Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Computer Science & Engineering

(Applicable from the academic session 2018-2019)

SEMESTER – IV

Discrete Mathematics

Code: PCC-CS401

Contacts: 3L+1T

Name of the Course:	*Discrete Mathematics*		
Course Code: PCC-CS401	*Semester: IV*		
Duration:6 months	*Maximum Marks:100*		
Teaching Scheme		*Examination Scheme*	
Theory:3 hrs./week		*Mid Semester exam: 15*	
Tutorial: 1 hour/week		*Assignment and Quiz : 10 marks*	
		Attendance : 5 marks	
Practical: NIL		*End Semester Exam :70 Marks*	
Credit Points:	*4*		
Objective:			
1	*Use mathematically correct terminology and notation.*		
2	*Construct correct direct and indirect proofs.*		
3	*To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees*		
4	*Use counterexamples. Apply logical reasoning to solve a variety of problems.*		
Pre-Requisite:			
1	*Some concepts from basic math – algebra, geometry, pre-calculus*		
Unit	*Content*	*Hrs/Unit*	*Marks/Unit*
1	*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 WellOrdering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.*	*8*	
2	*Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination*	*5*	

3	*Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables,*	*8*	
	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.		
4.	*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*	*7*	
5	*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.*	*8*	

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics forComputer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory,TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and DiscreteMathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.

10. *R. C. Penner, Discrete Mathematics: Proof Techniques and MathematicalStructures, World Scientific, 1999.*
11. *R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.*
12. *N. Deo, Graph Theory, Prentice Hall of India, 1974.*
13. *S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems ofDiscrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.*
14. *J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.*
15. *Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation*
16. *N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI*
17. *Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics forComputer Science, CENGAGE Learning*
18. *Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH*
19. *S.B. Singh, Discrete Structures – Khanna Publishing House (AICTE Recommended Textbook – 2018)*
20. *S.B. Singh, Combinatorics and Graph Theory, Khanna Publishing House(AICTE Recommended Textbook – 2018)*

Course Outcome(s)

On completion of the course students will be able to

PCC-CS401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives

PCC-CS401.2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inference

PCC-CS401.3 Classify its algebraic structure for a given a mathematical problem,

PCC-CS401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

PCC-CS401.5 Develop the given problem as graph networks and solve with techniques of graph theory.

Computer Architecture
Code: PCC-CS402
Contacts: 3L

Name of the Course:	*Computer Architecture*	
Course Code: PCC-CS402	*Semester: IV*	
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*		
Objective:			
1	*To learn the basics of stored program concepts.*		
2	*To learn the principles of pipelining*		
3	*To learn mechanism of data storage*		
4	*To distinguish between the concepts of serial, parallel, pipeline architecture.*		
Pre-Requisite:			
1	*Basic Structure of Computers, Functional units, software, performance issues software, machine instructions*		
2	*RAM, ROM, Memory management*		

Unit	*Content*	*Hrs/Unit*	*Marks/Unit*
1	*Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)*	*12*	
2	*Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)*	*8*	
3	*Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors. (6L)*	*6*	

4.	*Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed sharedmemory architecture. Cluster computers. (8L)* *Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)*	*7*	

Text/Reference Books:

1. V.Carl, G.Zvonko and S. G.Zaky, "Computerorganization", McGraw Hill, *1978.*
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, *2000.*
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", *Morgan Kauffman, 2011.*
4. W. Stallings, "Computer organization",PHI, *1987.*
5. P.BarryandP.Crowley,"ModernEmbeddedComputing",MorganKaufmann, *2012.*
6. N.Mathivanan,"Microprocessors,PCHardwareandInterfacing",PrenticeHall, *2004.*
7. *Y. C. Lieu* and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice *Hall India, 1986.*
8. J.Uffenbeck,"The8086/8088Design,Programming,Interfacing",PrenticeHall,*1987.*
9. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
10. P. Able, "8086 Assembly Language Programming", Prentice Hall India6. Winfried Karl *Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.*
11. *Rajaraman* – "Computer Organization & Architecture", PHI
12. *B.Ram* – "Computer Organization & Architecture", Newage *Publications*

Course Outcomes:

On completion of the course students will be able to

PCC-CS402.1 Learn pipelining concepts with a prior knowledge of stored program methods
PCC-CS402.2 Learn about memory hierarchy and mapping techniques.
PCC-CS402.3 Study of parallel architecture and interconnection network

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Formal Language & Automata Theory
Code: PCC-CS403
Contacts: 3L

Name of the Course:	*Formal Language & Automata Theory*
Course Code: PCC-CS403	*Semester: IV*
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*

Objective:	
1	*Be able to construct finite state machines and the equivalent regular expressions.*
2	*Be able to prove the equivalence of languages described by finite state machines and regular expressions*
3	*Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.*
4	*Be able to construct Turing machines and Post machines.* *Be able to prove the equivalence of languages described by Turing machines and Post machines*
Pre-Requisite:	
1	*Grammar and its classification (Context Free Grammar)*

Unit	*Content*	*Hrs/Unit*	*Marks/Unit*
1	*Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.*	*6*	
2	*Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)*	*7*	
3	*Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms,*	*6*	
	nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.		

4.	*Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.*	*6*	
5	*Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators*	*6*	
6	*Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages*	*6*	

Text books/ reference books:

1. *John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.*
2. *Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory ofComputation, Pearson Education Asia.*
3. *Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.*
4. *Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.*
5. *John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.*
6. *Dr. R.B.Patel, Theory of Computation, Khanna Publishing House*

Course Outcomes:

On completion of the course students will be able to

PCC-CS403.1 Write a formal notation for strings, languages and machines.

PCC-CS403.2 Design finite automata to accept a set of strings of a language.

PCC-CS403.3 For a given language determine whether the given language is regular or not.

PCC-CS403.4 Design context free grammars to generate strings of context free language.

PCC-CS403.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

PCC-CS403.6 Write the hierarchy of formal languages, grammars and machines.

PCC-CS403.7 Distinguish between computability and non-computability and Decidability and undecidability.

Design and Analysis of Algorithms
Code: PCC-CS404

Contacts: 3L

Name of the Course:	*Design and Analysis of Algorithms*	
Course Code: PCC-CS404	*Semester: IV*	
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*	

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 algorithms and 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 and* Masters' 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 their application domains.*	*8*	
3	*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.*	*6*	
	Tractable and Intractable Problems: Computability		

4.	*of Algorithms, Computability classes – P,NP, NPcomplete 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:

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.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,Reading, MA
7. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018)
8. Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai

Course Outcomes

On completion of the course students will be able to

PCC-CS404.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

PCC-CS404.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

PCC-CS404.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

PCC-CS404.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and

PCC-CS404.5 develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

PCC-CS404,6 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

PCC-CS404.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

PCC-CS404.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

Biology
Code: BSC 401
Contacts: 2L+1T

Name of the Course:	*Biology*		
Course Code: BSC-401	*Semester: IV*		
Duration: 6 months	*Maximum Marks:100*		
Teaching Scheme		*Examination Scheme*	
Theory: 2hrs./week		*Mid Semester exam: 15*	
Tutorial: 1 hour		*Assignment and Quiz: 10 marks*	
		Attendance: 5 marks	
Practical: NIL		*End Semester Exam: 70 Marks*	
Credit Points:	*3*		
Objective:			
1	*Bring out the fundamental differences between science and engineering*		
2	*Discuss how biological observations of 18_{th} Century that lead to major discoveries*		
Pre-Requisite:			
1	*Basic knowledge of Physics ,Chemistry and mathematics*		

Unit	*Content*	*Hrs/Unit*	*Marks/Unit*
1	*To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18_{th} Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.*	*2*	

2	*The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c)*	*3*	
	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus		
3	To convey that "Genetics is to biology what Newton'slawsaretoPhysicalSciences"Mendel's *laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.*	*4*	
4.	*Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.*	*4*	

5	*Enzymes: To convey that without catalysis life would not have existed on earth* *Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.*	*4*	
6	*Information Transfer:The molecular basis of coding and decoding genetic information is universal* *Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA*	*4*	
	structure- from single stranded to double helix to nucleosomes. Concept of genetic code. *Universality and degeneracy of genetic code.* *Define gene in terms of complementation and recombination.*		
7	*Macromolecular analysis: How to analyse biological processes at the reductionist level Proteinsstructure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure.* *Proteins as enzymes, transporters, receptors and structural elements.*	*5*	
8	*Metabolism: The fundamental principles of energy transactions are the same in physical and biological world.* *Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of $K_{eq}$and its relation to standard free energy.* *Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge*	*4*	
9	*Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions.* *Growth kinetics.*	*3*	

Text books/ reference books:

1. *Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd*
2. *Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons*
3. *Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company*
4. *Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher*
5. *Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers*

Course Outcomes:

On completion of the course students will be able to

BSC-401.1 Describe how biological observations of 18_{th} Century that lead to major discoveries.

BSC-401.2 Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological

BSC-401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring

BSC-401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine

BSC-401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-401.7 Analyse biological processes at the reductionistic level BSC-401.8
Apply thermodynamic principles to biological systems.

BSC-401.9 Identify and classify microorganisms.

Environmental Sciences
Code: MC-401
Contacts: 1L

Name of the Course:	*Environmental Sciences*		
Course Code: MC-401	*Semester: IV*		
Duration:6 months	*Maximum Marks:100*		
Teaching Scheme		*Examination Scheme*	
Theory:1hrs./week		*Mid Semester exam: 15*	
Tutorial: NIL		*Assignment and Quiz : 10 marks*	
		Attendance : 5 marks	
Practical: NIL		*End Semester Exam :70 Marks*	
Credit Points:	*1*		
Objective:			
1	*Be able to understand the natural environment and its relationships with human activities.*		
2	*Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.*		
3	*Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.*		
4	*Be able to solve scientific problem-solving related to air, water, noise & land pollution*		
Pre-Requisite:			
1	*Basic knowledge of Environmental science*		

Unit	*Content*	*Hrs/Unit*	*Marks/Unit*

1	*Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L)* *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. (2L)* *Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L)* *Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic*	*6*	

	degradation like Acid rain-cause, effects and control. *Nature and scope of Environmental Science and Engineering. (2L)*		
2	*Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L)* *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.(2L)* *Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L)* *Biodiversity- types, importance, Endemic species,* *Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)*	*6*	

3	*Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L)* *Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L)* *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.(1L) *Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L)* *Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L)* *Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria*	*11*	

	pollutant. Sources and effect of different air pollutantsSuspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) 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. (1L)* *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). (1L)*		

4.	*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. (2L)* *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. (2L)* *Lake: Eutrophication [Definition, source and effect]. (1L)* *Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L)* *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. (2L)* *Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)*	*9*	
5	*Lithosphere; Internal structure of earth, rock and soil (1L)*	*3*	
	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).(2L)		

6	*Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent level, noise L10 (18hr Index) ,n Ld.Noise pollution control. (1L)*	*3*	
7	*Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)*	*2*	

Text books/ reference books:

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 Outcomes:

On completion of the course students will be able to

MC-401.1 To understand the natural environment and its relationships with human activities.

MC-401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-401.4 Acquire skills for scientific problem-solving related to air, water, noise& land pollution.

PRACTICAL SYLLABUS

Semester IV

Computer Architecture Lab
Code: PCC-CS492
Contacts: 4P

Name of the Course:	*Computer Architecture Lab*
Course Code: PCC-CS492	*Semester: IV*
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*
Course Outcomes:	
1	*PCC-CS402.1*
2	*PCC-CS402.2*
3	*PCC-CS402.3*
Pre-Requisite:	
1	*The hardware based design has been done in 1.the Analog & Digital Electronics laboratory*
2	*Computer Organisation laboratory*
Laboratory Experiments:	
1	*HDL introduction.*
2	*Basic digital logic base programming with HDL*
3	*8-bit Addition, Multiplication, Division*
4	*8-bit Register design*
5	*Memory unit design and perform memory operations.*
6	*8-bit simple ALU design*
7	*8-bit simple CPU design*
8	*Interfacing of CPU and Memory.*

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

Design & Analysis Algorithm Lab
Code: PCC-CS494
Contact: 4P

Name of the Course:	*Design & Analysis Algorithm Lab*
Course Code: PCC-CS494	*Semester: IV*
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*
Course Outcomes:	
1	*PCC-CS402.1*
2	*PCC-CS402.2*

3	*PCC-CS402.3*
Pre-Requisite:	
Pre-Requisite as in : PCC-CS404	
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)