

**Bachelor of Technology (Computer Science and Engineering)**  
**Credit Based Scheme of Studies/Examination(Modified)**  
**Semester IV (w.e.f Session 2021-2022)**

S. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	PC-CS-202A	Discrete Mathematics	3:0:0	3	3	75	25	0	100	3
2	PC-CS-204A	Internet Technology and Management	3:0:0	3	3	75	25	0	100	3
3	PC-CS-206A	Operating Systems	3:0:0	3	3	75	25	0	100	3
4	PC-CS-208A	Design and Analysis of Algorithms	3:0:0	3	3	75	25	0	100	3
5	HTM-901A	Universal Human Values II : Understanding Harmony	3:0:0	3	3	75	25	0	100	3
6	PC-CS-210AL	Internet Technology and Management Lab	0:0:4	4	2	0	40	60	100	3
7	PC-CS-212AL	Operating Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-214AL	Design and Analysis of Algorithms Lab	0:0:4	4	2	0	40	60	100	3
		<b>Total</b>		<b>27</b>	<b>21</b>	<b>375</b>	<b>245</b>	<b>180</b>	<b>800</b>	

9	MC-901A*	Environmental Sciences	3:0:0	3	0	75	25	0	100	3
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**\*MC-901A is a mandatory credit-less course and student has to get passing marks in order to qualify for the award of B.Tech. Degree.**

PC-CS202A	Discrete Mathematics						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
<b>Purpose</b>	To provide the conceptual knowledge of Discrete structure.						
<b>Course Outcomes (CO)</b>							
<b>CO1</b>	To study various fundamental concepts of Set Theory and Logics.						
<b>CO2</b>	To study and understand the Relations, diagraphs and lattices.						
<b>CO3</b>	To study the Functions and Combinatorics.						
<b>CO4</b>	To study the Algebraic Structures.						

### Unit 1 Set Theory and Logic

Fundamentals - Sets and subsets, Venn Diagrams, Operations on sets, Laws of Set Theory, Power Sets and Products, Partition of sets, The Principle of Inclusion- Exclusion.

Logic : Propositions and Logical operations, Truth tables, Equivalence, Implications, Laws of Logic, Normal forms, Predicates and quantifiers, Mathematical Induction.

### Unit 2: Relations, diagraphs and lattices

Product sets and partitions, relations and diagraphs, paths in relations and diagraphs, properties of relations, equivalence and partially ordered relations, computer representation of relations and diagraphs, manipulation of relations, Transitive closure and Warshall's algorithm, Posets and Hasse Diagrams, Lattice.

### Unit 3 Functions and Combinatorics

Definitions and types of functions: injective, subjective and bijective, Composition, identity and inverse, Review of Permutation and combination-Mathematical Induction, Pigeon hole principle, Principle of inclusion and exclusion, Generating function-Recurrence relations.

### Unit 4: Algebraic Structures

Algebraic structures with one binary operation - semi groups, monoids and groups, Product and quotient of algebraic structures, Isomorphism, homomorphism, automorphism, Cyclic groups, Normal sub group, codes and group codes, Ring homomorphism and Isomorphism.

#### Suggested Books:

- Elements of Discrete Mathematics C.L Liu, 1985, Reprinted 2000, McGraw Hill
- Discrete Mathematics - Revised (SIE) (Schaum's Outline Series), LIPSCHUTZ, TMH
- Discrete mathematical structures by B Kolman RC Busby, S Ross PHI Pvt. Ltd.
- Discrete Mathematical Structures with Applications to Computer Science , by Tremblay J.P, and Manohar R., McGraw Hill Book Company, 1975, International Edition, 1987.
- Discrete and Combinatorial mathematics ", Ralph P., Grimaldi, Addison-Wesley Publishing Company, Reprinted in 1985.
- Discrete Mathematics and its Applications ", Kenneth H.Rosen, McGraw Hill Book Company, 1999. Sections: 7.1 to 7.5.
- Discrete Mathematics for computer scientists and Mathematicians, Joe L. Mott, Abraham

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

PC-CS204A	Internet Technology and Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
Purpose	To provide the conceptual knowledge of Internet and methodologies used in web and secure internet communication and networking.						
Course Outcomes (CO)							
CO1	To study various fundamental concepts of Internetworking techniques with their characteristics.						
CO2	To study and understand the requirements for world-wide-web formats and techniques.						
CO3	To study the E-mail functioning and basics of HTML, XML and DHTML languages.						
CO4	To study the functioning of Servers and Privacy and Security related mechanisms.						

#### UNIT-1 : THE INTERNET

Introduction to networks and internet, history, Internet, Intranet and Extranet, Working of Internet, Internet Congestion, internet culture, business culture on internet. Collaborative computing and the internet. Modes of Connecting to Internet, Internet Service Providers (ISPs), Internet address, standard address, domain name, DNS, IP.v6. Modems, Speed and time continuum, communications software; internet tools.

#### UNIT-II : WORLD WIDW WEB

Introduction, Miscellaneous Web Browser details, searching the www: Directories search engines and meta search engines, search fundamentals, search strategies, working of the search engines, Telnet and FTP, HTTP, Gopher Commands, TCP/IP. Introduction to Browser, Coast-to-coast surfing, hypertext markup language, Web page installation, Web page setup, Basics of HTML and formatting and hyperlink creation. Using FrontPage Express, Plug-ins.

#### UNIT-III : INTERNET PLATEFORM AND MAILING SYSTEMS

Introduction, advantages and disadvantages, User Ids, Pass words, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, MIME types, Newsgroups, mailing lists, chat rooms, secure-mails, SMTP, PICO, Pine, Library cards catalog, online ref. works.

**Languages:** Basic and advanced HTML, Basics of scripting languages – XML, DHTML, Java Script.

#### UNIT-IV : SERVERS

Introduction to Web Servers: PWS, IIS, Apache; Microsoft Personal Web Server. Accessing and using these servers.

**Privacy and security topics:** Introduction, Software Complexity, Attacks, security and privacy levels, security policy, accessibility and risk analysis, Encryption schemes, Secure Web document, Digital Signatures, Firewalls, Intrusion detection systems

#### Suggested Books:

- Internet and World Wide Programming, Deitel, Deitel and Nieto, 2012, Pearson Education
- Fundamentals of the Internet and the World Wide Web, Raymond Greenlaw and Ellen Hepp, TMH- 2012
- Inline/Online: Fundamentals of The Internet And The World Wide Web, GREENLAW, TMH
- Complete idiots guide to java script, Aron Weiss, QUE, 2013
- Network firewalls, Kironjeet syan -New Rider Pub. 2014
- Networking Essentials – Firewall Media. Latest-2015
- www.seconf.com
- www.hackers.com
- Alfred Gkossbrenner-Internet 101 Computing MGH, 2013

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PC-CS-206A	OPERATING SYSTEMS						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3
<b>Purpose</b>	To familiarize the students with the basics of Operating Systems.						
<b>Course Outcomes (CO)</b>							
<b>CO1</b>	To understand the structure and functions of Operating system.						
<b>CO2</b>	To learn about processes, threads and scheduling algorithms.						
<b>CO3</b>	To understand the principle of concurrency.						
<b>CO4</b>	To understand the concept of deadlocks.						
<b>CO5</b>	To learn various memory management schemes.						
<b>CO6</b>	To study I/O management and file systems.						
<b>CO7</b>	To study the concept of protection and security.						

#### UNIT 1

**Introduction:** Introduction to OS. Operating system functions, Different types of O.S.: batch process, multi-programmed, time-sharing, real-time, distributed, parallel.

**System Structure:** Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

#### UNIT II

**CPU scheduling:** scheduling criteria, preemptive and non-preemptive scheduling, scheduling algorithms, algorithm evaluation, multi-processor scheduling.

**Threads:** overview, benefits of threads, user and kernel threads.

**Process Management:** Concept of processes, process states, process control, co-operating processes, inter-process communication.

**Process Synchronization:** background, critical section problem, critical region, synchronization hardware, Classical problems of synchronization, semaphores.

#### UNIT III

**Deadlocks:** Concept of deadlock, deadlock characterization, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

**Memory Management:** background, logical vs. physical address space, contiguous memory allocation, paging, segmentation, segmentation with paging. Concept of fragmentation.

**Virtual Memory:** background, demand paging, concept of page replacement, page replacement algorithms, allocation of frames, thrashing.

#### UNIT IV

**File Systems:** file concept, file organization and access methods, allocation methods, directory structure, free-space management

**I/O Management:** I/O hardware, polling, interrupts, DMA, kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation)

**Disk Management:** disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk Performance parameters

**Protection and Security:**

Goals of protection and security, security attacks, authentication, program threats, system threats, threat monitoring.

**Case studies:** UNIX file system, Windows file system

#### Suggested Books:

- Operating System Concepts", Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, Wiley
- Operating systems: a concept based approach", Dhananjay M. Dhamdhare, McGraw Hill .
- Operating Systems : Internals and Design Principles, William Stallings, Pearson
- Operating Systems Design and Implementation" ,(Prentice Hall Software Series) Andrew S Tanenbaum and Albert S Woodhull.
- Taub and Schilling, Principles of Communication Systems, TMH.
- Mithal G K, Radio Engineering, Khanna Pub.
- Simon Haykin, Communication Systems, John Wiley.

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PC-CS208A	Design and Analysis of Algorithms						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hrs.
<b>Purpose</b>	To introduce advanced data structures and algorithms concepts involving their implementation for solving complex applications.						
<b>Course Outcomes (CO)</b>							
<b>CO1</b>	To introduce the basic concepts of Data Structures and their analysis.						
<b>CO2</b>	To study the concept of Dynamic Programming and various advanced Data Structures.						
<b>CO3</b>	To introduce various Graph algorithms and concepts of Computational complexities.						
<b>CO4</b>	To study various Flow and Sorting Networks						

#### Unit 1: Introduction

Review:- Elementary Data Structures, Algorithms and its complexity(Time and Space), Analysing Algorithms, Asymptotic Notations, Priority Queue, Quick Sort.

Recurrence relation:- Methods for solving recurrence(Substitution , Recursion tree, Master theorem), Strassen multiplication.

#### Unit 2: Advanced Design and analysis Techniques

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Travelling Salesman Problem.

Advanced data Structures:- Binomial heaps, Fibonacci heaps, Splay Trees, Red-Black Trees.

#### Unit 3: Graph Algorithms

Review of graph algorithms:- Traversal Methods(Depth first and Breadth first search), Topological sort, Strongly connected components, Minimum spanning trees- Kruskal and Prims, Single source shortest paths, Relaxation, Dijkstras Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, All pairs shortest paths- shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Computational Complexity:- Basic Concepts, Polynomial Vs Non-Polynomial Complexity, NP- hard and NP-complete classes.

#### Unit 4: Network and Sorting Algorithms

Flow and Sorting Networks Flow networks, Ford- Fulkerson method, Maximum Bipartite matching, Sorting Networks, Comparison network, The zero- One principle, Bitonic sorting network, Merging networks

#### Suggested Books :

- Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
- Das Gupta : Algorithms, TMH.
- Horowitz, Ellis and Sahni, Sartaj: Fundamentals of Computer Algorithms. Galgotia Publications
- Aho, Hopcroft and Ullman: The Design and Analyses of Computer Algorithms. Addison Wesley.
- R.B.Patel: Expert Data Structures with C, Khanna Publications , Delhi, India, 2<sup>nd</sup> Edition 2004, ISBN 81-87325-07-0.
- R.B.Patel and M.M.S Rauthan: Expert Data Structures with C++, Khana Publications, Delhi , India, 2<sup>nd</sup> Edition 2004, ISBN 87522-03-8

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HTM-901A	Universal Human Values II: Understanding Harmony						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3.0	75	25	100	3 Hours
Purpose	Purpose and motivation for the course, recapitulation from Universal Human Values-I						
Course Outcomes (CO)							
CO 1	Development of a holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence						
CO 2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.						
CO 3	Strengthening of self-reflection.						
CO 4	Development of commitment and courage to act.						

### Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

### Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

### Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

#### **Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

#### **Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

#### **READINGS:**

##### **Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

##### **Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj - Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

## **MODE OF CONDUCT**

Lecture hours are to be used for lecture/practice sessions.

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Practice hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions, the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Practice experiments are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

## **ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by

faculty mentor: 5 marks

Self-assessment: 5 marks

Assessment by peers: 5 marks

Socially relevant project/Group Activities/Assignments: 10 marks

Semester End Examination: 75 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

PC-CS210AL	Internet Technology and Management Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3 Hour
<b>Purpose</b>	Learn the internet and design different web pages using HTML .						
<b>Course Outcomes (CO)</b>							
<b>CO1</b>	Understanding different PC software and their applications.						
<b>CO2</b>	To be able to learn HTML.						
<b>CO3</b>	To be able to write Web pages using HTML.						
<b>CO4</b>	To be able to install modems and understand the e-mail systems.						

**PC Software:** Application of basics of MS Word 2000, MS Excel 2000, MS Power Point 2000, MS Access 2000, HTML

1. To prepare the Your Bio Data using MS Word
2. To prepare the list of marks obtained by students in different subjects and show with the help of chart/graph the average, min and max marks in each subject.
3. Prepare a presentation explaining the facilities/infrastructure available in your college/institute.
4. Design Web pages containing information of the Deptt.

**HTML Lists:**

1. Create a new document that takes the format of a business letter. Combine <P> and <BR> tags to properly separate the different parts of the documents. Such as the address, greeting, content and signature. What works best for each?
2. Create a document that uses multiple <BR> and <P> tags, and put returns between <PRE> tags to add blank lines to your document see if your browser renders them differently.
3. Create a document using the <PRE>tags to work as an invoice or bill of sale, complete with aligned dollar values and a total. Remember not to use the Tab key, and avoid using emphasis tags like <B> or <EM> within your list.
4. Create a seven-item ordered list using Roman numerals. After the fifth item, increase the next list value by 5.
5. Beginning with an ordered list, create a list that nests both an unordered list and a definition list.
6. Use the ALIGN attribute of an <IMG> tags to align another image to the top of the first image.. play with this feature, aligning images to TOP, MIDDLE and BOTTOM.
7. Create a 'table of contents' style page (using regular and section links) that loads a different document for each chapter or section of the document.

**Internet:**

1. Instilling internet and external modems, NIC and assign IP address.
2. Study of E-mail system.
3. Create your own mail-id in yahoo and indiatimes.com.
4. Add names (mail-id's) in your address book, compose and search an element.

**NOTE:**

A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

PC-CS212AL	Operating Systems Lab						
Lecture	Tutorial	Practical	Credit	Sessional	Practical	Total	Time
0	0	4	2.0	40	60	100	3
<b>Purpose</b>	To familiarize the students with the basics of Operating Systems.						
<b>Course Outcomes (CO)</b>							
CO1	To understand the CPU scheduling.						
CO2	To learn about memory management.						
CO3	To understand system calls.						
CO4	To understand the concept of file operations.						
CO5	To learn various classical problems.						

1. Simulation of the CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
2. Program for paging techniques of memory management.
3. Program for page replacement algorithms
4. Simulation of Bankers Deadlock Avoidance and Prevention algorithms.
5. Program for Implementation of System Calls.
6. Program for File Permissions
7. Program for File Operations.
8. Program for File Copy and Move.
9. Program for Dining Philosophers Problem.
10. Program For Producer – Consumer Problem concept.
11. Program for disk scheduling algorithms.

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

PC-CS214AL		Design and Analysis of algorithms Lab					
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2.0	40	60	100	3
Purpose	The student should be made to Learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and Understand the limitations of Algorithm power.						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for various computing problems.						
CO2	The student should be able to Analyze the time and space complexity of algorithms.						
CO3	The student should be able to Critically analyze the different algorithm design techniques for a given problem.						
CO4	The student should be able to Modify existing algorithms to improve efficiency.						

- Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- Using Open, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- Obtain the Topological ordering of vertices in a given digraph.
  - Compute the transitive closure of a given directed graph using Warshall's algorithm.
- Implement 0/1 Knapsack problem using Dynamic Programming.
- From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
- Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
- Print all the nodes reachable from a given starting node in a digraph using BFS method.
  - Check whether a given graph is connected or not using DFS method.
- Find a subset of a given set  $S = \{s_1, s_2, \dots, s_n\}$  of n positive integers whose sum is equal to a given positive integer d. For example, if  $S = \{1, 2, 5, 6, 8\}$  and  $d = 9$  there are two solutions  $\{1, 2, 6\}$  and  $\{1, 8\}$ . A suitable message is to be displayed if the given problem instance doesn't have a solution.
- Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
- Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
- Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. Parallelize this algorithm, implement it using Open and determine the speed-up achieved.
- Implement N Queen's problem using Back Tracking.
- Use divides and conquers method to recursively implement Binary Search

**NOTE:** A student has to perform at least ten experiments. Seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

MC-901A	Environmental Sciences						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	0	75	25	100	3 Hrs.
<b>Purpose</b>	To learn the multidisciplinary nature, scope and importance of Environmental sciences.						
<b>Course Outcomes (CO)</b>							
<b>CO1</b>	The students will be able to learn the importance of natural resources.						
<b>CO2</b>	To learn the theoretical and practical aspects of eco system.						
<b>CO3</b>	Will be able to learn the basic concepts of conservation of biodiversity.						
<b>CO4</b>	The students will be able to understand the basic concept of sustainable development.						

#### UNIT 1

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

- Forest Resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
  - Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
  - Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
  - Food Resources: World Food Problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
  - Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
  - Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.
- Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

#### UNIT II

**Ecosystem-Concept of an ecosystem.** Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

#### UNIT III

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity of global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

#### UNIT IV

**Social Issues and the Environment.** From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressant drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

#### Suggested Books

- Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
- Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India
- Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
- Environmental Science- Botkin and Keller. 2012. Wiley, India

**Note: The Examiner will be given the question paper template to set the question paper.**