory Papers								
1	Professional Core Courses	PCCCS401	Discrete Mathematics	3	0	0	1	4
2	Engineering Science Courses	PCCCS402	Computer Organization & Architectur	3	0	0	0	3
3	Professional Core Courses	PCCCS403	Operating Systems	3	0	0	0	3
4	Professional Core Courses	PCCCS404	Design & Analysis of Algorithms	3	0	0	0	3
5	Professional Core Courses	PCCCS405	Artificial Intelligence & Machine Learning	2	0	0	0	2
6	Basic Science Course	BSC401	Mathematics IV	3	0	0	0	3
7	Humanities & Social Sciences including Management Courses	HSMC401	Management 1 (Organizational Behaviour)	3	0	0	0	3
8	Humanities & Social Sciences including Management courses	HSMC402	Essential Studies for Professionals - IV	2	0	0	0	0.5
8	Mandatory Courses	MC401	Environmental Sciences	**2**	**0**	**0**	**0**	**0**
	Total			24	0	0	1	21.5
Practical Papers								
9	Engineering Science Courses	PCCCS492	Computer Organization & Architectur	0	0	4	0	2
10	Professional Core Courses	PCCCS493	Operating Systems	0	0	4	0	2
11	Professional Core Courses	PCCCS494	Design & Analysis of Algorithms	0	0	4	0	2
12	Professional Core	PCCCS495	Artificial	0	0	2	0	1

	Courses		Intelligence & Machine Learning					
Total				0	0	14	0	7
Sessional Papers								
13	Humanities & Social Sciences including Management courses	HSMC482	Skill Development for Professionals - IV	0	0	0	2	0.5
14	Innovative Project	PROJCS401	Innovative Project – II (Problem Solving Approaches using Design Patterns)	0	0	0	0	1
15	Mandatory Additional Requirements(MAR)	MAR481	Mandatory Additional Requirements (MAR)-IV	0	0	0	0	0
Total				0	0	0	2	1.5
Total								**30**

Twenty Credit Points are required in Massive Open Online Courses (MOOCs).

Twenty certificates are required in International Foreign Certification.

Course Name: Discrete Mathematics

Course Code: PCCCS401

Semester: 4

Contact Hours: L-T-P: 3-1-0

Credits: 4

Prerequisite: Linear algebra, Calculus

Module 1 [10L]

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module 2 [8L]

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 3 [12L]

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and

Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Module 4 [12L]

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Text Books and/or Reference Material

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill

2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.

3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Reference books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application to Computer Science", TMG Edition, TataMcgraw-Hill

2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson

3. Discrete Mathematics, Tata McGraw – Hill

Course Name: Computer Organization & Architecture

Course Code: PCCCS402

Semester: 4

Contact Hours: L-T-P: 3-0-0

Credits: 3
Prerequisite: Digital Electronics

Module 1 [12L]

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Module 2 [7L]

Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in

process state transitions, I/O device interfaces – SCII, USB

Module 3 [5L]

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Module 4 [6L]

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

1. “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. “Computer Organization and Embedded Systems”, 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Reference Books

1. “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.
3. “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Name: Operating Systems

Course Code: PCCCS403

Semester: 4

Contact Hours: L-T-P: 3-0-0

Credits: 3
Prerequisite: Data Structure & Algorithms

Module 1 [8L]

Introduction: Generations & Concept 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. **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switchin. **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Process Scheduling:** Foundation and Scheduling objectives, 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.

Module 2 [10L]

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 Problem etc. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module 3 [8L]

Memory Management: Basic concept, Logical and Physical 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 of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not Recently used (NRU) and Least Recently used (LRU)

Module 4 [6L]

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt 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 and performance.
Disk Management: Disk structure, Disk scheduling: FCFS, SSTF, SCAN, C SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Text Books

1. Operating System Concepts Essentials, 9th Edition byAviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition,William Stallings, Prentice Hall of India.

Reference Books

1. Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
3. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
4. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
5. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet,Marco Cesati, O'Reilly and Associates

Course Name: Design & Analysis of Algorithms

Course Code: PCCCS404

Semester: 4

Contact Hours: L-T-P: 3-0-0

Credits: 3

Prerequisite: Data Structure & Algorithms

Module 1[8L]

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 and Masters' theorem.

Module 2 [14L]

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 their application domains.

Module 3 [8L]

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting,Network Flow Algorithm.

Module 4 [6L]

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction

techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPACE.

Text Books

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

Reference Material

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms—A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley

Course Name: Artificial Intelligence & Machine Learning

Course Code: PCCCS405

Semester: 4

Contact Hours: L-T-P: 3-0-0

Credits: 2

Prerequisite: Data Structure & Algorithms

Module 1 [5L]

Introduction to Artificial Intelligence: The Foundations of Artificial Intelligence, The History of Artificial Intelligence, and the State of the Art. Knowledge Representation: A Knowledge-Based Agent, Knowledge Representation, Reasoning & Logic, Propositional Logic, Inference in First Order Logic

Module 2 [6L]

Search techniques: AI-Problem formulation, solving problems by searching, uninformed search strategies: depth first search, breadth first search, depth limited search, iterative deepening search, bi-directional search and others.

Module 3 [6L]

Introduction to Machine Learning: Machine learning and it's types; Applications of machine learning; Issues in machine learning. Modelling and Evaluation: Selecting a model; Training model - Holdout, k- fold cross-validation, bootstrap sampling; Model representation and interpretability - under-fitting, over- fitting, bias-variance tradeoff; Model performance evaluation - Classification, regression, clustering; Performance improvement.

Module 4 [5L]

Supervised learning – Classification: k-Nearest Neighbour; Decision tree; Naïve Bayes. Supervised learning – Regression: Linear regression. Unsupervised learning: k-Means, Association Analysis

Text & Reference Books

1. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990.
3. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
4. Peter Jackson, "Introduction to Expert Systems", AWP, M.A., 1992.
5. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
6. M. Sasikumar, S. Ramani, "Rule Based Expert Systems", Narosa Publishing House, 1994.
7. Machine learning Tom Mitchell, McGraw Hill,1997

Course Name: Mathematics IV

Course Code: BSC 401

Semester: 4

Contact Hours: L-T-P: 3-0-0

Credits: 3

Prerequisite: BSC 103, BSC 104, BSC 301

Module 1: Method of Least Squares and Curve Fitting (6L)

Principle of Least Squares, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and exponential curves.

Module 2: Estimation of Parameters (6L)

Point and Interval estimations, Biased and Unbiased estimators, Minimum Variance Unbiased Estimator (MVUE), Consistent Estimator, Maximum Likelihood Estimation of Parameters,

Applications in populations following theoretical distributions (Binomial, Poisson and Normal), Calculation of confidence limits for population mean and population proportions.

Module 3: Testing of Hypothesis (Large and Small Sample Tests) (14L)

Large Sample Test: Statistical Hypothesis, Test Statistic, Best Critical Region, Test for single mean, difference of means, single proportion, difference of proportions, and difference of standard deviations. Small Sample Test: Test for single mean, difference of means and correlation coefficients, Test for ratio of variances, Chi-square test for goodness of fit and independence of attributes. One way ANOVA.

Module 4: Transform Calculus (14L)

Laplace Transform: Laplace Transform and its properties, Laplace Transform of periodic functions. Finding Inverse Laplace Transform by different methods, Convolution theorem. Evaluation of integrals by Laplace Transform, Solving ODEs by Laplace Transform method. Fourier Transforms: Fourier Transform and its properties, Fourier Sine and Cosine Transforms, Inverse Fourier Transform (statement only), Fourier Transform of Derivatives (statement only), Convolution theorem (statement only), Related problems and their applications to engineering.

Recommended Text/Reference Books:

1. Sheldon M. Ross (2021), Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Academic Press, ISBN: 978-0128243466
2. Douglas C. Montgomery (2017), Applied Statistics and Probability for Engineers, 7th Edition, John Wiley & Sons, ISBN: 978-1119409533
3. Richard A Johnson, Irwin Miller and John Freund (2015), Probability and Statistics for Engineers, 8th Edition, Pearson Education India, ISBN: 978-9332550414
4. Murray R. Spiegel, John Schiller and R. Alu Srinivasan, R. A., (2012), Probability & Statistics- Schaum's Outlines, 4th Edition, McGraw Hill, ISBN: 978-0071795579
5. Ronald E. Walpole, Raymomd H. Myers, Sharon L. Myers and Keying. Ye (2010), Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson Education, ISBN: 978 0321629111
6. S. C. Gupta and V. K. Kapoor (2014), Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons, ISBN: 978-8180545283
7. Saktipada Nanda and Sibashis Nanda (2022), A Course on Probability & Statistics, 1st Edition, Mindprobooks, ISBN: 978-1922608314
8. B. S. Grewal (2021), Higher Engineering Mathematics, 44th Edition, Khanna Publishers, ISBN: 978- 8193328491
9. R. K. Jain and S. R. K. Iyengar (2017), Advanced Engineering Mathematics, 5th Edition, Narosa Publishing House, ISBN: 978-8184875607

Course Name: Management 1 (Organizational Behaviour)

Course Code: HSMC401

Semester: 4

Contact Hours: L-T-P: 3-1-0

Credits: 3

Module 1 [6L]

Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction

Module 2 [8L]

Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. 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.

Module 3 [10L]

Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. Leadership: Definition, Importance, Theories of Leadership Styles.

Module 4 [8L]

Organizational Politics: Definition, Factors contributing to Political Behaviour. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.

Text Books and/or Reference Material

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.

Course Name: Environmental Sciences

Course Code: MC401

Semester: 4

Contact Hours: L-T-P: 2-1-0

Credits: 0

Module 1 [5L]

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

Module 2 [7L]

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global

warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutantsSuspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Module 3 [7L]

Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

Module 4 [5L]

Lithosphere; Internal structure of earth, rock and soil Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste). Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.

Text Books and/or Reference Material

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of

India Pvt. Ltd.,1991.
3. De, A. K., “Environmental Chemistry”, New Age International

Course Name: Essential Studies for Professionals - IV

Course Code: HSMC402

Semester: 4

Contact Hours: L-T-P: 2-0-0

Credits: 0.5

Prerequisite: Basic Social Science from primary to high school, NCERTs

Module 1 [10L]

Constitution of India: Central Legislative System of India, State Legislative System of India, Constitutional Amendments.

Module 2 [12L]

History: Islam and Early Muslim Invaders, Delhi Sultanate, Rise of the Mughals (Till Akbar)

Module 3 [12L]

Geography: Rivers of India, Multipurpose River Valley Projects, Thermal Power Projects.

Module 4 [9L]

Economics: Tax System of India, Balance of Payment, Industrial Reforms, NITI Aayog and its relationship with 5 year plan, SDG

Module 5 [5L]

Current affairs and Static GK: Monthly Current Affairs Magazine

Text Books

1. Indian Constitution- M. Laxmikant
2. Indian Economy-Ramesh Singh
3. History of Modern India- Bepan Chandra
4. Geography of India- Majid Hussain

Reference Books

1. Current Affairs Magazine of IEM-UEM
2. Lucent GK

Course Name: Computer Organization & Architecture Lab

Course Code: PCCCS492

Semester: 4

Contact Hours: L-T-P: 0-0-4

Credits: 2

Prerequisite: Digital Electronics Lab

Module 1 [6L]

1. HDL introduction
2. Basic digital logic base programming with HDL

Module 2 [5L]

3. 8-bit Addition, Multiplication, Division
4. 8-bit Register design

Module 3 [5L]

5. Memory unit design and perform memory operations.
6. 8-bit simple ALU design

Module 4 [6L]

7. 8-bit simple CPU design
8. Interfacing of CPU and Memory

Course Name: Operating Systems Lab

Course Code: PCCCS493

Semester: 4

Contact Hours: L-T-P: 0-0-4

Credits: 2

Prerequisite: Data Structure & Algorithms Lab

Module1 [4L]

Managing Unix/Linux Operating System 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. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

Module2 [6L]

Process Starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process. Signal signal handling, sending signals, signal interface, signal sets.

Module3 [10L]

Semaphore Programming with semaphores (use functions semctl, semget,semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

Module4 [10L]

POSIX Threads Programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel) Inter-process communication pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

Course Name: Design & Analysis of Algorithm Lab

Course Code: PCCCS494

Semester: 4

Contact Hours: L-T-P: 0-0-4

Credits: 2
Prerequisite: Data Structure & Algorithms Lab

Module 1 [8L]
Divide and Conquer:
1. Implement Binary Search using Divide and Conquer approach
2. Implement Merge Sort using Divide and Conquer approach
3. Implement Quick Sort using Divide and Conquer approach
4. Find Maximum and Minimum element from an array of integers using Divide and Conquer

approach
Dynamic Programming:
5. Implement Matrix Chain Multiplication
6. Implement all pair of Shortest path for a graph (Floyd- Warshall Algorithm)
7. Implement 0/1 Knapsack Problem

Module 2 [6L]

Branch and Bound:
8. Implement 15 Puzzle Problem
Backtracking:
9. Implement 8-Queen problem
10. Graph Coloring Problem Hamiltonian Problem

Module 3 [6L]

Greedy Method:
11. Knapsack Problem Job sequencing with deadlines
12. Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm

Module 4 [4L]

Graph Traversal Algorithm:
13. Implement Breadth First Search (BFS). Implement Depth First Search (DFS)
14. Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)

Course Name: Artificial Intelligence & Machine Learning Lab

Course Code: PCCCS495

Semester: 4

Contact Hours: L-T-P: 0-0-4

Credits: 1
Prerequisite: Data Structure & Algorithms Lab

Module 1 [6L]

Lab 1:
To implement Depth first search, Breadth first search
Lab 2:
To implement A* search

Module 2 [9L]

Lab 3:
Implement Perceptron. and to write a program to implement AND OR gates using Perceptron.
Lab 4:

Implementation of Decision Tree Classifier.
Lab 5:
Implementation of Random Forest Classifier.
Lab 6:
To study Long Short-Term Memory for Time Series Prediction

Module 3 [6L]

Lab 7:
To study Convolutional Neural Network and Recurrent Neural Network
Lab 8:
To study ImageNet, Google Net, ResNet convolutional Neural Networks

Module 4 [9L]

Lab 9:
To implement K-Mean's algorithm
Lab 10:
To implement K-Nearest Neighbour algorithm
Lab 11:
To implement Naïve Bayesian Classifier

Course Name: Skill Development for Professionals - IV

Course Code: HSMC482

Semester: 4

Contact Hours: L-T-P: 2-0-0

Credits: 0.5

Prerequisite: Basic Mathematics, General English from primary to high school.

Module 1 [6L]

Quantitative Aptitude Permutation & Combination, Probability, Geometry, Mensuration

Module 2 [12L]

Logical Reasoning
1) Seating Arrangement
a) Circular seating arrangement
b) Square seating Arrangement
c) Line Arrangement

2) Calendar And Clock
3) Miscellaneous Problems

Module 3 [12 L]

Verbal English
1) Sentence Corrections
2) Fill the blanks with appropriate words/articles/preposition/verbs/adver bs/conjunction.
3) Reading Comprehension (Advance Level)
4) Vocabulary

Learning Resources:
Text Books:
1. Objective General English- S.P Bakshi
2. English Grammar and Competition-S.C Gupta
3. Fast Track Objective Arithmetic- Rajesh Verma
4. Advance Maths- Rakesh Yadav
5. Verbal and Non-Verbal Reasoning- R.S Agarwal
6. A new approach to Reasoning- BS Sijwali
7. Quantitative Aptitude-R.S Agarwal